Background Report Reference

AP-42 Section Number: 1.4

Background Chapter: 2

Reference Number: 38

Title: Results of the July 27, 1994 Air Emission Compliance Testing of the No. 10 Boiler at the Virginia public Utilities Plant in Virginia, Minnesota

Interpoll Laboratories, Inc.

Interpoll Laboratories, Inc.

August 1994

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Section 1.4
(BIO Ch.2)
132-1

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RESULTS OF THE JULY 27, 1994 AIR EMISSION COMPLIANCE TESTING OF THE NO. 10 BOILER AT THE VIRGINIA PUBLIC UTILITIES PLANT IN VIRGINIA, MINNESOTA

Submitted to:

CITY OF VIRGINIA
Department of Public Utilities
618 South Second Street
Virginia, Minnesota 58792

Attention:

Doug Ganoe

Approved by:

Daniel Despen
Manager
Stationary Source Testing Department

Report Number 4-3469
August 17, 1994
SP/slp

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INTERPOLL LABORATORIES, INC.
(612) 786-6020

Certifications Required For Performance Test Reports

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: Gary Hove Printed Name of Person Signing: GARY HOVE
Title: FIELD TECH Date: 9-27-94

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: David J Schaefer Printed Name of Person Signing: David Schaefer
Title: QA Officer Date: 9/6/94

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: Daniel J. Deeper Printed Name of Person Signing: Daniel J. Deeper
Title: Mgr Stationary Sources Date: 9/6/94

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: Jeff Marwick/DG Printed Name of Person Signing: Jeff Marwick/DG
Title: Operations Supervisor Date: 9/9/94

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INTERPOLL LABORATORIES, INC.
(612) 786-6020

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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: Gary Hove Printed Name of Person Signing: GARY HOVE
Title: FIELD TECH Date: 7-27-94

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: David J Schneider Printed Name of Person Signing: David Schneider
Title: QA Officer Date: 9/6/94

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: Daniel J. Despen Printed Name of Person Signing: Daniel J. Despen
Title: Mgr Stationary Source Date: 9/6/94

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: _____

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1 INTRODUCTION

On July 27, 1994 Interpoll Laboratories Personnel conducted particulate, oxides of nitrogen, and opacity emission compliance tests on the No. 10 Boiler at the Virginia Public Utilities Plant in Virginia, Minnesota. Gary Hove and Ed Juers performed the on-site portion of the test. Coordination between testing activities and plant operation was provided by Jeff Marwick of Virginia Public Utilities. The tests were witnessed by Yolanda Hernandez of the Minnesota Pollution Control Agency.

The No. 10 Boiler is a Zurn boiler which was built in 1992. It is equipped with an economizer. The rated steaming capacity is 200,000 LB/HR of superheated steam. Flue gas is exhausted to the atmosphere via a 150-foot high steel dual wall stack which has a 5 foot diameter.

Particulate evaluations were performed in accordance with EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1993). A preliminary determination of the gas linear velocity profile was made before the first particulate determination to allow selection of the appropriate nozzle diameter required for isokinetic sample withdrawal. An Interpoll Labs sampling train which meets or exceeds specifications in the above-cited reference was used to extract particulate samples by means of a heated stainless steel-lined probe. Wet catch samples were collected in the back half of the Method 5 sampling train and analyzed per MN Rules Part 7011.0725.

The oxides of nitrogen samples were collected using an all-glass Method 7 sampling train. A heated stainless steel probe was used to extract the samples from the exhaust stream. A plug of glass-wool was used in the end of the probe to remove particulate material.

The NO_x samples were collected in volume-calibrated two-liter all-glass flasks. An aliquot of 25 cc of absorbing solution was added to each flask on-site; the flask was closed; inserted into the sampling train; and evacuated. The probe was then purged and the sample collected over a 15 second interval. The flask was then closed; the flask removed from the sampling train; shook for two minutes and then secured for transport to the laboratory.

Upon arrival at the laboratory, the NO_x samples are logged in, placed in a designated area and maintained at 72 °F for 24 hours to allow completion of the conversion of NO to NO_2 and absorption in the acidified peroxide reagent. The flasks are then shook to complete absorption; attached to a mercury manometer and the static pressure and temperature recorded. The samples are then recovered and analyzed by ion chromatography.

An integrated flue gas sample was extracted using a specially designed gas sampling system. Integrated flue gas samples were collected in 44-liter Tedlar bags housed in a protective aluminum container. After sampling was complete, the bags were returned to the laboratory for Orsat analysis. Prior to sampling, the Tedlar bags are leak checked at 15 IN.HG. vacuum with an in-line rotameter. Bags with any detectable inleakage are discarded.

