Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP42 Section: 11.1

Reference Number: 51

Title: Results Of The September 30, 1994 Particulate Emission Compliance Test On The Baghouse Outlet Stack At The Northland Constructors Facility Located In Duluth, Minnesota,

Pace, Inc., Golden Valley, MN,

November 15, 1994.

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Minnesota Pollution Control Agency
Division of Air Quality

RESULTS OF THE SEPTEMBER 30, 1994 PARTICULATE EMISSION COMPLIANCE TEST ON THE BAGHOUSE OUTLET STACK AT THE NORTHLAND CONSTRUCTORS FACILITY LOCATED IN DULUTH, MINNESOTA

Prepared For: Mr. James Oswald
Northland Constructors

Prepared By: PACE, Incorporated
1710 Douglas Drive North
Golden Valley, Minnesota 55422

PACE Project No.: 940927.402
Report Date: November 15, 1994

Field sampling was performed by me and personnel under my director supervision.

(For)

Michael S. Loftus
Project Field Supevisor

All sampling, analysis and data reduction were performed by PACE, Incorporated under my direct supervision.

Curtis H. Stock
Supervisor, Air Sampling Section

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EXECUTIVE SUMMARY

PACE Incorporated was contracted by Northland Constructors to perform particulate emissions testing on the Baghouse Outlet Stack at the Northland Constructors facility located in Duluth, Minnesota. This series of tests was performed on September 30, 1994. The results are summarized with pertinent process data in the following table:

Test Results Summary

	Run 1	Run 2	Run 3	Average
Asphalt Production (Tons/HR)	228.9	229.2	231.2	229.8
Dust Collector Pressure Drop (In, H_2O)	3.0	3.0	3.5	3.2
Fuel Input (Cubic Feet/Ton Hot Mix)	196	196	194	195
% Recycle	28.0	28.4	27.7	28.0
Aggregate Recycle Moisture (%)	3.7	3.8	3.7	3.7
Volumetric Flow Rate				
ACFM	36000	37000	38100	37000
DSCFM	15600	16300	17000	16300
Gas Temperature (°F)	258	262	265	262
Gas Moisture Content (% v/v)	39.8	38.3	37.4	38.5
Particulate Emission Rate (GR/DSCF)	0.008	0.006	0.024	0.013
Average Opacity (%)	0	0	0	0

INTRODUCTION

PACE, Incorporated personnel conducted particulate emission compliance testing on the Baghouse Outlet Stack at the Northland Constructors facility located in Duluth, Minnesota. On-site testing was performed by a three member team consisting of M. Loftus, M. McDermott and M. Wilson. Coordination between plant operations and testing activities was provided by Jack Holmgran of Northland Constructors through direct contact with the test team leader. Testing was not witnessed by the Minnesota Pollution Control Agency. The test consisted of three independent one-hour samplings for particulate with concurrent integrated gas sampling for Orsat analyses. One-hour opacity observations were conducted for each particulate run.

The objectives of this project were to quantify particulate emissions and compare them to applicable air emissions regulations stipulated by Minnesota Pollution Control Agency. Special provisions for this test program include operating at 230 Tons/HR and burning natural gas as fuel.

Results are summarized in the next section followed by descriptions of the process under investigation and test methods. All supporting data are included in subsequent appendices.

RESULTS SUMMARY

Results of particulate determinations and gas composition are summarized in Table 1. The particulate emission rate averaged 1.8 LB/HR at an average particulate concentration of 0.011 GR/DSCF. Minnesota Pollution Control Agency emissions regulations limit sources of this type to 0.04 GR/DSCF.

Opacity observations were recorded every 15 seconds for a one-hour period during each run. These results are shown in Table 4. Within the three one-hour observation period, the highest average opacity for a consecutive six-minute time span was 0 percent. The average opacity for the three one-hour period was 0 percent.

The plant shut down 20 minutes into the first run. Testing was resumed when the plant operations were restarted and stabilized.

No problems were encountered in the sampling or analyses of emissions samples. On this and after complete review of the test results, we believe that the values reported herein are an accurate representation of the source conditions at the time of the test.

SUMMARY OF THE RESULTS

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 3, 1994

TABLE 1
SUMMARY OF THE RESULTS
TEST 1

Baghouse Outlet Stack

Parameter	**Run 1**	**Run 2**	**Run 3**	**Average**
Date of Run	9/30/94	9/30/94	9/30/94	
Time of Run	1000-1156	1235-1336	1652-1753	
Asphalt Production (Tons/HR)	228.9	229.2	231.2	229.8
Duct Collector Pressure Drop (In. H2O)	3.0	3.0	3.5	3.2
Fuel Input (Cubic Feet/Ton Hot Mix)	196	196	194	195
Volumetric Flow Rate				
ACFM	36000	37000	38100	37000
DSCFM	15600	16300	17000	16300
Gas Temperature (°F)	258	262	265	262
Gas Moisture Content (%v/v)	39.8	38.3	37.4	38.5
Gas Composition (%v/v,Dry)				
CO2	7.4	7.3	7.2	7.3
O2	7.4	7.5	8.0	7.6
N2	85.2	85.2	84.8	85.1
Isokinetic Variation (%)	101.2	99.1	99.8	
Particulate Emission Rate (LB/HR)	1.1	0.8	3.6	1.8
Particulate Concentration				
GR/ACF	0.003	0.003	0.011	0.006
GR/DSCF	0.008	0.006	0.024	0.013
GR/DSCF @ 12% CO2	0.013	0.010	0.041	0.021

RESULTS OF ORSAT AND MOISTURE DETERMINATIONS

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 3, 1994

TABLE 2
RESULTS OF ORSAT AND MOISTURE DETERMINATIONS
TEST 1

Baghouse Outlet Stack

Parameter	**Run 1**	**Run 2**	**Run 3**
Date of Run	9/30/94	9/30/94	9/30/94
Time of Run	1000-1156	1235-1336	1652-1753
ORSAT (%v/v)			
Dry Basis			
Carbon Dioxide	7.40	7.30	7.20
Oxygen	7.40	7.50	8.00
Carbon Monoxide*	•	•	•
Nitrogen	85.20	85.20	84.80
WetBasis			
Carbon Dioxide	4.46	4.50	4.50
Oxygen	4.46	4.63	5.01
Carbon Monoxide*	•	•	•
Nitrogen	51.31	52.58	53.06
Portable Oxygen Monitor Result			
Time Weighted Average (%O2)	Not Available	Not Available	Not Available
Moisture Collected (ml)	597.0	574.0	580.0
Moisture Content (%v/v)	39.78	38.29	37.43
Molecular Weight of Flue Gas (lb/lb-mole)			
Dry	29.48	29.47	29.47
Wet	24.91	25.08	25.18
Fo	1.824	1.836	1.792

*Carbon monoxide was not measured, assumed concentrations less than 0.01%.

RESULTS OF PARTICULATE LOADING DETERMINATIONS

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 3, 1994

TABLE 3
RESULTS OF PARTICULATE LOADING DETERMINATIONS
TEST 1

Baghouse Outlet Stack

Parameter	**Run 1**	**Run 2**	**Run 3**
Date of Run	9/30/94	9/30/94	9/30/94
Time of Run	1000-1156	1235-1336	1652-1753
Sample Duration (Min.)	60.0	60.0	60.0
Average Flue Gas Temperature (°F)	257.9	261.5	265.4
Moisture Content of Flue Gas (%v/v)	39.78	38.29	37.43
Particulate Collected (Mg)*			
Wet Catch	2.1	1.9	2.8
Dry Catch	19.9	15.1	69.4
Total	22.0	17.0	72.2
Volumetric Flow Rate			
ACFM	36040	36950	38130
SCFM	25970	26490	27190
DSCFM	15640	16350	17010
Sample Volume (Cubic Feet)			
Meter Conditions	43.50	45.58	47.03
Dry Standard	42.54	43.54	45.63
Isokinetic Variation (%)	101.2	99.1	99.8
Particulate Concentration*			
Wet Catch, GR/DSCF	0.001	0.001	0.001
Dry Catch, GR/DSCF	0.007	0.005	0.023
Total, GR/DSCF	0.008	0.006	0.024
Particulate Emission Rate*			
Total, LB/HR	1.07	0.84	3.56

*Dry catch plus organic/residual wet catch

RESULTS OF OPACITY OBSERVATIONS

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 3, 1994

TABLE 4
RESULTS OF OPACITY OBSERVATIONS
TEST 1

Baghouse Outlet Stack

Percent Opacity	Optical Density	Relative Frequency
0	0.000	100.00
5	0.022	0.00
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average > 0.0	0.000	**Total >** 100

Average Opacity Per Six Minute Period:

Period	Opacity	Period	Opacity
1	0.0	6	0.0
2	0.0	7	0.0
3	0.0	8	0.0
4	0.0	9	0.0
5	0.0	10	0.0

High Six Minute Average: 0.0
Maximum reading: 0.0
Minumum reading: 0.0

Observer: M. Wilson
Date of test: 9/30/94
Time of test: 1000-1155

NOTE: The high six minute average opacity might not coincide with any of the 10 reported six minute periods. The high value is the maximum consecutive period possible and may overlap two of the ten consecutive six-minute periods.

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 3, 1994

TABLE 4 (Continued)
RESULTS OF OPACITY OBSERVATIONS
TEST 1

Baghouse Outlet Stack

Percent Opacity	Optical Density	Relative Frequency
0	0.000	100.00
5	0.022	0.00
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average > 0.0	0.000	**Total >** 100

Average Opacity Per Six Minute Period:

Period	Opacity	Period	Opacity
1	0.0	6	0.0
2	0.0	7	0.0
3	0.0	8	0.0
4	0.0	9	0.0
5	0.0	10	0.0

High Six Minute Average: 0.0
Maximum reading: 0.0
Minumum reading: 0.0

Observer: M. Wilson
Date of test: 9/30/94
Time of test: 1235-1335

NOTE: The high six minute average opacity might not coincide with any of the 10 reported six minute periods. The high value is the maximum consecutive period possible and may overlap two of the ten consecutive six-minute periods.

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 3, 1994

TABLE 4 (Continued)
RESULTS OF OPACITY OBSERVATIONS
TEST 1

Baghouse Outlet Stack

Percent Opacity	Optical Density	Relative Frequency
0	0.000	100.00
5	0.022	0.00
10	0.046	0.00
15	0.071	0.00
20	0.097	0.00
25	0.125	0.00
30	0.155	0.00
35	0.187	0.00
40	0.222	0.00
45	0.260	0.00
50	0.301	0.00
55	0.347	0.00
60	0.398	0.00
65	0.456	0.00
70	0.523	0.00
75	0.602	0.00
80	0.699	0.00
85	0.824	0.00
90	1.000	0.00
95	1.301	0.00
99	2.000	0.00
Average > 0.0	0.000	**Total >** 100

Average Opacity Per Six Minute Period:

Period	Opacity	Period	Opacity
1	0.0	6	0.0
2	0.0	7	0.0
3	0.0	8	0.0
4	0.0	9	0.0
5	0.0	10	0.0

High Six Minute Average: 0.0
Maximum reading: 0.0
Minumum reading: 0.0

Observer: M. Wilson
Date of test: 9/30/94
Time of test: 1652-1752

NOTE: The high six minute average opacity might not coincide with any of the 10 reported six minute periods. The high value is the maximum consecutive period possible and may overlap two of the ten consecutive six-minute periods.

RESULTS OF PRELIMINARY SOURCE DETERMINATIONS

TABLE 5
RESULTS OF AIR FLOW DETERMINATIONS
TEST 1

Baghouse Outlet Stack

Date of Run	9/30/94
Time of Measurement	0940
Number of Sampling Ports	6
Number of Points Sampled	24
Barometric Pressure (In. Hg)	29.25
Static Pressure (In. WC)	0.85
Absolute Flue Gas Pressure (In. Hg)	29.31
Average Flue Gas Temperature (F)	258
Average Moisture Content (%v/v)	39
Flue Gas Average Velocity (Feet/Second)	76.07
Duct Dimension (Inches)	27x40.25
Duct Cross-sectional Area (Square Feet)	7.55
Volumetric Flow Rate	
ACFM	34450
SCFM	24820
DSCFM	15140

PROCESS DESCRIPTION

The hot mix asphalt facility is a Astec model No. DDC-735C manufactured in 1994. The plant uses a drum mix with a manufactures rated drying capacity of 450 Tons/HR at 5% moisture. Natural gas is the fuel used with a heat input capacity rated at 80 million BTU/HR.

An Astec SBH-44:DB baghouse is used for pollution control equipment. The baghouse uses a air pressure drop with a range of 0-20 inches of water to monitor the control equipment. The stack has an inside diameter that measures 27 x 40.5 inches and has a rated flow of 44,490 ACFM. Flue gasses are pulled through the system with an induced draft fan and exhausted through the 24 foot stack to atmosphere. A relational flow diagram is represented by Figure 1.

For this series of tests, the production rate averaged 229.8 tons per hour. Natural gas was used for fuel and the average input was 229.8 cubic feet per ton hot mix.

Northland Constructors
Duluth, Minnesota
Asphalt Plant

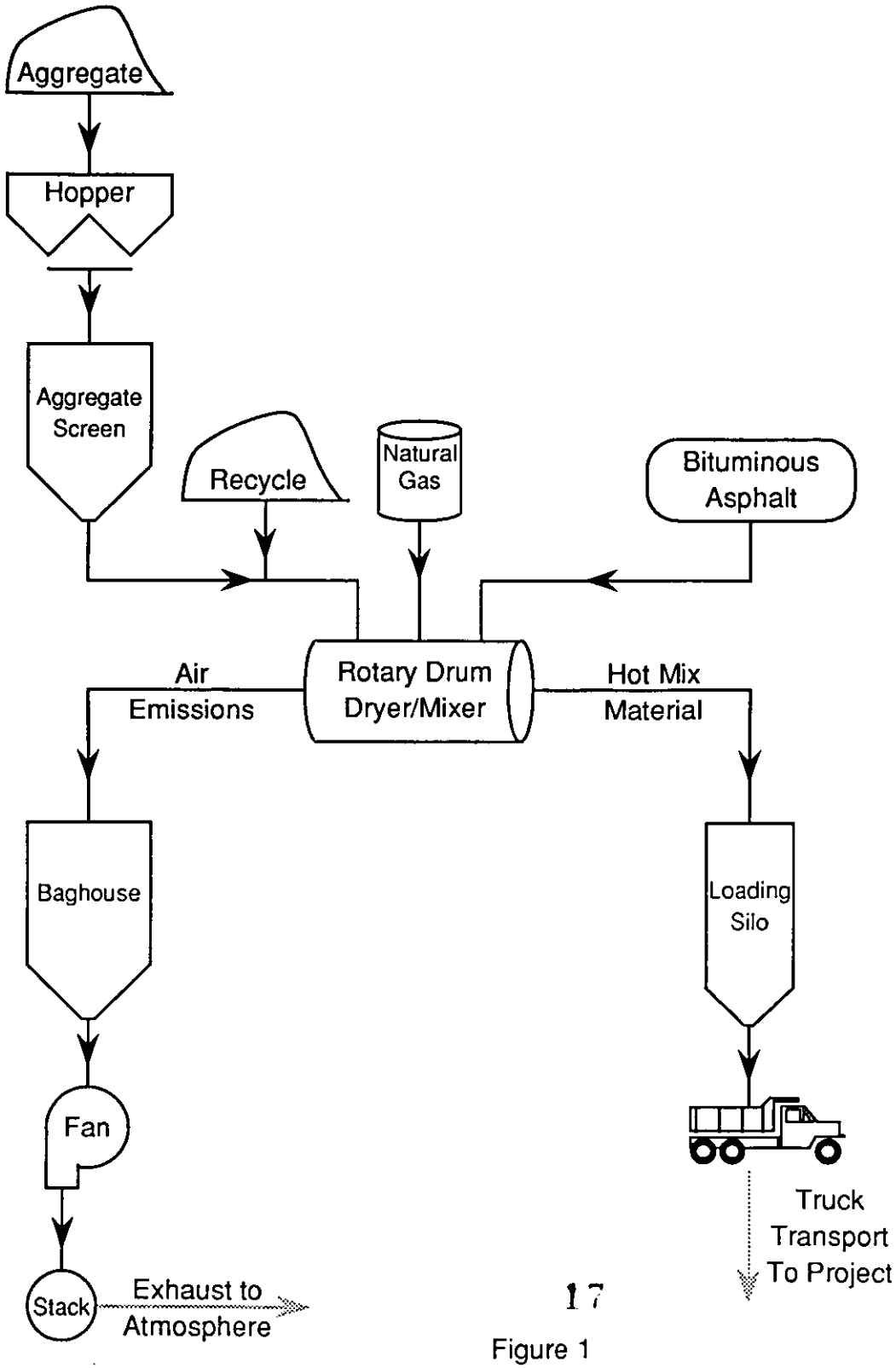


Figure 1

TEST PROCEDURES SUMMARY

Testing on the Baghouse Outlet Stack was performed from 6 test ports oriented horizontally on a vertical duct, approximately 8.0 duct diameters downstream of the nearest flow disturbance and 0.7 duct diameters upstream of the stack outlet. The duct dimension at this point was verified on-site and measures 27 x 40.25 inches in diameter. A 24 point traverse was used to extract representative flue gas samples. Each point was sampled 2.5 minutes for a run duration of 60 minutes. Test port and traverse point locations are displayed in Figures 2 and 3.

Particulate testing was performed in accordance with EPA Methods 1 - 5, 40 CFR 60, Appendix A. A preliminary velocity traverse and moisture estimation were conducted so that an appropriate sampling nozzle required for isokinetic sample withdrawal could be selected. A PACE sampling train that meets or exceeds the specifications outlined in the above reference was used to collect particulate samples. A temperature controlled glass-lined sampling probe was used to extract flue gas samples and transport them to an all glass filter and cyclone assembly in a temperature controlled oven. The back half of the particulate sampling train consisted of a series of three glass impingers, each of the first two prepared with 100 mls of deionized water, followed by a desiccant packed drying column. In addition, integrated gas samples were collected concurrently with the three particulate runs so that gas composition (Orsat) could be determined. The portable oxygen analyzer was also used to monitor the oxygen content of the flue gas throughout the test.

Opacity evaluations were performed in accordance with EPA Method 9, 40 CFR 60, Appendix A. After positioning himself with respect to the sun, the source and plume (wind) direction, the certified observer proceeds to record opacity readings at 15 second intervals for one hour. A total of 240 observations is recorded in 60 minutes. The readings are integrated to calculate a one-hour average opacity and ten successive six-minute averages. In addition, computer spreadsheets are used to search the data set to find a group of 24 consecutive readings anywhere within the one-hour evaluation for the highest possible six-minute average.

readings anywhere within the one-hour evaluation for the highest possible six-minute average.

Air flow determinations were performed in accordance with EPA Method 2 using traverse point protocols specified by EPA Method 1, 40 CFR 60, Appendix A. Point velocity measurements were conducted using a S-Type pitot tube and a Neotronics Model EDM-1 Electronic Digital Manometer. Source gas moisture content was estimated using wet bulb/dry bulb temperature measurements.

Northland Constructors
Duluth, Minnesota
Drum Dryer Baghouse Stack

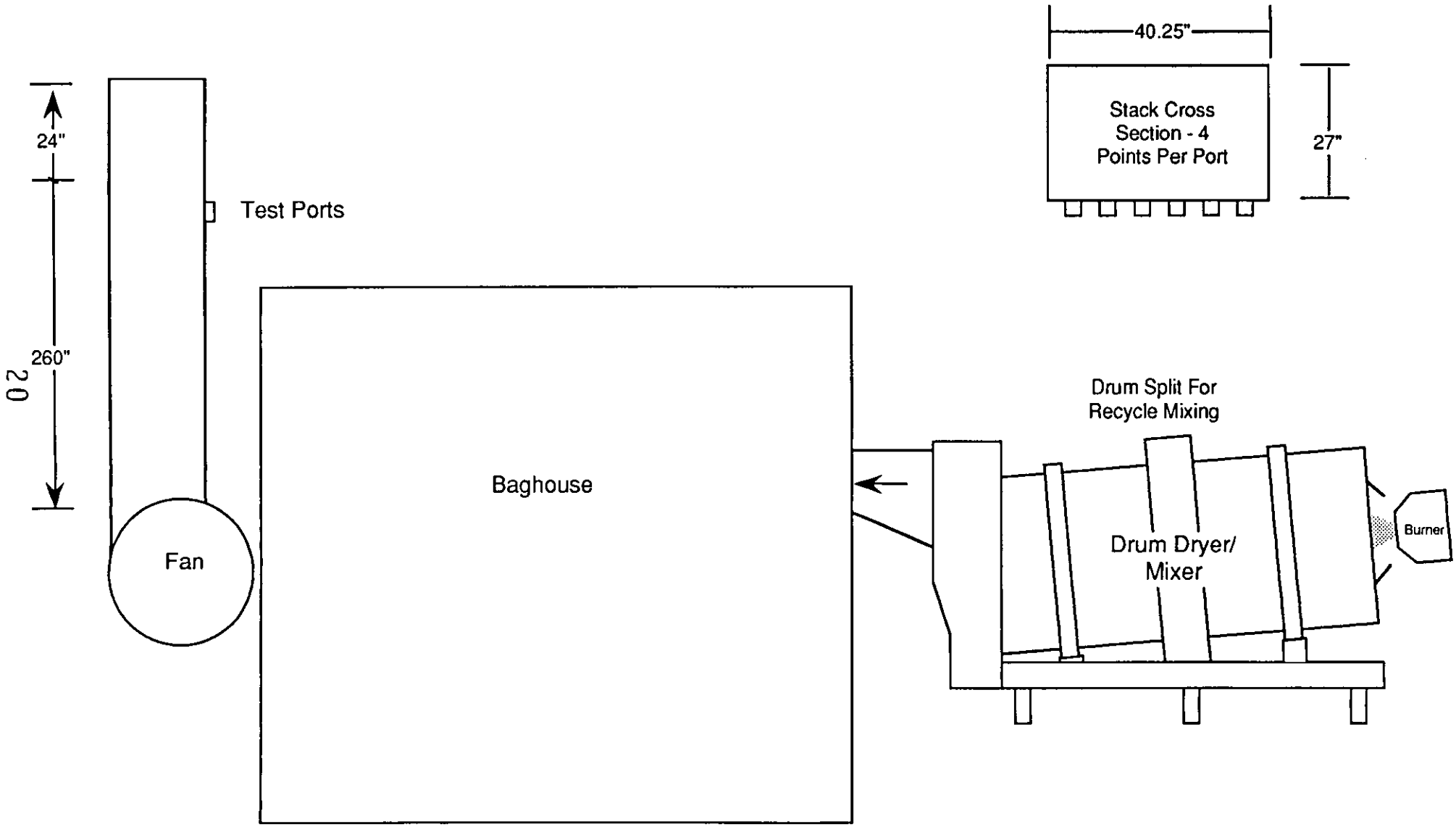


Figure 2

APPENDIX A

Field Data Sheets and Notes

EPA METHODS 2-5 FIELD DATA SHEETS

Pace INCORPORATED THE ASSURANCE OF QUALITY

AIR SAMPLING DEPARTMENT

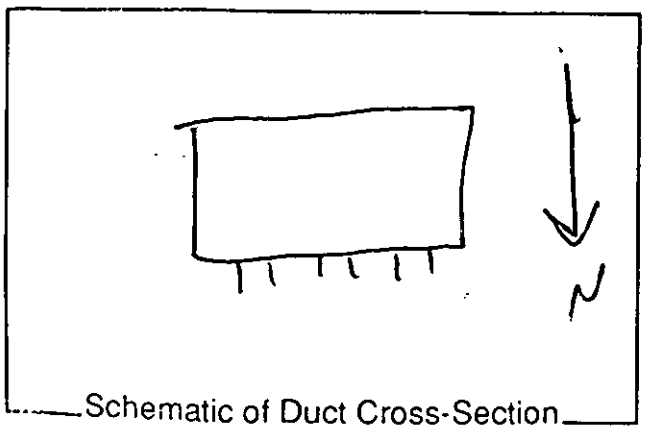
EPA Method 2 Field Data Sheet

Project Northland Constructors
Test Location Baghouse stack
Date 9/30/94 Test 1 Run
Operators MSL WAM
Barometric Pressure 29.25 Inches Hg
Static Pressure +.85 Inches H_2O
Pitot Leak Check - Positive OK Negative OK