Testing was conducted from 4 test ports oriented at 90 degrees on the stack. The test ports are located approximately 9 diameters downstream and 7 diameters upstream of the nearest flow disturbances. A 24-point traverse was used to collect representative particulate samples. Each traverse point was sampled 5 minutes to give a total sampling time of 120 minutes per run. Visible emission determinations were performed by Ed Juers, an EPA-certified observer.

The important results of the test are summarized in Section 2. Detailed results are presented in Section 3. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

The particulate results are presented in Tables 1a and 1b. The particulate concentration averaged 0.00497 GR/DSCF. The particulate emission factor averaged 0.007 LB/10^6BTU. Opacity averaged 1.7 percent.

The oxides of nitrogen results are presented in Table 2. The oxides of nitrogen concentration averaged 39 ppm,d and the emission factor averaged 0.046 LB/10^6BTU.

No difficulties were encountered in the field or in the laboratory evaluation of the samples. On the basis of these facts and a complete review of the data and results, it is our opinion that the results reported herein are accurate and closely reflect the actual values which existed at the time the test was performed.

Table 1b. Summary of the Results of the July 27, 1994 Particulate Emission Compliance Test on the No. 10 Boiler Stack at the Virginia Public Utilities Facility Located in Virginia, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		07-27-94	07-27-94	07-27-94
Time runs were done	(HRS)	800/1014	1040/1249	1310/1514
Volumetric flow				
actual	(ACFM)	82584	84538	84144
standard	(DSCFM)	43837	45076	44344
Gas temperature	(DEG-F)	309	312	313
Moisture content	(%V/V)	18.48	17.81	18.62
Gas composition	(%V/V,dry)			
carbon dioxide		10.60	10.50	10.50
oxygen		2.50	2.70	2.70
nitrogen		86.90	86.80	86.80
Isokinetic variation	(%)	98.5	98.9	100.1
Particulate concentration				
actual	(GR/ACF)	.00157	.00126	.00245
standard	(GR/DSCF)	.00295	.00236	.00466
Part. emission rate	(LB/HR)	1.11	0.913	1.77
Emission factor	(LB/MMBTU)	0.0042	0.0034	0.0067

Note: Dry Catch Only

Corrected = 0.0017 0.0012 0.0032

Avg = 0.0023

Table 1a. Summary of the Results of the July 27, 1994 Particulate Emission Compliance Test on the No. 10 Boiler Stack at the Virginia Public Utilities Facility Located in Virginia, Minnesota.

ITEM		Run 1	Run 2	Run 3
Date of test		07-27-94	07-27-94	07-27-94
Time runs were done	(HRS)	800/1014	1040/1249	1310/1514
Volumetric flow				
actual	(ACFM)	82584	84538	84144
standard	(DSCFM)	43837	45076	44344
Gas temperature	(DEG-F)	309	312	313
Moisture content	(%V/V)	18.48	17.81	18.62
Gas composition	(%V/V,dry)			
carbon dioxide		10.60	10.50	10.50
oxygen		2.50	2.70	2.70
nitrogen		86.90	86.80	86.80
Isokinetic variation	(%)	98.5	98.9	100.1
Particulate concentration				
actual	(GR/ACF)	.00222	.00203	.00365
standard	(GR/DSCF)	.00418	.00381	.00692
Part. emission rate	(LB/HR)	1.57	1.47	2.63
Emission factor	(LB/MMBTU)	0.0059	0.0054	0.0099

Note: Dry + Organic Wet Catch

Table 2. Summary of the Results of the July 27, 1994 **Oxides of Nitrogen Determinations** on the No. 10 Boiler at the Virginia Public Utilities Plant Located in Virginia, Minnesota.

Date	Time (HRS)	Concentration (ppm,d)	Emission Factor (LB/10^6BTU)
7-27-94	0800-1014	36	0.043
7-27-94	1040-1249	40	0.047
7-27-94	1310-1514	41	0.049
Average		39	0.046

3 RESULTS

The results of all field and laboratory evaluations are presented in this section. Gas composition (Orsat and moisture) are presented first followed by the computer printout of the particulate, oxides of nitrogen, and opacity results. Preliminary measurements including test port locations are given in the appendices.

The results have been calculated on a personal computer using programs written in Extended BASIC specifically for source testing calculations. EPA-published equations have been used as the basis of the calculation techniques in these programs. The particulate emission rate has been calculated using the product of the concentration times flow method.