Pitot Tube No. 1 C_p .839
Pressure Measurement Device oil man.
Duct Dimensions 27 x 40 @ 25 Inches
Port Length 3.5 Inches
Temp. - Dry Bulb 257.7 °F, Wet Bulb 171 °F
Moisture Content 39 %
320P Oxygen Concentration 16 %
Time of Measurement 0940 (24 Hr. Clock)

Traverse Point Identification				Cyclonic Flow Yaw Angle	Velocity Head ΔP Inches H_2O	Stack Temperature °F
Point Number	% Of Diameter	Inches From: Wall	Inches From: Port			
A 1		3.38	6.88	°	1.0	257
2		10.13	13.63	°	1.05	261
3		16.88	20.38	°	1.10	261
4		23.63	27.13	°	.83	258
B 1				°	1.30	257
2				°	1.25	261
3				°	1.15	261
4				°	.88	261
C 1				°	1.50	257
2				°	1.45	260
3				°	1.15	259
4				°	.95	260
d 1				°	.88	255
2				°	1.40	258
3				°	1.40	259
4				°	1.20	259
e 1				°	1.10	254
2				°	1.45	257
3				°	1.30	257
4				°	1.05	257
f 1				°	1.10	251
2				°	1.15	254
3				°	1.10	255
4				°	1.00	255

AVG = 1.15
.253
1/4



Schematic of Duct Cross-Section

Computer Data Summary:
Stack Pressure ____ Inches Hg
Duct Area ____ Square Feet
Molecular Weight - M_d ____
Molecular Weight - M_s ____
Avg. Duct Temperature 257.7 °F
Average $\sqrt{\Delta P}$ 1.0715
Flue Gas Velocity ____ Feet/Sec.
Volumetric Flow Rate:
ACFM ____
DSCFM ____

AS 102

Pace Incorporated — The Assurance of Quality

A[redacted]AM[redacted]NG[redacted]PA[redacted]ME[redacted]

EPA Method 5 Field Data Sheet

Project: Northland Constructors
Sample Location: Baghouse stack
Date: 9-30-94 Test: 1 Run: 1
Operators: MSL MAM

Train No.: C4, B4, P2
Meter Coef. ∂: .9999
Orifice Coef. ΔH@: 2263
Nozzle No.: L-2 D_n: .249

Pitot Tube No.: 1 C_p: .839
Bar. Pres.: 29.25 Ins. Hg
Static Pres.: .85 Ins. H_2O
Estimated MC: 39 %

Sampling Train Leak Checks:
Pretest 0.00 @ 15 Ins. Hg
Posttest 0.00 @ 9.0 Ins. Hg
Pitot - Positive OK Negative OK

Point No.	Time ΔT	Meter Vol. V_m Cubic Feet	Velocity Head - ΔP Inches WC	Orifice Meter - ΔH Inches WC	Desired ΔV_m	Desired V_m	Vacuum Inches Hg	Stack Temp. °F	Sampling Train Temperatures - °F: Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	320 P Oxygen Percent	
	(1000)	(116.40)													
A 4		117.86	.80	1.30	143	783	3.9	256	236	241	59	63	64		
3	5	119.28	1.25	2.04	179	962	5.5	259	238	249	56	64	64		
2		121.50	1.30	2.12	183	145	5.7	259	238	248	57	67	64		WB=170
1	10	123.39	1.40	2.30	191	336	6.1	255	238	247	59	69	64		
B 4		125.15	1.05	1.72	165	501	5.4	260	236	251	62	69	63		
3	15	126.84	1.05	1.71	165	666	5.3	261	236	251	61	72	63		WB=171
2		128.59	1.15	1.88	173	839	5.4	261	235	251	60	74	64		
1	20	130.26	1.20	1.98	178	017	5.4	259	237	250	59	75	64		
C 4		131.97	.98	1.63	161	178	4.9	248	250	250	59	65	65		O2=11 WB=1
3	25	133.65	1.15	1.88	173	350	5.0	248	247	247	54	67	64		WB=171
2		135.54	1.45	2.36	193	544	6.5	253	239	235	55	73	64		
1	30	137.42	1.40	2.29	191	735	6.5	252	237	243	56	76	64		
d 4		139.12	.94	1.54	157	842	4.9	254	233	249	58	76	64		
3	35	140.87	1.30	2.07	182	073	5.9	255	232	238	58	78	64		WB=172 W=
2		142.75	1.50	2.39	196	269	6.9	255	230	246	58	78	64		
1	40	144.70	1.50	2.39	196	464	6.9	255	230	242	58	80	64		
e 4		146.54	1.25	1.97	178	642	6.0	262	230	250	59	81	65		
3	45	148.42	1.30	2.05	182	824	6.9	263	230	252	59	83	66		WB=169 W=3
2		150.36	1.40	2.75	211	035	8.1	264	230	245	59	84	66		
1	50	152.42	1.50	2.54	204	239	8.0	262	230	246	60	85	67		
f 4		154.26	1.10	1.85	173	412	6.2	264	231	251	61	84	67		w=38
3	55	156.16	1.40	2.35	195	606	7.0	265	232	253	61	85	68		WB=171
2		158.07	1.50	2.45	199	805	7.3	265	233	249	61	87	68		w=39
1	60	159.90	1.20	1.98	179	984		260	235	250	62	88	69		
	(1156)														
	Θ=60	V_m=43.50	1.19	$\overline{\Delta H}$=2.066				$\overline{T_s}$=257.88					$\overline{T_m}$=70.46		

Samples Recovered: Filter No. 3225 ; ☑ Probe Wash; ☑ Wet Catch; ☐ Other _____

Integrated Gas Sampling Data:

Box No. 4
Bag No. 1
Bag Vol. 40 Liters
Bag Material kevlar
Leak Checks 0.00 cc/min. @ 25"Hg
Posttest O_2 Reading _____
320 P No. OK-1

Moisture Recovery Data:

Impinger No.	1	2	3	4	Desiccant	Total
Final Volume	380	384	9	—	1541	
Initial Volume	100	100	0	—	1529	
Difference	280	284	9	—	12	597

AS 10:

EPA Method 5 Field Data Sheet

Project: Northlead Const.
Sample Location: Baghouse stack
Date: 9-30-94 Test: 1 Run: 2
Operators: MSL [illegible]

Train No.: C4, D4, P2
Meter Coef. ∂: .9999
Orifice Coef. ΔH@: 2.263
Nozzle No.: 1-2 D_n: .249

Pitot Tube No.: 1 C_p: .839
Bar. Pres.: 29.25 Ins. Hg
Static Pres.: .85 Ins. H_2O
Estimated MC: 39 %

Sampling Train Leak Checks:
Pretest: 0.00 @ 15 Ins. Hg
Posttest: 0.00 @ 8.9 Ins. Hg
Pitot - Positive: OK Negative: OK

Point No.	Time ΔT	Meter Vol. V_m Cubic Feet	Velocity Head - ΔP Inches WC	Orifice Meter - ΔH Inches WC	Desired ΔV_m	Desired V_m	Vacuum Inches Hg	Stack Temp. °F	Sampling Train Temperatures - °F: Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	320 P Oxygen Percent	
	(1235)	(160.20)													
4		161.78	.88	1.46	153	173	4.1	245	233	248	59	72	71	.	
3	5	163.55	.95	1.58	154	332	4.5	246	233	243	59	76	71	.	
2		165.01	1.00	1.65	163	495	4.7	257	233	248	58	80	71	.	WB169
1	10	166.77	1.10	1.83	172	667	5.1	251	235	247	57	84	71	.	
4		168.57	1.15	1.90	175	842	5.5	259	231	248	58	86	72	.	
3	15	170.37	1.15	1.90	176	018	5.5	260	235	251	57	88	72	.	WB=168
2		172.13	1.20	1.99	180	197	5.5	260	233	250	58	89	72	.	
1	20	173.96	1.25	2.08	184	381	5.7	258	231	249	57	89	72	.	
4		175.78	1.20	1.98	179	561	5.4	264	232	251	58	91	73	.	
3	25	177.60	1.30	2.15	187	748	5.9	264	229	251	58	92	74	.	WB=170
2		179.50	1.40	2.32	195	943	6.3	269	229	250	58	93	74	.	
1	30	181.53	1.55	2.58	205	148	7.1	261	231	241	58	94	75	.	
4		183.44	1.25	2.07	184	333	7.1	265	231	239	59	93	76	.	
3	35	185.31	1.40	2.32	195	528	6.8	266	230	250	59	93	76	.	WB=170
2		187.39	1.55	2.56	205	733	7.2	266	232	248	58	95	76	.	
1	40	189.48	1.70	2.83	216	948	8.1	264	233	248	58	96	77	.	
4		191.43	1.30	2.16	189	137	6.5	266	236	250	60	95	78	.	
3	45	193.44	1.50	2.49	202	339	6.9	267	236	253	60	96	78	.	WB=170
2		195.54	1.65	2.74	213	552	8.1	266	237	250	59	97	79	.	
1	50	197.70	1.70	2.84	217	768	8.5	264	238	248	60	98	79	.	
4		199.63	1.25	2.08	186	954	6.5	266	240	250	62	97	80	.	
3	55	201.65	1.45	2.55	205	159	7.5	268	240	253	61	98	80	.	WB=168 w=3
2		203.70	1.50	2.64	209	368	7.8	268	241	250	61	99	81	.	
1	60	205.78	1.50	2.65	210	578	7.8	266	241	249	62	99	81	.	
	(1336)														
	Θ=60	V_m 45.58	1.48	$\overline{\Delta H}$= 2.21				$\overline{T_s}$=261.42					$\overline{T_m}$ 83.34		

Samples Recovered: Filter No. 3248 ; ☑ Probe Wash; ☑ Wet Catch; ☐ Other _____

Integrated Gas Sampling Data:

Box No. 4
Bag No. 2
Bag Vol. 40 Liters
Bag Material Tedlar
Leak Checks OK cc/min. @ 25"Hg
Posttest O_2 Reading _____
320 P No. OK-1

Moisture Recovery Data:

Impinger No.	1	2	3	4	Desiccant	Total
Final Volume	382	365	10	—	1428	
Initial Volume	100	100	0	—	1411	
Difference	282	265	10	—	17	574

AS 10

pace. INCORPORATED THE ASSURANCE OF QUALITY

AIR SAMPLING DEPARTMENT

EPA Method 5 Field Data Sheet

Project Northland Const. Train No. C4, B4, P2 Pitot Tube No. 1 C_p .839 Sampling Train Leak Checks:

Sample Location Bosheuse stack Meter Coef. ∂ .9999 Bar. Pres. 29.25 Ins. Hg Pretest 0.00 @ 15 Ins. Hg

Date 9-30-94 Test 1 Run 3 Orifice Coef. ΔH@ 2263 Static Pres. .85 Ins. H_2O Posttest 0.00 @ 11.1 Ins. Hg

Operators MSC MWM Nozzle No. 1-2 D_n .249 Estimated MC 3.8 % Pitot - Positive OK Negative OK

Point No.	Time ΔT	Meter Vol. V_m Cubic Feet	Velocity Head - ΔP Inches WC	Orifice Meter - ΔH Inches WC	Desired ΔV_m	Desired V_m	Vacuum Inches Hg	Stack Temp. °F	Sampling Train Temperatures - °F: Filter	Probe	Impinger Outlet	Meter Inlet	Meter Outlet	320 P Oxygen Percent	W/B
	(1652)	(206.00)													
4		207.77	.95	1.68	166	768	5.0	218	235	250	60	66	65		16 WB
3	5	209.29	1.10	1.90	173	936	5.5	220	236	247	56	69	65		
2		211.18	1.30	2.23	188	124	6.5	257	236	248	56	72	65		
1	10	213.05	1.35	2.29	191	315	6.9	246	237	248	56	74	65		
4		214.89	1.15	1.92	175	490	6.5	261	239	250	57	76	65		
3	15	216.69	1.25	2.08	182	672	6.5	264	238	252	56	78	65		WB=168
2		218.69	1.50	2.49	200	872	7.5	266	242	251	56	78	65		
1	20	220.51	1.70	2.82	213	055	8.7	267	244	245	53	80	65		
4		222.67	1.20	1.98	178	263	6.5	272	247	247	57	81	66		
3	25	224.56	1.30	2.21	189	451	6.9	271	246	251	57	82	66		WB=168 W=3
2		226.67	1.60	2.72	209	661	8.4	272	250	250	57	83	66		
1	30	228.84	1.80	3.06	222	883	9.2	272	251	249	57	84	67		
4		230.78	1.25	2.13	185	068	7.3	274	252	249	58	83	67		168
3	35	232.64	1.35	2.30	192	261	7.5	273	242	252	58	85	68		
2		234.79	1.70	2.90	217	477	9.0	273	249	250	57	86	68		
1	40	236.97	1.75	2.99	220	697	9.7	272	252	248	58	88	69		
4		238.92	1.30	2.22	190	887	7.8	275	248	251	60	87	70		
3	45	240.90	1.45	2.48	200	087	8.0	275	246	249	61	87	70		WB=167
2		243.01	1.65	2.81	214	301	9.1	277	245	249	61	89	71		
1	50	245.18	1.65	2.82	214	515	9.5	276	246	248	62	90	71		
4		247.07	1.30	2.22	190	706	7.3	276	244	244	63	88	72		
3	55	248.02	1.35	2.31	194	899	7.9	277	243	248	64	89	72		
2		251.04	1.45	2.47	201	100	8.2	278	244	250	66	91	73		
1	60	253.03	1.45	2.48	201	302	8.2	278	244	251	66	91	74		
	(1753)														
	Θ=60	V_m 47.03	1.164	$\overline{\Delta H}$=2.385				$\overline{T_s}$=76.58					$\overline{T_m}$=75.75		

Samples Recovered: Filter No. 3249 ; ☑ Probe Wash; ☑ Wet Catch; ☐ Other _____

Integrated Gas Sampling Data:

Box No. 4 Bag Material Tedlar

Bag No. 3 Leak Checks 0.00 cc/min. @ 25"Hg

Bag Vol. 40 Liters Posttest O_2 Reading _____

320 P No. OP-1

Moisture Recovery Data:

Impinger No.	1	2	3	4	Desiccant	Total
Final Volume	381	372	8	—	1560	
Initial Volume	100	100	0	—	1541	
Difference	281	272	8	—	19	580
		553	561			

AS 105

pace

AIR SAMPLING DEPARTMENT

Field Computer Summary

Project Name: Northland Constructors Operator M. Loftus
Sampling Location: Baghouse stack
Date of Test: 9-30-84
Test Number: 1

Initialization Parameters

Meter Coef. - ∂	=	.999
Orif. Coef. - ΔH@	=	2263
Pitot Coef. - C_p	=	.85
Nozzle Dia. - D_n	=	.249
Bar. Pres. - P_b	=	29.25
Time/Point - ΔT	=	2.5
Moisture Content	=	39
% Oxygen	=	16
Meter Temp. - t_m	=	60
Static Pres. - P_g	=	.85

Run Specific Input Parameters

	Run 1	Run 2	Run 3	Run 4
V/O	116.40	160.20	206.00	
No. Of Points	24	24	24	
MC	39	39	39	
V/F	159.90	205.78	253.03	
Grams H_2O	597	574	580	
Run Time	60	60	60	
1-Rnd/2-Rect	2	2	2	
Diameter(Ins.)	—	—	—	
Length(Ins.)	27	27	27	
Width(Ins.)	40.25	40.25	40.25	

End Of Run Summary

	Run 1	Run 2	Run 3	Run 4
Avg. √ΔP	1.119	1.148	1.184	
Avg. ΔH	2.066	2.221	2.395	
Avg. t_s	257.88	261.42	265.88	
Avg. t_m	70.46	83.31	75.15	
Standard Vol.	42.54	43.54	45.63	
Moist. Content	39.78	38.29	37.43	
Avg. Gas Vel.	78.92	80.79	83.56	
% Isokinetic	102.10	100.12	100.67	
ACFM	35736	36580	37836	
DSCFM	15507	16185	16870	

EPA METHOD 9 FIELD DATA SHEETS

pace

AIR SAMPLING DEPARTMENT

EPA Method 9 Field Data Sheet

Project Northland Constructors 9/94
Source No. 1 I.D. Baghouse Stack
Source No. 2 I.D.
Test No. 1

Evaluation Date 9/30/94
Observer M. Wilson
Certification Date April 6, 1994

Source No. 1

Type of Source Asphalt Mat. Control Device Baghouse
Fuel Type Natural Gas Load

Source No. 2

Type of Source Control Device
Fuel Type Load

Source Height(s) ~~35'~~ 22' MEW 9/30/94 Outlet Dimensions 27" x ~~41.25~~ = 40.25" MEW 9/30/94

Plume Description:

Type ☐ Coning ☐ Fanning ☐ Looping ☑ Lofting ☐ Fumigating
Color White Length 100'
Steam Plume ☑ Attached ☐ Detached ☐ No Visible Steam

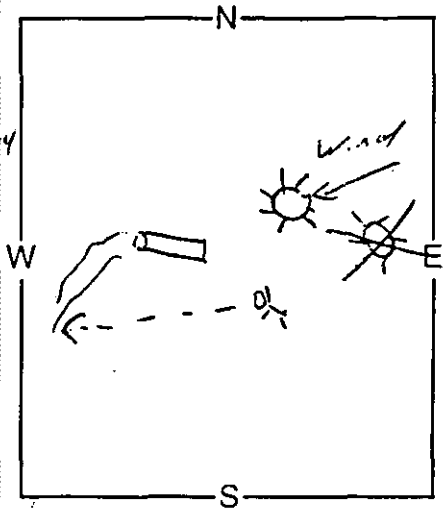
Background Description (Type, color) Green, Light Green Trees

Meteorological Conditions (clear, % cloudy, etc.) 100-80% Cloudy
Wind Direction NE, E Speed 5-15 mph
Ambient Temp. ~~59~~ 52 °F MEW 9/30/94

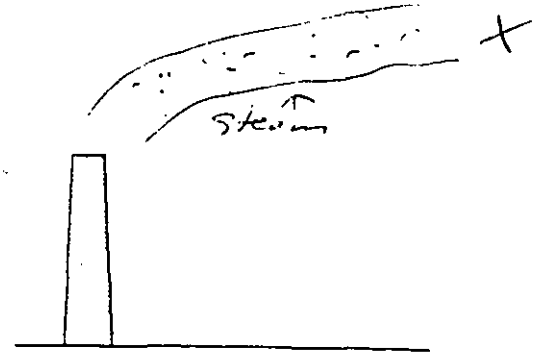
Location of Observer (direction and distance) 600' S.E. of Stack

Personnel Present During Observation M. Wilson, M. Lostus, M. McDermott

Show Observer's Position In Relation to the Source, Plume and Lighting



Show Point Where Readings Were Evaluated In Relation to the Source Outlet and the Steam Plume



Comments (include any changes to the above during evaluation)
Run was stopped at 1020 and then continued at 1115 hrs.

pace

AIR SAMPLING DEPARTMENT

EPA Method 9 Field Data Sheet

Page 2

Source No. 1 1155 MEW 9/30/44

Time Start 1000 Time Stop ~~1215~~

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

process went down at 1020 started up at 1115

Source No. 2

Time Start _____ Time Stop _____

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

Observer Signature Mark E Wilson

pace

AIR SAMPLING DEPARTMENT

EPA Method 9 Field Data Sheet

Project Northland Constructors 9/94
Source No. 1 I.D. Baghouse Stack
Source No. 2 I.D.
Test No. 1

Evaluation Date 9/30/94
Observer M. Wilson
Certification Date April 6, 1994

Source No. 1

Type of Source Asphalt Mast. Control Device Baghouse
Fuel Type Natural Gas Load

Source No. 2

Type of Source Control Device
Fuel Type Load

Source Height(s) 22' Outlet Dimensions 40.25x27"

Plume Description:

Type ☐ Coning ☐ Fanning ☐ Looping ☑ Lofting ☐ Fumigating
Color White Length 100'
Steam Plume ☑ Attached ☐ Detached ☐ No Visible Steam

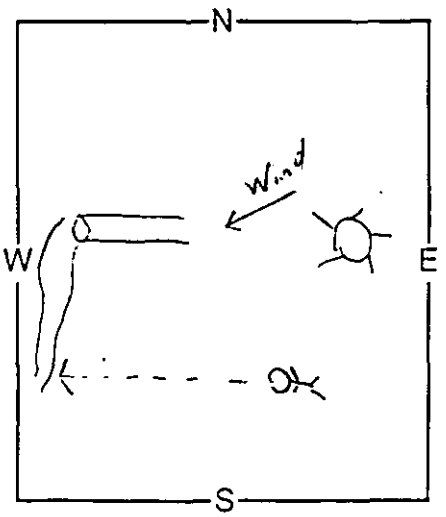
Background Description (Type, color) Green, Light Green Trees.

Meteorological Conditions (clear, % cloudy, etc.) 100-90% Cloudy
Wind Direction NE, E Speed 5-15 mph
Ambient Temp. 55 °F

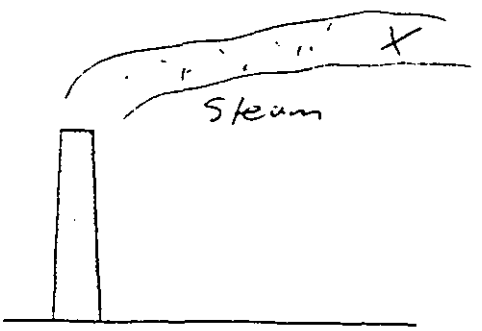
Location of Observer (direction and distance) 600' S.E. of Stack

Personnel Present During Observation M. Wilson, M. Loftus, M. McDermott

Show Observer's Position In Relation to the Source, Plume and Lighting



Show Point Where Readings Were Evaluated In Relation to the Source Outlet and the Steam Plume



Comments (include any changes to the above during evaluation) Cloud cover was 100% for most of the run.