3.1 Results of Orsat & Moisture Analyses

Test No. 1
No. 10 Boiler Stack

Results of Orsat & Moisture Analyses-----Methods 3 & 4(%v/v)

	Run 1	Run 2	Run 3
Date of run	07-27-94	07-27-94	07-27-94
Dry basis (orsat)			
carbon dioxide.....	10.60	10.50	10.50
oxygen.....	2.50	2.70	2.70
nitrogen.....	86.90	86.80	86.80
Wet basis (orsat)			
carbon dioxide.....	8.64	8.63	8.54
oxygen.....	2.04	2.22	2.20
nitrogen.....	70.84	71.34	70.63
water vapor.....	18.48	17.81	18.62
Dry molecular weight.....	29.80	29.79	29.79
Wet molecular weight.....	27.62	27.69	27.59
Specific gravity.....	0.954	0.956	0.953
Water mass flow.....(LB/HR)	27868	27403	28468
FO	1.736	1.733	1.733

3.2 Results of Particulate Loading Determinations

Test No. 1
No. 10 Boiler Stack

Results of Particulate Loading Determinations-------Method 5

	Run 1	Run 2	Run 3
Date of run	07-27-94	07-27-94	07-27-94
Time run start/end.....(HRS)	800/1014	1040/1249	1310/1514
Static pressure.....(IN.WC)	-0.75	-0.75	-0.75
Cross sectional area (SQ.FT)	21.65	21.65	21.65
Pitot tube coefficient.....	.840	.840	.840
Water in sample gas			
condenser.....(ML)	0.0	0.0	0.0
impingers.....(GRAMS)	360.0	351.0	369.0
desiccant.....(GRAMS)	32.0	36.0	38.0
total.....(GRAMS)	392.0	387.0	407.0
Total particulate material..			
.....collected(grams)	0.0221	0.0208	0.0376
Gas meter coefficient.....	1.0005	1.0005	1.0005
Barometric pressure..(IN.HG)	28.44	28.44	28.44
Avg. orif.pres.drop..(IN.WC)	1.77	1.91	1.89
Avg. gas meter temp..(DEF-F)	95.0	98.5	99.1
Volume through gas meter....			
at meter conditions...(CF)	89.78	93.24	92.96
standard conditions.(DSCF)	81.55	84.20	83.85
Total sampling time....(MIN)	120.00	120.00	120.00
Nozzle diameter.....(IN)	.250	.250	.250
Avg.stack gas temp ..(DEG-F)	309	312	313
Volumetric flow rate.....			
actual.....(ACFM)	82584	84538	84144
dry standard.....(DSCFM)	43837	45076	44344
Isokinetic variation.....(%)	98.5	98.9	100.1
Particulate concentration...			
actual.....(GR/ACF)	0.00222	0.00203	0.00365
dry standard.....(GR/DSCF)	0.00418	0.00381	0.00692
Particle mass rate...(LB/HR)	1.571	1.473	2.630
F-factor .....(DSCF/MMBTU)	8710	8710	8710
Emission factor...(LB/MMBTU)	0.006	0.005	0.010

3.3 Results of Oxides of Nitrogen Determinations

Took
Averages
For each 4 RUNS
and combined for RUNS 1, 2 3

tions---------Method 7

			Run 1C	Run 1D
		B		
		4	07-27-94	07-27-94
		830	858	940
Flask number.....	13	14	15	16
Volume of flask.....(ML)	2060	2048	2045	2067
Data: time of sampling				
flask temperature..(DEG-F)	60.00	60.00	60.00	64.00
bar. press.....(IN.HG)	28.44	28.44	28.44	28.44
flask vacuum.....(IN.HG)	25.80	25.80	25.80	25.85
flask abs. press...(IN.HG)	2.64	2.64	2.64	2.59
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.12	29.12	29.12	29.12
flask static press.(IN.HG)	-2.20	-0.40	-1.40	-0.50
flask abs. press...(IN.HG)	26.92	28.72	27.72	28.62
Volume gas sampled....(DSML)	1634	1745	1676	1760
Moisture content.....(%V/V)	18.48	18.48	18.48	18.48
Oxygen content....(%V/V,DRY)	2.50	2.50	2.50	2.50
Nitrate in gas sample...(JG)	139.0	155.0	163.0	176.0
NO2 in gas sample.....(JG)	103.1	115.0	120.9	130.6
NOx Concentration				
(GR/DSCF).....	0.0276	0.0288	0.0315	0.0324
(MG/DSCM).....	63	66	72	74
(PPM-DRY).....	33	34	38	39
(PPM-WET).....	27	28	31	32
NOX Emission rate....(LB/HR)	10.36	10.82	11.85	12.19
NOx emission factor..... .....(LB/MMBTU)*	0.039	0.041	0.045	0.046

* F = 8710 DSCF/MMBTU

Test No. 1
No. 10 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 2A	Run 2B	Run 2C	Run 2D
Date of run.....	07-27-94	07-27-94	07-27-94	07-27-94
Time of run.....(HRS)	1040	1100	1140	1215
Flask number.....	17	18	7	55
Volume of flask.....(ML)	2054	2045	2081	2086
Data: time of sampling				
flask temperature..(DEG-F)	65.00	65.00	65.00	65.00
bar. press.....(IN.HG)	28.44	28.44	28.44	28.44
flask vacuum.....(IN.HG)	25.80	25.80	25.80	25.80
flask abs. press...(IN.HG)	2.64	2.64	2.64	2.64
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.12	29.12	29.12	29.12
flask static press.(IN.HG)	-0.60	-0.40	-0.80	-2.00
flask abs. press...(IN.HG)	28.52	28.72	28.32	27.12
Volume gas sampled....(DSML)	1739	1744	1748	1671
Moisture content.....(%V/V)	17.81	17.81	17.81	17.81
Oxygen content....(%V/V,DRY)	2.70	2.70	2.70	2.70
Nitrate in gas sample...(JG)	176.0	174.0	172.0	180.0
NO2 in gas sample.....(JG)	130.6	129.1	127.6	133.6
NOx Concentration				
(GR/DSCF).....	0.0328	0.0323	0.0319	0.0349
(MG/DSCM).....	75	74	73	80
(PPM-DRY).....	39	39	38	42
(PPM-WET).....	32	32	31	34
NOX Emission rate....(LB/HR)	12.68	12.50	12.33	13.50
NOx emission factor..... .....(LB/MMBTU)*	0.047	0.046	0.046	0.050

* F = 8710 DSCF/MMBTU

Test No. 1
No. 10 Boiler Stack

Results of Oxides of Nitrogen (NOx) Determinations---------Method 7

	Run 3A	Run 3B	Run 3C	Run 3D
Date of run.....	07-27-94	07-27-94	07-27-94	07-27-94
Time of run.....(HRS)	1300	1330	1400	1445
Flask number.....	56	57	59	60
Volume of flask.....(ML)	2069	2062	2077	2066
Data: time of sampling				
flask temperature..(DEG-F)	64.00	64.00	65.00	65.00
bar. press.....(IN.HG)	28.44	28.44	28.44	28.44
flask vacuum.....(IN.HG)	25.85	25.80	25.80	25.80
flask abs. press...(IN.HG)	2.59	2.64	2.64	2.64
Data: Time of Flask Opening				
flask temperature..(DEG-F)	72.00	72.00	72.00	72.00
lab. bar. press....(IN.HG)	29.12	29.12	29.12	29.12
flask static press.(IN.HG)	-1.50	-1.80	-0.90	-1.40
flask abs. press...(IN.HG)	27.62	27.32	28.22	27.72
Volume gas sampled....(DSML)	1694	1664	1738	1695
Moisture content.....(%V/V)	18.62	18.62	18.62	18.62
Oxygen content....(%V/V,DRY)	2.70	2.70	2.70	2.70
Nitrate in gas sample...(JG)	185.0	161.0		191.0
NO2 in gas sample.....(JG)	137.3	119.5		141.7
NOx Concentration				
(GR/DSCF).....	0.0354	0.0314		0.0365
(MG/DSCM).....	81	72		84
(PPM-DRY).....	42	38		44
(PPM-WET).....	34	31		36
NOX Emission rate....(LB/HR)	13.46	11.92		13.89
NOx emission factor..... .....(LB/MMBTU)*	0.051	0.045		0.052

* F = 8710 DSCF/MMBTU

3.4 Results of Opacity Observations

Test No. 11
No. 10 Boiler Stack

Results of Opacity Observations ---------- EPA Method 9

PERCENT OPACITY	OPTICAL DENSITY	RELATIVE FREQUENCY (%)
0	0.0000	100.00
5	0.0223	0.00
10	0.0458	0.00
15	0.0706	0.00
20	0.0969	0.00
25	0.1249	0.00
30	0.1549	0.00
35	0.1871	0.00
40	0.2219	0.00
45	0.2596	0.00
50	0.3010	0.00
55	0.3468	0.00
60	0.3979	0.00
65	0.4559	0.00
70	0.5229	0.00
75	0.6021	0.00
80	0.6690	0.00
85	0.8239	0.00
90	1.0000	0.00
95	1.3010	0.00
99	2.0000	0.00
Avg Opac 0.00	Avg OD 0.0000	Time average

Observer: Edward Juers
Cert. Date: 04-06-94
Date of Observation: 07-27-94
Time of Observation: 0850/0950

Test No. 12
No. 10 Boiler Stack

Results of Opacity Observations ---------- EPA Method 9

PERCENT OPACITY	OPTICAL DENSITY	RELATIVE FREQUENCY (%)
0	0.0000	100.00
5	0.0223	0.00
10	0.0458	0.00
15	0.0706	0.00
20	0.0969	0.00
25	0.1249	0.00
30	0.1549	0.00
35	0.1871	0.00
40	0.2219	0.00
45	0.2596	0.00
50	0.3010	0.00
55	0.3468	0.00
60	0.3979	0.00
65	0.4559	0.00
70	0.5229	0.00
75	0.6021	0.00
80	0.6690	0.00
85	0.8239	0.00
90	1.0000	0.00
95	1.3010	0.00
99	2.0000	0.00
Avg Opac 0.00	Avg OD 0.0000	Time average