EPA Method 9 Field Data Sheet

Page 2

Source No. 1

Time Start 1235 Time Stop 1335

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

Source No. 2

Time Start _____ Time Stop _____

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

Observer Signature [illegible]

pace

AIR SAMPLING DEPARTMENT

EPA Method 9 Field Data Sheet

Project Northland Constructors 9/94
Source No. 1 I.D. Baghouse Stack
Source No. 2 I.D.
Test No. 1

Evaluation Date 9/30/94
Observer M. Wilson
Certification Date April 6, 1994

Source No. 1

Type of Source Asphalt Manf. Control Device Baghouse
Fuel Type Natural Gas Load

Source No. 2

Type of Source Control Device
Fuel Type Load

Source Height(s) 100' Outlet Dimensions 27" x 40.25"

Plume Description:

Type ☐ Coning ☐ Fanning ☐ Looping ☑ Lofting ☐ Fumigating

Color White Length 100'

Steam Plume ☑ Attached ☐ Detached ☐ No Visible Steam

Background Description (Type, color) Green, Light Green Trees / Yellow Asphalt Storage Silos

Meteorological Conditions (clear, % cloudy, etc.) 100% Cloudy

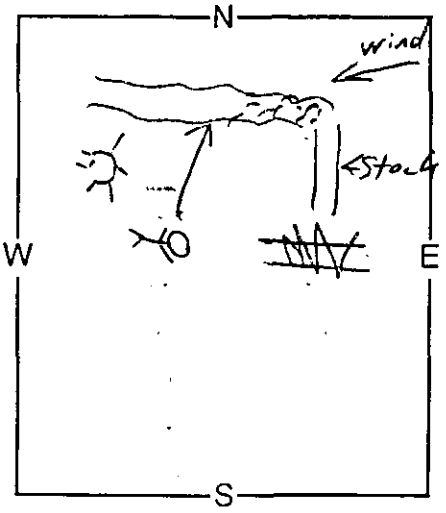
Wind Direction ~~S~~ NEE Speed 5-10 mph

Ambient Temp. 58 °F

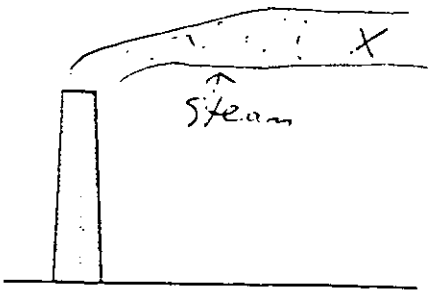
Location of Observer (direction and distance) 600' S.S.W. of the Stack

Personnel Present During Observation M. Wilson, M. Loftus, + M. McDermott

Show Observer's Position In Relation to the Source, Plume and Lighting



Show Point Where Readings Were Evaluated In Relation to the Source Outlet and the Steam Plume



Comments (include any changes to the above during evaluation) When the wind speed decreased, I used the yellow Silos to take the most accurate readings possible.

EPA Method 9 Field Data Sheet

Page 2

Source No. 1

Time Start 1652 Time Stop 1752

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

Source No. 2

Time Start _____ Time Stop _____

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

Observer Signature Mark E Wilson

VISIBLE EMISSION EVALUATOR CERTIFICATION

VISIBLE EMISSIONS EVALUATOR

This is to certify that

Mark Wilson

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.

Thomas Rose
President

243062
Certificate Number

Vice President

Minneapolis
Location

David B. Savage, Jr.
Program Manager

April 6, 1994
Date of Issue

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APPENDIX B

Laboratory Data and Reports

ORSAT ANALYTICAL DATA

pace INCORPORATED THE ASSURANCE OF QUALITY

AIR SAMPLING DEPARTMENT

EPA Method 3 Laboratory Summary Sheet

Project Northland Constructors 9/94
Sampling Location Baghouse Stack
Sampling Date 9/30/94
Project Number 940927.402

Analyst M. Wilson
Analysis Date 10/3/94
Apparatus Leak Check - Pos. 0.0 Neg. 0.0
Apparatus Identification OB-02
Sample Type ☑ Integrated ☐ Grab

Test No.	Run No.	Orsat Analyzer Results			F_o	O_2 Analyzer Results		Sample Container
		% CO_2	% O_2	% CO		Field	Lab	
1	0	0.00	20.90		N/A	—	—	☐ Tedlar™ Bag ☐ Glass Bulb
1	1	7.40	7.40		1.824	Not Given	7.4	☑ Tedlar™ Bag ☐ Glass Bulb
1	2	7.30	7.50		~~1.813~~	Not Given	7.0	☑ Tedlar™ Bag ☐ Glass Bulb
1	3	7.20	8.00		1.836.5 MEV 1.792	Not Given	7.9	☑ Tedlar™ Bag ☐ Glass Bulb
								☐ Tedlar™ Bag ☐ Glass Bulb
								☐ Tedlar™ Bag ☐ Glass Bulb
								☐ Tedlar™ Bag ☐ Glass Bulb
								☐ Tedlar™ Bag ☐ Glass Bulb
								☐ Tedlar™ Bag ☐ Glass Bulb
								☐ Tedlar™ Bag ☐ Glass Bulb

Calculate F_o before evacuating any samples. Compare F_o to expected fuel values. If discrepancies exist, reanalyze samples. Calculate F_o as follows:

$$F_o = \frac{20.9 - \% O_2}{\% CO_2}$$

Comments _____

F_o Ranges For Common Fuels	
Anthracite Coal & Lignite	1.016 - 1.130
Bituminous Coal	1.083 - 1.230
Distillate Oil	1.260 - 1.413
Residual Oil	1.210 - 1.370
Wood	1.000 - 1.120
Wood Bark	1.003 - 1.130
Natural Gas	1.600 - 1.836
Propane	1.434 - 1.586
Butane	1.405 - 1.553

EPA Method 3 Laboratory Data Sheet

Project Northland Constructors 9/94
Sampling Location Baghouse Stack
Sampling Date 9/30/94
Project Number 940927.402

Analyst M. Wilson
Analysis Date 10/3/94
Apparatus Leak Check - Pos. 0.0 Neg. 0.0
Apparatus Identification OB-01

	Aliquot Volume	CO_2	O_2
Test 1 Run 0	Zero Point 0.00 ml Sample Volume 100.00 ml	Initial Reading 0.00 ml Final Reading 0.00 ml Volume CO_2 0.00 ml % CO_2 0.00 %	Initial Reading 0.00 ml Final Reading 20.90 ml Volume O_2 20.90 ml % O_2 20.90 %
Duplicate	Zero Point ____ ml Sample Volume ____ ml	Initial Reading ____ ml Final Reading ____ ml Volume CO_2 ____ ml % CO_2 ____ %	Initial Reading ____ ml Final Reading ____ ml Volume O_2 ____ ml % O_2 ____ %
Average		% CO_2 0.00 %	% O_2 20.90 %
Test 1 Run 1	Zero Point 0.00 ml Sample Volume 100.00 ml	Initial Reading 0.00 ml Final Reading 7.40 ml Volume CO_2 7.40 ml % CO_2 7.40 %	Initial Reading 7.40 ml Final Reading 14.80 ml Volume O_2 7.40 ml % O_2 7.40 %
Duplicate	Zero Point 0.00 ml Sample Volume 100.00 ml	Initial Reading 0.00 ml Final Reading 7.40 ml Volume CO_2 7.40 ml % CO_2 7.40 %	Initial Reading 7.40 ml Final Reading 14.80 ml Volume O_2 7.40 ml % O_2 7.40 %
Average		% CO_2 7.40 %	% O_2 7.40 %

Comments:

EPA Method 3 Laboratory Data Sheet

Project Northland Constructors 9/94
Sampling Location Baghouse Stack
Sampling Date 9/30/94
Project Number 940927.402

Analyst M. Wilson
Analysis Date 10/3/94
Apparatus Leak Check - Pos. 0.0 Neg. 0.0
Apparatus Identification OB-02

	Aliquot Volume	CO_2	O_2
Test 1 Run 2	Zero Point 0.00 ml Sample Volume 100.00 ml	Initial Reading 0.00 ml Final Reading 7.30 ml Volume CO_2 7.30 ml % CO_2 7.30 %	Initial Reading 7.30 ml Final Reading 14.80 ml Volume O_2 7.50 ml % O_2 7.50 %
Duplicate	Zero Point 0.00 ml Sample Volume 100.00 ml	Initial Reading 0.00 ml Final Reading 7.30 ml Volume CO_2 7.30 ml % CO_2 7.30 %	Initial Reading 7.30 ml Final Reading 14.80 ml Volume O_2 7.50 ml % O_2 7.50 %
Average		% CO_2 7.30 %	% O_2 7.50 %
Test 1 Run 3	Zero Point 0.00 ml Sample Volume 100.00 ml	Initial Reading 0.00 ml Final Reading 7.20 ml Volume CO_2 7.20 ml % CO_2 7.20 %	Initial Reading 7.20 ml Final Reading ~~8.00~~ ml Volume O_2 ~~15.20~~ ml % O_2 8.00 %
Duplicate	Zero Point 0.00 ml Sample Volume 100.00 ml	Initial Reading 0.00 ml Final Reading 7.20 ml Volume CO_2 7.20 ml % CO_2 7.20 %	Initial Reading 7.20 ml Final Reading 15.20 ml Volume O_2 8.00 ml % O_2 8.00 %
Average		% CO_2 7.20 %	% O_2 8.00 %

MEW 10/3/94
15.20
8.00

Comments:

AS 103

PARTICULATE ANALYTICAL DATA

pace INCORPORATED THE ASSURANCE OF QUALITY

INORGANIC LABORATORY

Jme 10-19-94

EPA Method 5 Particulate Gravimetric Sheet
Organic Condensibles

Project: NorthLand Constructors
Analyst: BOL
Sampling Location: Baghouse Stack
Analysis Date(s): 10-14-94
Sampling Date: 9-30-94
Sampling Reagent: DI
Test Number: 1
LDMS Entry: 10-19-94 Initials: BOL
Project Number: 941006.500
LDMS Validation: _____ Initials: _____

BATCH 1060221

Sample No. 23256.4	Sample No. 23257.2	Sample No. 23258.0
Run Number T1R1	Run Number T1R2	Run Number T1R3
Dish Number 74 (1 390 mls, 2 400 mls)	Dish Number 44 (1. 395 mls, 2. 390 mls)	Dish Number A9 (1. 380 mls, 2 390 mls)
Date/Time 10-17-94 0930	Date/Time 10-17-94 0930	Date/Time 10-17-94 0930
Gross Weight 98.2286 g	Gross Weight 102.3337 g	Gross Weight 108.6738 g
Date/Time 10-18-94 0945	Date/Time 10-18-94 0945	Date/Time 10-18-94 0945
Gross Weight 98.2290 g	Gross Weight 102.3337 g	Gross Weight 108.6738 g
Avg. Gross Wt. 98.2288 g	Avg. Gross Wt. 102.3337 g	Avg. Gross Wt. 108.6738 g
Dish Tare Wt. 98.2260 g	Dish Tare Wt. 102.3311 g	Dish Tare Wt. 108.6703 g
Difference 0.0028 g	Difference 0.0026 g	Difference 0.0035 g
Blank Weight +0.0007 g	Blank Weight +0.0007 g	Blank Weight +0.0007 g
Condensible Organic Wt. 0.0021 g	Condensible Organic Wt. 0.0019 g	Condensible Organic Wt. 0.0028 g
Transfer "Condensible Organic Wt." to Box Number 1.	Transfer "Condensible Organic Wt." to Box Number 2.	Transfer "Condensible Organic Wt." to Box Number 3.
WC 1 [0.0021] g	WC 2 [0.0019] g	WC 3 [0.0028] g