Observer: Edward Juers
Cert. Date: 04-06-94
Date of Observation: 07-27-94
Time of Observation: 1125/1225

Test No. 13
No. 10 Boiler Stack

Results of Opacity Observations ---------- EPA Method 9

PERCENT OPACITY	OPTICAL DENSITY	RELATIVE FREQUENCY (%)
0	0.0000	0.00
5	0.0223	100.00
10	0.0458	0.00
15	0.0706	0.00
20	0.0969	0.00
25	0.1249	0.00
30	0.1549	0.00
35	0.1871	0.00
40	0.2219	0.00
45	0.2596	0.00
50	0.3010	0.00
55	0.3468	0.00
60	0.3979	0.00
65	0.4559	0.00
70	0.5229	0.00
75	0.6021	0.00
80	0.6690	0.00
85	0.8239	0.00
90	1.0000	0.00
95	1.3010	0.00
99	2.0000	0.00
Avg Opac 5.00	Avg OD 0.0223	Time average

Observer: Edward Juers
Cert. Date: 04-06-94
Date of Observation: 07-27-94
Time of Observation: 1320/1420

APPENDIX A

PRELIMINARY VOLUMETRIC FLOW RATE DETERMINATION

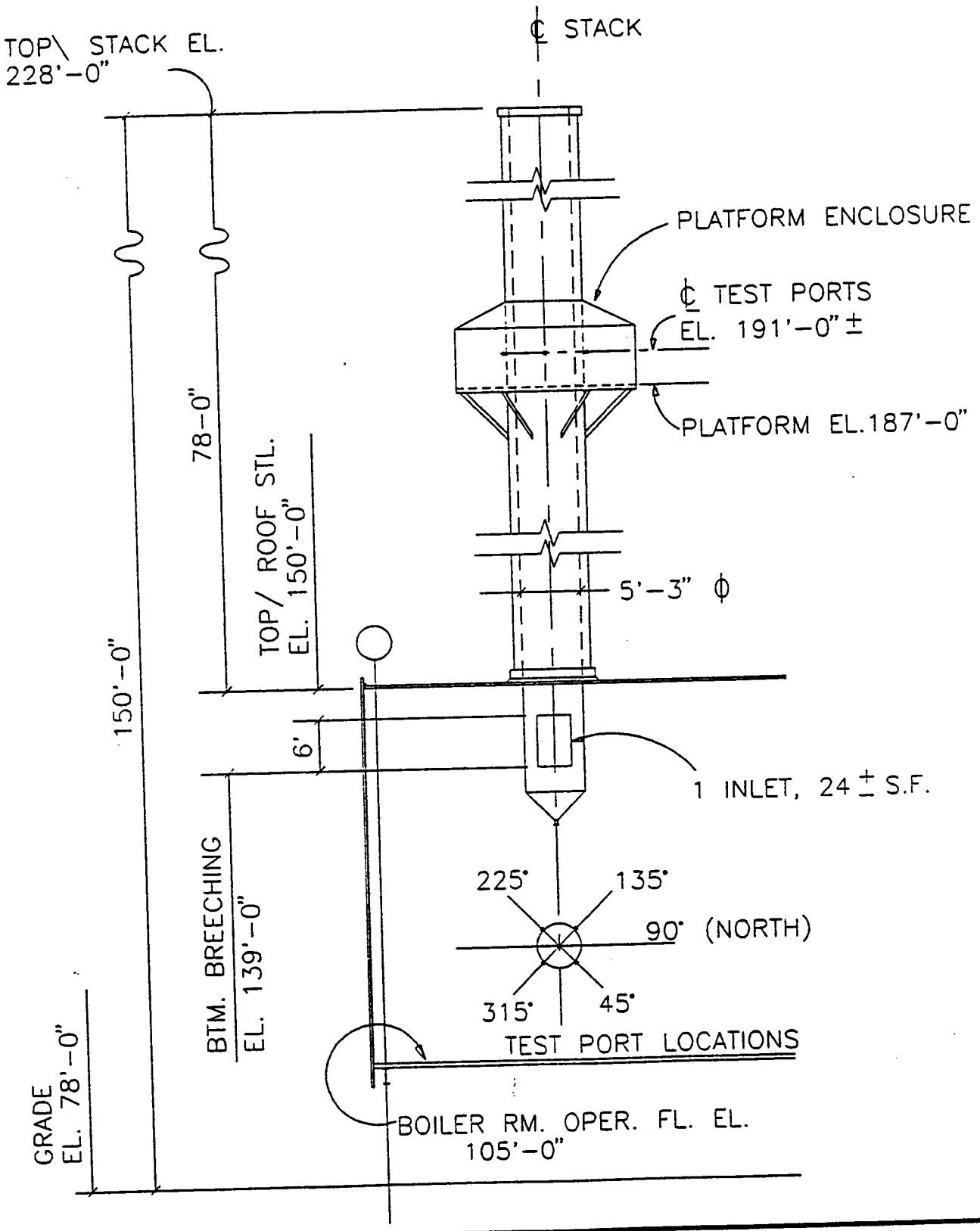
Test No. 1
No. 10 Boiler Stack

Results of Volumetric Flow Rate Determination-------Method 2

Date of Determination.....	07-27-94