AS 105 A

INORGANIC LABORATORY

EPA Method 5 Particulate Gravimetric Sheet
Organic Condensibles

Project Northland Constructors
Analyst BDL
Sampling Location Baghouse Stack
Analysis Date(s) 10-14-94
Sampling Date 9-30-94
Sampling Reagent DI
Test Number 1
LDMS Entry 10-19-94 Initials BDL
Project Number 941006.500
LDMS Validation _____ Initials _____

Sample No. 23259.9	Sample No. _____	Sample No. _____
Run Number T1 R0	Run Number _____	Run Number _____
Dish Number E10	Dish Number _____	Dish Number _____
Vol 200 mls		
Date/Time 10-17-94 0930	Date/Time _____	Date/Time _____
Gross Weight 105.5883 g	Gross Weight _____ g	Gross Weight _____ g
Date/Time 10-18-94 0945	Date/Time _____	Date/Time _____
Gross Weight 105.5885 g	Gross Weight _____ g	Gross Weight _____ g
Avg. Gross Wt. 105.5884 g	Avg. Gross Wt. _____ g	Avg. Gross Wt. _____ g
Dish Tare Wt. 105.5867 g	Dish Tare Wt. _____ g	Dish Tare Wt. _____ g
Difference 0.0017 g	Difference _____ g	Difference _____ g
Blank Weight 0.0007 g	Blank Weight _____ g	Blank Weight _____ g
Condensible Organic Wt. 0.0010 g	Condensible Organic Wt. _____ g	Condensible Organic Wt. _____ g
Transfer "Condensible Organic Wt." to Box Number 1.	Transfer "Condensible Organic Wt." to Box Number 2.	Transfer "Condensible Organic Wt." to Box Number 3.
Probe wash 0.0031		
WC 1 [0.0010] g	WC 2 [ ] g	WC 3 [ ] g

AS 105 A

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INORGANIC LABORATORY

JMC 10.19.94

EPA Method 5 Particulate Gravimetric Sheet

Particulate In Probe Wash

Project Northland Constructors
Sampling Location Baghouse Stack
Sampling Date 9-30-94
Test Number 1
Project Number 941006.500

Analyst BDL
Analysis Date(s) 10-14-94
Cleanup Reagent(s) Acetone
LDMS Entry 10-19-94 Initials BDL
LDMS Validation _____ Initials _____

Sample No. 23256.4	Sample No. 23257.2	Sample No. 23258.0
Run Number T1R1	Run Number T1R2	Run Number T1R3
Dish Number A0A	Dish Number S6	Dish Number B1
Reagent Vol. 85 ml	Reagent Vol. 100 ml	Reagent Vol. 75 ml
Date/Time 10-17-94 0930	Date/Time 10-17-94 0930	Date/Time 10-17-94 0930
Gross Weight 105.3311 g	Gross Weight 106.6369 g	Gross Weight 103.0376 g
Date/Time 10-18-94 0945	Date/Time 10-18-94 0945	Date/Time 10-18-94 0945
Gross Weight 105.3308 g	Gross Weight 106.6372 g	Gross Weight 103.0378 g
Avg. Gross Wt. 105.3310 g	Avg. Gross Wt. 106.6370 g	Avg. Gross Wt. 103.0377 g
Dish Tare Wt. 105.3077 g	Dish Tare Wt. 106.6229 g	Dish Tare Wt. 102.9727 g
Difference 0.0233 g	Difference 0.0141 g	Difference 0.0650 g
Blank Weight +0.0006 g	Blank Weight +0.0006 g	Blank Weight +0.0006 g
Particulate In Rinse Weight 0.0227 g	Particulate In Rinse Weight 0.0135 g	Particulate In Rinse Weight 0.0644 g
Transfer "Particulate In Rinse Weight" to Box Number 1.	Transfer "Particulate In Rinse Weight" to Box Number 2.	Transfer "Particulate In Rinse Weight" to Box Number 3.
PW 1 0.0227 g	PW 2 0.0135 g	PW 3 0.0644 g

AS 105 A

pace

INORGANIC LABORATORY

EPA Method 5 Particulate Gravimetric Sheet

Particulate On Filter

Project: Northland Constructors
Analyst: BDL
Sampling Location: Baghouse Stack
Analysis Date(s): 10-14-94
Sampling Date: 9-30-94
Filter Type: Fiberglass
Test Number: 1
LDMS Entry: 10-19-94 Initials: BDL
Project Number: 941006.500
LDMS Validation: Initials:

Sample No. 232564	Sample No. 232572	Sample No. 232580
Run Number 1	Run Number 2	Run Number 3
Filter Number 3225	Filter Number 3248	Filter Number 3249
Date/Time 10-14-94 0715	Date/Time 10-14-94 0715	Date/Time 10-14-94 0715
Gross Weight 0.6681 g	Gross Weight 0.6629 g	Gross Weight 0.6723 g
Date/Time 10-14-94 1530	Date/Time 10-14-94 1530	Date/Time 10-14-94 1530
Gross Weight 0.6686 g	Gross Weight 0.6629 g	Gross Weight 0.6724 g
Avg. Gross Wt. 0.6684 g	Avg. Gross Wt. 0.6629 g	Avg. Gross Wt. 0.6724 g
Filter Tare Wt. 0.6712 g	Filter Tare Wt. 0.6613 g	Filter Tare Wt. 0.6674 g
Difference -0.0028 g	Difference 0.0016 g	Difference 0.0050 g
Particulate On Filter Weight -0.0028 g	Particulate On Filter Weight 0.0016 g	Particulate On Filter Weight 0.0050 g
Transfer "Particulate On Filter Weight" to Box Number 1.	Transfer "Particulate On Filter Weight" to Box Number 2.	Particulate On Filter Weight" to Box Number 3.
Sum particulate weights from each box labeled "1" and record in box labeled "T1."	Sum particulate weights from each box labeled "2" and record in box labeled "T2."	Sum particulate weights from each box labeled "3" and record in box labeled "T3."
AF 1 -0.0028 g	AF 2 0.0016 g	AF 3 0.0050 g
Total T1 0.0220 g	Total T2 0.0170 g	Total T3 0.0722 g

AS 108 A

INORGANIC LABORATORY

EPA Method 5 Particulate Gravimetric Sheet
Reagent Blanks

Project: NorthLand Constructors
Sampling Location: Baghouse Stack
Sampling Date: 9-30-94
Test Number: 1
Project Number: 941006.500

Analyst: BDL
Analysis Date(s): 10-14-94

Wet Catch

Type:
- [ ] Organic Condensibles (Extract.)
- [ ] Inorganic (Residual)
- [ ] Other
- [ ] Retain For Further Analyses

Reagent: TPX 75 ml chloroform - 75 ml Ethyl Ether
Volume: 150 ml

Date/Time: 10-18-94 1300
Gross Weight: 113.7102 g

Date/Time: 10-19-94 0700
Gross Weight: 113.7097 g

Avg. Gross Wt.: 113.7100 g
Dish Tare Wt.: 113.7093 g
Difference: +0.0007 g

Blank Weight: +0.0007 g

Probe Wash

Type:
- [x] Gravimetric
- [ ] Other
- [ ] Retain For Further Analyses

Ty

Reagent: Acetone
Volume: 100 ml

Date/Time: 10-18-94 1300
Gross Weight: 100.9445 g

Date/Time: 10-19-94 0700
Gross Weight: 100.9446 g

Avg. Gross Wt.: 100.9446 g
Dish Tare Wt.: 100.9440 g
Difference: + 0.0006 g

Blank Weight: +0.0006 g

OTHER ANALYTICAL DATA

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Northland Constructors
4843 Rice Lake Road
Duluth, MN 55803

October 20, 1994
PACE Project Number: 941006500

Attn: Mr. James Oswald

Client Reference: Northland Const. 9/94

PACE Sample Number:			10 0232564	10 0232572	10 0232580
Date Collected:			09/30/94	09/30/94	09/30/94
Date Received:			10/05/94	10/05/94	10/05/94
Client Sample ID:			Baghouse Stack	Baghouse Stack	Baghouse Stack
Parameter	Units	MDL	T1R1	T1R2	T1R3
INORGANIC ANALYSIS					
EPA 5: ORGANIC CONDENSIBLES					
Particulates, filter	g	0.0001	-0.0028	0.0016	0.0050
Particulates, probe wash	g	0.0001	0.0227	0.0135	0.0644
Particulates, Organic Condensibles	g	0.0001	0.0021	0.0019	0.0028
Particulates, total-EPA 5	g	0.0001	0.0220	0.0170	0.0722

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REPORT OF LABORATORY ANALYSIS

Mr. James Oswald
Page 2

October 20, 1994
PACE Project Number: 941006500

Client Reference: Northland Const. 9/94

PACE Sample Number:			10 0232599	10 0241326	10 0241334
Date Collected:			09/30/94	09/30/94	09/30/94
Date Received:			10/05/94	10/05/94	10/05/94
Client Sample ID:			T1R0 Blank	Baghouse Stack T1R1 Moist	Baghouse Stack T1R2 Moist
Parameter	Units	MDL			
INORGANIC ANALYSIS					
INDIVIDUAL PARAMETERS					
Moisture content	%	0.1	-	3.7	3.8
EPA 5: ORGANIC CONDENSIBLES					
Particulates, probe wash	g	0.0001	0.0031	-	-
Particulates, Organic Condensibles	g	0.0001	0.0010	-	-
Particulates, total-EPA 5	g	0.0001	0.0041	-	-

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REPORT OF LABORATORY ANALYSIS

Mr. James Oswald
Page 3

October 20, 1994
PACE Project Number: 941006500

Client Reference: Northland Const. 9/94

PACE Sample Number:			10 0241342
Date Collected:			09/30/94
Date Received:			10/05/94
Client Sample ID:			Baghouse Stack T1R3
Parameter	Units	MDL	Moist
INORGANIC ANALYSIS			
INDIVIDUAL PARAMETERS			
Moisture content	%	0.1	3.7

The analyses of soil samples were performed 'as received' and do not reflect analyses on a dry weight basis unless indicated.

These data have been reviewed and are approved for release.