Time of Determination.....(HRS)	730
Barometric pressure.....(IN.HG)	28.435
Pitot tube coefficient.....	.84
Number of sampling ports.....	4
Total number of points.....	12
Shape of duct.....	Round
Stack diameter.....(IN)	63
Duct area.....(SQ.FT)	21.65
Direction of flow.....	UP
Static pressure.....(IN.WC)	-.75
Avg. gas temp.....(DEG-F)	310
Moisture content.....(% V/V)	15.60
Avg. linear velocity.....(FT/SEC)	59.1
Gas density.....(LB/ACF)	.04725
Molecular weight.....(LB/LBMOLE)	29.80
Mass flow of gas.....(LB/HR)	217587
Volumetric flow rate.....	
actual.....(ACFM)	76751
dry standard.....(DSCFM)	42160

APPENDIX B

LOCATION OF TEST PORTS



HELMICK & LUTZ COMPANY

VIRGINIA PUBLIC UTILITIES
VIRGINIA, MN.

STACK- NO. 10 BOILER

Revision	Date	Drawn	Scale	Job number	Sheet number
	2/26/93	B.L.	1/16"=1'-0"	915	SK-1

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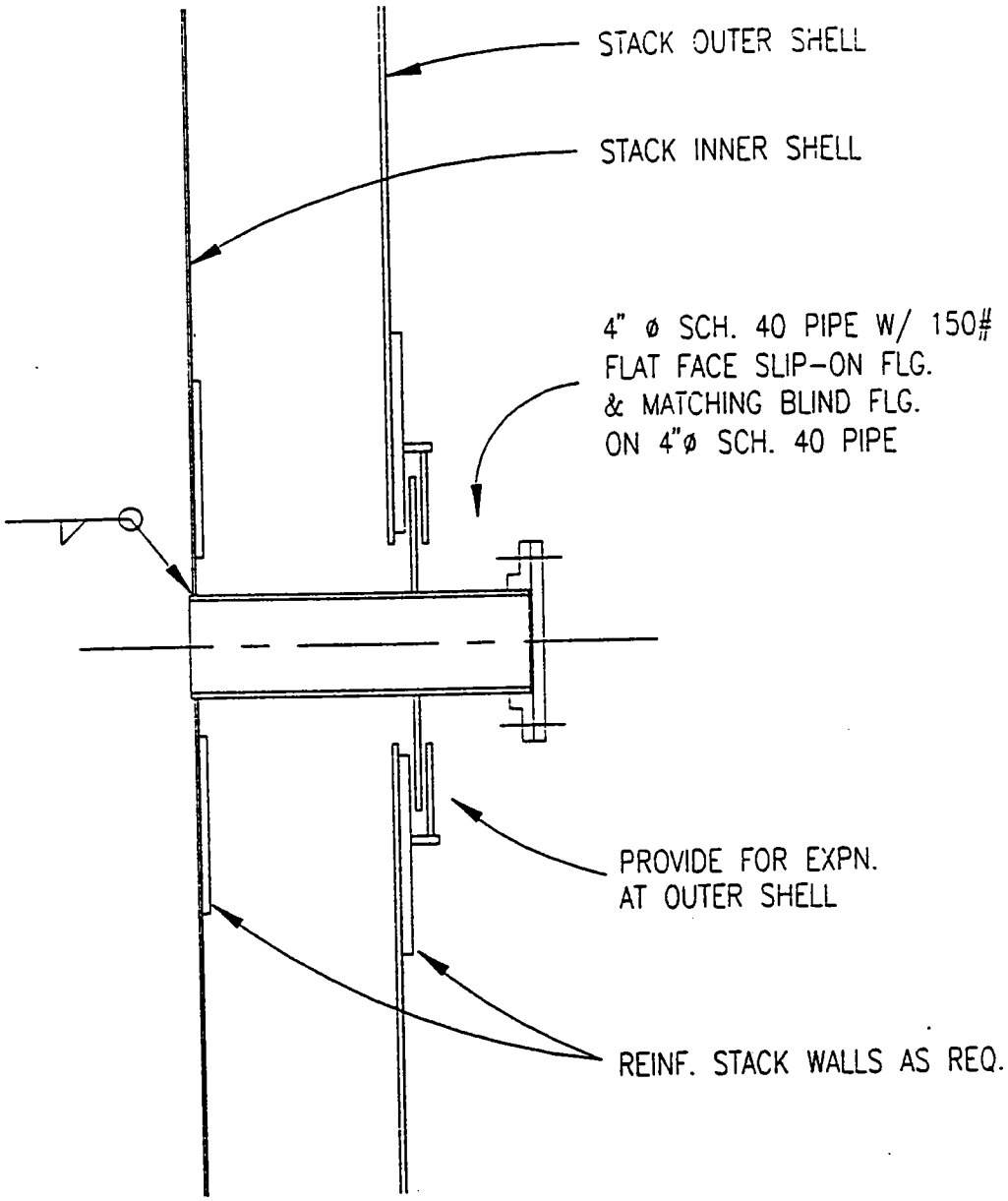