Mary Jo Connolly
Project Manager

1710 Douglas Drive N
Minneapolis, MN 55422
TEL: 612-544-5543
FAX: 612-525-3366

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FOOTNOTES
for pages 1 through 3

October 20, 1994
PACE Project Number: 941006500

Client Reference: Northland Const. 9/94

MDL Method Detection Limit

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REPORT OF LABORATORY ANALYSIS

Mr. James Oswald
Page 5

QUALITY CONTROL DATA

October 20, 1994
PACE Project Number: 941006500

Client Reference: Northland Const. 9/94

Moisture content
Batch: 10 60214
Samples: 10 0241326, 10 0241334, 10 0241342

METHOD BLANK AND SAMPLE DUPLICATE:

Parameter	Units	MDL	Method Blank	100240834	Duplicate of 10 0240834	RPD
Moisture content	%	0.1	ND	3.0	2.9	3%

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Client Reference: Northland Const. 9/94

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

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Minneapolis, MN 55422
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FAX: 612-525-3366

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APPENDIX C

Calculation Equations and Report Nomenclature

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 3, 1994

APPENDIX C
METHOD 5 CALCULATION SUMMARY
TEST 1

Baghouse Outlet Stack

Parameter	**Run 1**	**Run 2**	**Run 3**
Date of Run	9/30/94	9/30/94	9/30/94
Sample Duration (Minutes)	60	60	60
Barometric Pressure (inches Hg)	29.25	29.25	29.25
Static Pressure Of Duct (Inches H2O)	0.85	0.85	0.85
Absolute Pressure Of Duct (Inches Hg)	29.31	29.31	29.31
Meter Coefficient	0.9999	0.9999	0.9999
Pitot Tube Coefficient	0.839	0.839	0.839
Nozzle Diameter (Inches)	0.249	0.249	0.249
Area Of Nozzle Opening (Square Feet)	0.000338	0.000338	0.000338
Average $\sqrt{\Delta P}$	1.1193	1.1483	1.1840
Average ΔH	2.06	2.22	2.40
Average Stack Temperature (°R)	717.88	721.54	725.42
Average Meter Temperature (°R)	530.46	543.31	535.15
Meter Volume (Cubic Feet)	43.5	45.58	47.03
Dry Standard Sample Volume (Cubic Feet)	42.54	43.54	45.63
Collected Condensate Volume (mls)	597.0	574.0	580.0
Volume Of Water Vapor (Standard Cubic Feet)	28.10	27.02	27.30
Moisture Content Of Flue Gas (% v/v)	39.78	38.29	37.43
Weight Of Particulate (mg)	22.0	17.0	72.2
Particulate Concentration (GR/DSCF)	0.00798005	0.00602522	0.02441715
Source Gas Velocity (Feet Per Second)	79.6	81.6	84.2
Isokinetic Variation (%)	101.2	99.1	99.8

Calculation Equations

EPA Method 2 Calculations

Flue Gas Linear Velocity

$$V_s = 85.49 \times C_p \times \overline{\sqrt{\Delta P}} \times \sqrt{\frac{\overline{T_s}}{P_s \times M_s}}$$

Volumetric Flow Rates - ACFM, SCFM & DSCFM

$$Q = 60 \times v_s \times A$$

$$Q_s = Q \times \left(\frac{528}{T_s}\right) \times \left(\frac{P_s}{29.92}\right) = Q \times 17.647 \times \left(\frac{P_s}{T_s}\right)$$

$$Q_{sd} = Q_s \times (1 - B_{ws})$$

Mass Flow Rate of Wet Flue Gas

$$m_g = \frac{4.995 \times Q_{sd} \times G_d}{1 - B_{ws}}$$

Actual Gas Density

$$\rho = \frac{0.04585 \times P_s \times M_s}{\overline{T_s}}$$

Where:

A	=	Cross-sectional area of duct at sample point (sq. ft.).
B_{ws}	=	Water vapor in gas stream (proportion by volume).
C_p	=	Pitot tube calibration coefficient.
G_d	=	Flue gas specific gravity relative to air, dimensionless.
m_g	=	Mass flow rate of wet flue gas (LB/HR).
M_s	=	Molecular weight of wet flue gas (LB/LB-mole).
P_s	=	Absolute gas pressure of duct (Inches Hg).
ΔP	=	Velocity pressure measured by pitot tube (Inches WC).
Q	=	Actual flue gas volumetric flow rate (ACFM).
Q_s	=	Volumetric gas flow at standard conditions (SCFM).
Q_{sd}	=	Dry standard volumetric gas flow rate (DSCFM).
T_s	=	Flue gas temperature (°R).
V_s	=	Flue gas linear velocity (feet per second).
ρ	=	Actual flue gas density (LB/CF).

Calculation Equations

EPA Method 3 Calculations

Dry Molecular Weight of Flue Gas

$$M_d = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + (0.28 \times (\%N_2 + \%CO))$$

Wet Molecular Weight of Flue Gas

$$M_s = M_d \times (1 - B_{ws}) + (18 \times B_{ws})$$

Percent Excess Air

$$\%EA = 100 \times \left(\frac{\%O_2 - (0.05 \times \%CO)}{(0.264 \times \%N_2) - \%O_2 + (0.5 \times \%CO)} \right)$$

Fuel F-factor (for comparison)

$$F_o = \frac{20.9 - \%O_2}{\%CO_2}$$

Where:

B_{ws}	=	Water vapor in gas stream (proportion by volume).
%CO	=	Carbon monoxide in gas stream (percent).
$\%CO_2$	=	Carbon dioxide in gas stream (percent).
%EA	=	Excess air for combustion (percent).
F_o	=	Fuel F-factor for results comparison.
M_d	=	Molecular weight of dry flue gas (LB/LB-mole).
M_s	=	Molecular weight of wet flue gas (LB/LB-mole)
$\%N_2$	=	Nitrogen in gas stream (percent).
$\%O_2$	=	Oxygen in gas stream (percent).

Calculation Equations

EPA Method 5 Calculations

Sample Volume, Standard Conditions

$$V_{std} = 17.647 \times V_m \times Y \times \left(\frac{P_b + \frac{\overline{\Delta H}}{13.6}}{\overline{T_m}} \right)$$

Isokinetic Variation

$$I = 0.09450 \times \left(\frac{\overline{T_s} \times V_m}{P_s \times V_s \times A_n \times \theta \times (1 - B_{ws})} \right)$$

Particulate Concentration

$$C_s = 15.432 \times \left(\frac{m_n}{V_{std}} \right)$$

Particulate Mass Rate

$$m_p = 0.008571 \times C_s \times Q_{sd}$$

Where:

A_n	=	Cross-sectional area of nozzle opening (square feet).
B_{ws}	=	Water vapor in gas stream (proportion by volume).
C_s	=	Particulate concentration of gas stream (GR/DSCF).
ΔH	=	Orifice meter differential pressure (Inches WC).
I	=	Isokinetic variation of sampling rate (percent).
m_n	=	Total particulate collected in sampling train (grams).
m_p	=	Particulate mass flow rate (LB/HR).
P_b	=	Barometric pressure (Inches Hg).
P_s	=	Absolute gas pressure of duct (Inches Hg).
Q_{sd}	=	Dry standard volumetric gas flow rate (DSCFM).
T_m	=	Sampling train meter temperature (°R).
T_s	=	Flue gas temperature (°R).
V_m	=	Volume of gas sample measured by gas meter (CF).
V_{std}	=	Gas volume corrected to standard conditions (DSCF).
V_s	=	Flue gas linear velocity (feet per second).
Y	=	Dry gas meter calibration coefficient.
θ	=	Total sampling time of run (minutes).

Calculation Equations

Nomenclature

A	= Cross-sectional area of duct
A_n	= Cross-sectional area of nozzle
B_{ws}	= Water vapor in gas stream, proportion by volume
C_a	= Particulate concentration, actual, wet basis - GR/ACF
C_p	= Pitot tube calibration coefficient
C_s	= Particulate concentration at dry standard conditions - GR/DSCF
%EA	= Excess air, percent by volume
F_o	= Fuel factor
G_d	= Specific gravity relative to air, dimensionless
I	= Isokinetic variation, percent by volume
M_d	= Molecular weight of flue gas, dry, lb/lb-mole
m_g	= Mass flow of wet flue gas, LB/HR
m_n	= Total particulate collected, grams
m_p	= Particulate mass flow, LB/HR
M_s	= Molecular weight of flue gas, wet, lb/lb-mole
P_b	= Barometric pressure, uncompensated, inches of mercury
P_g	= Static pressure of duct, inches of water
P_s	= Absolute gas pressure of duct, inches of mercury
Q	= Actual flue gas volumetric flow rate, ACFM
Q_{sd}	= Dry flue gas volumetric flow rate corrected to standard conditions, DSCFM
$\overline{T_m}$	= Average dry gas meter temperature, °R
$\overline{T_s}$	= Average stack gas temperature, °R
$\emptyset$	= Total sampling time, minutes
V_{lc}	= Total volume of liquid collected in impingers and desiccant, ml
V_m	= Volume of gas sample measured by gas meter, cubic feet
V_{std}	= Volume of gas sample corrected to standard conditions, dry standard cubic feet
V_w	= Volume of water vapor in gas sample, corrected to standard conditions
V_s	= Linear velocity of flue gas, feet per second
Y	= Dry gas meter calibration factor
ΔH	= Orifice meter differential pressure, inches of water
ΔP	= Velocity pressure of flue gas, inches of water
ρ	= Actual gas density, pounds per cubic foot

APPENDIX D

Test Procedures

OXYGEN AND CARBON DIOXIDE CONCENTRATION (ORSAT)

Integrated gas samples are collected in 40 liter Tedlar™ bags and ultimately transferred to an Orsat gas analyzer for oxygen and carbon dioxide analyses. A PACE sampling train which meets or exceeds the specifications of EPA Method 3, 40 CFR 60, Appendix A is used to collect gas samples. Normally, gas samples are collected at the exhaust of an EPA Method 4 or 5 sampling train since this gas stream is moisture conditioned. Method 4 and 5 sampling equipment is maintained and checked to assure no leaks occur between the flue and the integrated gas sampler.

Gas samples are collected by drawing a portion of the stream through a chemically resistant diaphragm pump and delivering it to the Tedlar™ bag at a constant, settable rate depending on expected sampling time. At the conclusion of sampling, the bag and associated hardware is sealed and labeled. When multiple tests are to be performed, gas samples are often transferred to glass gas collection tubes for storage. A portable oxygen analyzer is used for this to ensure sample integrity.

Samples are analyzed by chemical absorption using an Orsat gas analyzer. Following positive and negative leak checks of the gas analyzer, the system is purged with the gas to be analyzed. The burret is filled with approximately 100 mls of sample gas and the exact volume recorded. The sample line stopcock is closed and the stopcock for the first bubbler containing carbon dioxide absorbent is opened. Several passes are made, bubbling the sample gas through the reagent and the absorbent is returned to the initial mark. The new volume of the burret is recorded and an additional 1-2 passes are made to verify total absorption. Similar procedures are used to quantify oxygen with the same gas aliquot and oxygen absorbent.

PARTICULATE LOADINGS AND EMISSION RATES

Particulate emission rates were determined in accordance with EPA Methods 1-5, 40 CFR 60, Appendix A. Using traverse points determined with EPA Method 1, a preliminary velocity profile was obtained with respect to the velocity traverse, gas temperature, gas pressure and estimated moisture content. From this data sampling nozzles of the appropriate diameter to ensure isokinetic sampling were selected.

The particulate sampling train consists of a temperature controlled ¤ lined sampling probe equipped with a S-type pitot tube and Type K thermocouples to monitor stack temperature and probe liner temperature. The sampling probe is attached to a sample module which houses an all glass in-line filter and cyclone assembly in a temperature controlled oven. The back half of the sampling train consists of a series of three glass impingers followed by a tared desiccant-packed drying column. The sample train is connected by means of a control and sampling umbilical cord to the control module. The control module houses a temperature monitored dry test gas meter, a calibrated orifice, dual inclined manometers, temperature controllers, and necessary flow rate control devices.

Particulate samples are collected by isokinetically extracting a sample gas stream from the flue by means of the sampling probe and passing the stream through the cyclone which collects larger, heavier particles. The sample gas stream then passes through a 4 inch diameter Gelman Type A/E glass fiber filter to collect finer particulates. The filter is followed by an ice-cooled impinger train and a desiccant packed drying column which quantitatively collects all moisture from the sample gas stream. The gas then passes through a leak proof rotary vane sampling pump and a dry test gas meter which integrates the sample volume throughout the course of the test. A calibrated orifice is connected to the gas meter outlet to facilitate sample flow rate adjustment.

Representative particulate samples are collected by sampling the centroid of equal area sections of the duct for equal time periods. The sampling rate is adjusted at each traverse point to ensure isokinetic sampling. Pre-programmed

field computers are used to facilitate rapid determination of the correct sampling rate.

Integrated gas samples are collected concurrently with particulate samples to determine a representative gas composition of the flue gas. Gas samples are collected in Tedlar™ bags throughout the course of the particulate run and analyzed with an Orsat gas analyzer.