HELMICK & LUTZ COMPANY					
VIRGINIA PUBLIC UTILITIES VIRGINIA, MINNESOTA		BOILER ADDITION		TYPICAL INSTRUMENT PORT	
Revision	Date 1/5/93	Drawn B.L	Job number 909	Scale NONE	Sheet number STACK-2

Saved 08-18-93 07:42

APPENDIX C

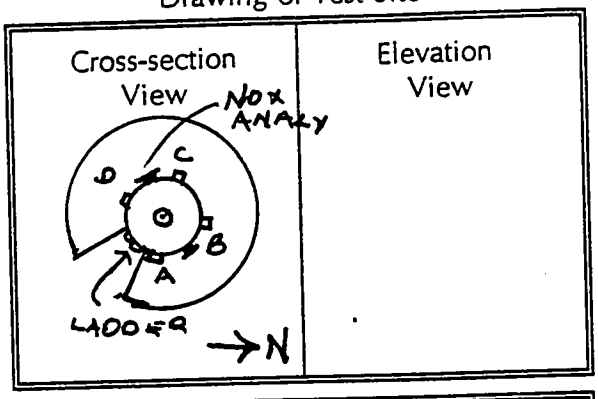
FIELD DATA SHEETS

INTERPOLL LABORATORIES, INC.
(612) 786-6020

EPA Method 2 Field Data Sheet

Job VIRGINIA PUBLIC UTILITIES
Source NO 10 BOILER STACK
Test 1 Run 0 Date 7-27-94
Stack Dimen. 63 IN.
Dry Bulb 281 °F Wet bulb 140 °F
Manometer ☒ Reg. ☐ Exp ☐ Elec.
Barometric Pressure 28.435 IN.HG
Static Pressure − .75 IN.WC
Operators GH, EJ,
Pitot No. 36 V 4 C_p .84

Drawing of Test Site



Traverse Point No.	Fraction of Diameter	Distance From Stack Wall (IN.)	Distance From End of Port (IN.)	Velocity	Temp. of Gas (°F)
		Port Length: 17.5 IN.		Time Start: 0730 HRS	
A 1	.044	2.79	20.27	.75	310
2	.146	9.198	26.698	.80	
3	.296	18.64	36.14	.94	
				.75 .75	
B 1				.95	309
2				.90	
3				.45	
C 1				.55	310
2				.66	
3				.65	
D 1				.55	308
2				.62	
3					
Temp. Meas. Device & S/N:		PDT 25		0745 Time End:	HRS

R or nothing = reg. manometer; S = expanded; E = electronic

032594-G:\STACK\WP\FORMS\S-392.1

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: VIRGINIA PULP. UTILITIES — Operators: GH, QH, ____, TH, HC
Source: NO 10 BOILER STACK — Meter Box No.: 15 — Pitot No.: 24 V 4 — Cp: .84
Date: 7-27-94 — Test: 1 — Run: 1 — Counter coeff.: 1.0005 — Bar. Press.: 28.435 — Nozzle No.: 6-2 — Nozzle Dia: .250 in. — Targ H2O: 35-18%