At the end of each particulate run, the sampling train is disassembled and the samples recovered. The sampling filter is transferred from the filter holder to its dedicated petri dish. The probe nozzle is acetone rinsed, brushed, rinsed again and the washings placed in a uniquely labeled polyethylene container. The probe is similarly cleaned; acetone rinsed, brushed several times, rinsed again and the washing transferred to the same polyethylene container. The filter holder and cyclone are wiped free of silicone grease, acetone rinsed, brushed, rinsed and these washings added to the probe wash container. The container is tightly capped and the liquid level marked for transport. The impinger catch volume is determined to the nearest milliliter using a graduated cylinder. If the impinger catch is to be analyzed it is transferred to a separate polyethylene container, capped, and the liquid level marked. The desiccant-packed drying column is weighed in the field to the nearest 0.5 g and the weight of absorbed moisture added to the condensate for moisture calculations.

Particulate samples are transported back to the laboratory, logged in, and prepared for analyses. Filters are desiccated for 24 hours and weighed to a constant weight and the results recorded to the nearest 0.1 mg. Probe wash samples are evaporated at ambient temperatures to dryness in tared evaporating dishes. They are then desiccated for 24 hours and weighed to a constant weight. Results are reported to the nearest 0.1 mg.

WET CATCH ANALYSIS - ORGANIC CONDENSIBLES

Particulate concentrations reported in this document include gravimetric results of both the dry catch and the organic wet catch. Organic condensibles were collected in a series of three ice-cooled all-glass impingers in the back half of the Method 5 sampling train. The first two impingers were initially prepared with 100 mls of deionized water in each and the third impinger was dry. After sampling, the volume of condensate in the impingers was determined and the contents transferred to an air-tight polyethylene sample container.

The wet catch was analyzed for condensible organic particulate with the chloroform/diethyl ether extraction. Three 25 ml portions of chloroform and three 25 ml portions of diethyl ether were used to extract condensed organics from the impinger catches (wet catch). The extractions were evaporated at room temperature and desiccated to a constant weight. Gravimetric results were then added to dry catch results to calculate particulate concentrations.

APPENDIX E

Quality Assurance Data

SAMPLING TRAIN CALIBRATION DATA

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 14, 1994

Air Sampling Department Calibration Report

Pitot Tube Calibration Data

Pitot Tube Number : 1

Date of Calibration : 8/18/94

Calibration Technician: K. Lattery

A Side Calibration

Calibration Trial No.	ΔP(standard) Inches WC	ΔP(S-type) Inches WC	Pitot Coefficient
1	0.510	0.710	0.839
2	0.795	1.110	0.838
3	1.110	1.535	0.842
4	1.305	1.810	0.841
		A Side Average	0.840

B Side Calibration

Calibration Trial No.	ΔP(standard) Inches WC	ΔP(S-type) Inches WC	Pitot Coefficient
1	0.500	0.695	0.840
2	0.835	1.165	0.838
3	1.150	1.610	0.837
4	1.360	1.900	0.838
		B Side Average	0.838
		Pitot Tube Coefficient	**0.839**

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 14, 1994

Air Sampling Section Calibration Report

Dry Test Meter and Orifice Calibration Data

Control Module Number : C-4

Calibration Technician: M.Wilson

Date of Calibration : 9/7/94

Barometric Pressure : 29.14

Orifice Diff. Press., ΔH Inches WC	Dry Test Meter Vol. Cubic Ft.	Wet Test Meter Vol. Cubic Ft.	Dry Test Meter Temperatures, °F Inlet	Dry Test Meter Temperatures, °F Outlet	Wet Test Meter Temp., °F	Elapsed Time Minutes	Gas Meter Coefficient ∂	Orifice Coefficient ΔH@
0.50	5.150	5.000	90.0	79.0	70.0	13.939	0.9962	2.203
1.00	5.140	5.000	94.0	79.0	70.0	9.900	1.0005	2.223
1.75	5.110	5.000	93.5	76.0	70.0	7.579	1.0013	2.292
2.50	10.230	10.000	96.5	76.5	70.0	12.664	1.0016	2.284
3.50	10.250	10.000	98.0	78.0	70.0	10.789	0.9999	2.314

Average Meter Coefficient 0.9999

Average Orifice Coefficient 2.263

Northland Constructors
Duluth, Minnesota
PACE Project No. 940927.402

PACE Incorporated
November 14, 1994

Air Sampling Department Calibration Report

Sampling Nozzle Calibration Data

Nozzle Number : 1-2

Date of Calibration : 9/14/94

Calibration Technician: MEW

Measurement Position		Diameter Inches
1		0.247
2		0.249
3		0.250
4		0.249
5		0.248
	Average	0.249

The sampling nozzle is rotated and measured at 36 degree Increments. Diameters are measured to the nearest 0.001". All measurements must be within a range of 0.004".

APPENDIX F

Process/Source Information

SOURCE OPERATIONAL DATA

MIKE PACE LABS.

Gas 240845 Start
x100 242641 End
179,600 CF Gas

Rev/YH/93

Asphalt Plant Operating Conditions During Stack Testing

Test Date(s) 9-30-94

Plant Mfr. & Model Astec - Model DDC-735C 7' Drum Coater

Type (circle one): Drum Mix Conventional
Other (list): _____

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

If wet scrubbing: ____% scrubber water recycled

List model: BagHouse # SBH-44:DB

Normal pressure drop across control equipment: 3 inches water

Air flow through control equipment: 44,940 acfm at ____F

Was control equipment operating normally during testing? ____

Date & procedures of last maintenance/cleaning of control equipment 9-29-94 Replace 1 Bad Bag

Fuel:

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

Test No.___	Fuel Input (Gal/hr)	BTU/GAL (as received)	Heat Input (BTU/HR)	%Moisture (as received in aggregate) Virgin	recycle	combined
Run 1				6	5	4.3
Run 2						4.3
Run 3						4.3

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

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

_____ gal/ton hot mix

No. of Burners: 1 Burner(s) rating: 92 MBH MMBTU/HR = 100% setting

Operation:

time 15 min. intervals	burner setting %	aggregate tons per hour	recycle tons per hour	asphalt tons per hour	Drum Mix temp. F	dust collector pressure drop inches water	scrubber water flow rate gpm	Other (list)
10:00	55	154	64	10.58	275	3		
10:15	55	155	65	10.76	271	3		
1115 ~~11:45~~	55	153	63	10.71	283	3		
11:30	55	155	65	10.80	270	3		
11:45	55	153	64	10.70	286	3		
12:30	55	154	65	10.71	278	3		
12:45	55	153	62	10.36	295	3		
1:00	55	154	65	10.76	276	3		
1:15	55	155	66	10.89	278	3		
4:50	55	155	65	10.90	286	3		
5:05	55	156	65	10.91	300	3.5		
5:20	50	158	64	10.93	296	3.5		
5:35	54	156	63	10.65	300	3.5		

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

By: [signature], Phone: (218) 722-0995

Position: Plant Operator

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

Company: Northland Constructors Inc.

Operation:

Test Date(s): 9-30-94

time 15 min. intervals	burner setting %	aggregate tons per hour	recycle tons per hour	asphalt tons per hour	Drum Mix temp. F	dust collector pressure drop inches water	scrubber water flow rate gpm	Other (list)
5:50	54	155	65	10:50	310	3.5		

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

By:_____, Phone: (_____)_____

Position: _____

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

APPENDIX G

Test Plan

Source Emissions Test Plan

Date Submitted:	September 22 , 1994	
Date Revised:		
Scheduled Test Dates:	September 29, 1994	(Garfield Ave. Astec Double Drum Plant/Source No. 2)

General Information

Emissions Facility:	Northland Constructors Of Duluth, Inc. 4843 Rice Lake Road Duluth, Minnesota 55803 Hot Mix Asphalt Plant And Air Pollution Control Equipment
Test Contact: Phone Number:	James Oswald (218)-722-0995
Facility Contact: Phone Number:	Jack Holmgren (218)-722-0995
Permit File No.:	2086B-B-94-G-1
Reason(s) For Test:	New Source Emissions Compliance Requirement Garfield Ave Astec Double Drum Plant Source No. 2

Testing Firm:	PACE Incorporated 1710 Douglas Drive North Minneapolis, Minnesota 55422
Project Contact: Phone Number:	Curt Stock 612-525-3349

Testing Requirements

Source No.	Source Identification	Test Constituent	Test Methods	Emission Limit	Applicable Rule or Reg.
2	Baghouse Stack	Vol. Airflow	EPA Method 2		
2	Baghouse Stack	O_2, CO_2, N_2	EPA Method 3B		
2	Baghouse Stack	Moisture	EPA Method 4		
2	Baghouse Stack	Particulate Matter	EPA Method 5	0.04 GR/DSCF	Minn. Rules part 7005.2020, Subp. A. & 40 CFR 60, Subp I.
2	Baghouse Stack	Opacity	EPA Method 9	20%	Minn. Rules part 7005.2020, Subp. B. & 40 CFR 60, Subp I.

Process Description and Operating Conditions

Operating Information:

The objectives of this project are to quantify particulate emissions and compare them to applicable air emissions regulations stipulated by Minnesota Rules. During operation of the emission facility and air pollution control equipment, Northland Constructors operators shall maintain the pressure drop across the baghouse at a minimum of six inches water and a maximum of 10 inches water.

Process Description:

The hot mix asphalt facility is a Astec model No. RDOC-735C manufactured in 1994. The plant uses a double barrel drum mix with a manufactures rated drying capacity of 450Tons/HR. at 5% moisture. Natural gas is the fuel used with a heat input capacity rated at 80 million BTU/HR.

An Astec RBH45-DB baghouse is used for pollution control equipment. The baghouse uses a air pressure drop with a range of 0-20 inches of water to monitor the control equipment. The stack has an inside diameter that measures 30 x 44 inches and has a rated flow of 50,000 ACFM at 325°F. Flue gases are pulled through the system with an induced draft fan and exhausted through the 20 foot stack to atmosphere. A relational flow diagram is represented by Figure 1.

APPENDIX H

Certifications

CERTIFICATIONS REQUIRED FOR PERFORMANCE TEST REPORTS

NOV 1994
RECEIVED
Minnesota Pollution Control Agency
Air Quality

NOTE: All performance test reports must contain a certification by the responsible parties that the test results have been reported accurately, that the field data is a true representation of the sampling procedures, and that the process data is a true indicator of the operating parameters of the emissions unit at the time of the performance test. (Ref. Minn. Rules pt. 7017.2040). Performance test results will not be accepted without certification of the report.

1. Certification of sampling procedures by the team leader of the personnel conducting the sampling procedures:

"I certify under penalty of law that the sampling procedures were performed in accordance with the approved test plan and that the data presented in this test report are, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below."

Signature: Mike Loftus
Printed Name of Person Signing: Mike Loftus
Title: Proj Mgr.
Date: 11/15-94

2. Certification of analytical procedures by the person responsible for the laboratory analysis of field samples:

"I certify under penalty of law that the analytical procedures were performed in accordance with the requirements of the test methods and that the data presented for use in the test report were, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below."

Signature: Jane Costello
Printed Name of Person Signing: Jane Costello
Title: General Chemistry Super.
Date: 11/17/94

3. Certification of test report by the senior staff person at the testing company who is responsible for compiling and checking the test report:

"I certify under penalty of law that this test report and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed sampling and analysis relating to the performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below."

Signature: [illegible]
Printed Name of Person Signing: Curtis H. Stock
Title: Supervisor Air Sampling
Date: 11-15-94

4. Certification of test report by owner or operator of the emission facility:

"I certify under penalty of law that the information submitted in this test report accurately reflects the operating conditions at the emission facility during this performance test and describes the date and nature of all operational and maintenance activities that were performed on process and control equipment during the month prior to the performance test. Based on my inquiry of the person or persons who performed the operational and maintenance activities, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below."

Signature: _____
Printed Name of Person Signing: _____
Title: _____
Date: _____