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inH2O)	Orifice Meter (inH2O)	Dry Gas Vol. (cf)	Vac. (inHg)	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas In	Gas Out	Oxygen (%v/v)
	(0800)	616.20											
B - 3	5	619.99	.98	1.85	9.99	8	315	231	249	44	83	83	9.9
3	10	623.80	.98	1.86	3.80	8	314	238	233	44	86	84	9.9
2	15	627.57	.95	1.81	7.57	8	312	246	245	41	86	84	10.6
2	20	631.35	.96	1.83	1.35	8	313	242	241	39	88	84	10.7
MOISTURE → TOP 2	25	635.35	.92	2.04	5.35	8	313	243	244	40	92	85	10.9
08 1	30	639.41	.94	2.09	9.41	8	312	241	245	41	93	85	12.6
C - 3	35	643.87	.67	1.49	2.84	6	313	243	242	40	94	88	3.9
3	40	646.49	.72	1.62	6.43	5	306	242	241	42	99	87	4.0
2	45	649.90	.67	1.51	9.90	6	309	241	245	42	102	87	4.6
2	50	653.24	.69	1.56	3.43	6	310	245	249	42	103	89	4.5
1	55	657.00	.70	1.60	7.00	6	307	247	251	43	103	90	3.3
1	60	660.46	.65	1.49	0.46	4	302	238	255	41	104	91	3.3
D - 3	65	664.05	.70	1.60	4.05	6	302	230	270	42	104	91	3.3
3	70	667.69	.72	1.65	7.69	6	302	241	268	41	104	93	3.3
2	75	670.60	.67	1.54	1.20	6	302	244	260	42	105	93	3.3
2	80	674.42	.58	1.32	4.46	6	310	253	258	43	106	94	3.2
1	85	677.67	.55	1.25	7.65	6	310	251	259	44	106	93	3.3
0940 1	90	680.88	.57	1.30	0.88	6	310	254	263	45	107	93	3.3
A - 3	95	686.37	1.1	2.50	5.37	10	310	251	255	46	103	93	3.4
3	100	689.67	1.0	2.27	9.63	10	310	253	251	46	105	97	3.7
2	105	693.94	1.0	2.28	3.91	10	311	252	263	45	106	94	3.3
2	110	698.15	.98	2.23	8.15	10	311	251	255	43	107	94	3.2
1	115	702.09	.85	1.94	2.09	8	311	244	264	51	107	94	3.1
1	120	705.98	.82	1.87	5.98	8	310	248	265	50	107	94	3.1
	(1014)												
	θ = 120	Vm = 89.78		ΔH = 1.77							Avg. = 95.0		

C-3

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job: VIRGINIA P.C. — Operator: GH — Pitot No. 2404 Cp .84
Source: NO 10 BOILER STACK — Meter Box No. 15 ΔH 1.94 IN WC — Bar. Press.: 28.42 IN Hg — H2O 28 %
Date 7-27-94 Test 1 Run 2 — Calibr coeff.: 1.0004 — Nozzle No. 1-4 — Nozzle Dia .250 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (in WC)	Orifice Meter (in WC)	Dec. Vol. (cf)	VAC. in Hg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	(1040	706.30											
A 3	5	710.53	1.0	2.25	053	9	312	232	251	50	96	91	3.1
3	10	714.78	1.0	2.25	4.75	9	312	232	252	51	100	91	3.1
2	15	719.19	1.1	2.47	9.19	9	314	241	255	49	103	95	3.2
2	20	723.45	1.0	2.26	3.45	9	314	242	256	48	103	95	3.2
1	25	727.37	.84	1.91	7.37	9	311	242	257	45	104	95	3.2
1	30	731.19	.80	1.82	1.19	9	311	243	251	44	104	95	3.2
B 3	35	735.67	1.1	2.50	5.67	10	311	244	252	50	103	95	3.2
3	40	740.14	1.1	2.49	0.14	10	314	244	253	45	103	95	3.2
2	45	744.50	1.1	2.49	4.50	10	313	243	251	44	104	95	3.2
2	50	748.97	1.1	2.49	8.97	10	313	236	255	42	105	95	3.1
1	55	753.24	1.0	2.27	3.24	10	313	236	256	43	104	95	3.1
1	60	757.51	1.0	2.27	7.51	10	313	241	248	41	104	95	3.1
C 3	65	761.33	.80	1.82	1.33	10	312	242	249	42	104	96	3.1
3	70	765.16	.80	1.82	5.16	10	312	245	251	43	100	97	3.0
2	75	768.71	.69	1.56	8.71	10	312	251	252	44	104	94	3.1
2	80	772.28	.70	1.59	2.28	9	312	248	249	44	104	94	3.1
1	85	775.58	.60	1.36	5.58	7	312	249	255	40	105	94	3.2
1	90	778.80	.60	1.36	8.90	7	314	241	256	42	105	94	3.0
D 3	95	782.34	.65	1.47	2.34	6	314	241	257	43	103	94	3.1
3	100	785.78	.66	1.47	5.78	6	314	246	251	44	104	90	3.1
2	105	789.22	.65	1.48	9.22	6	309	247	252	43	105	91	3.1
2	110	792.66	.65	1.48	2.66	6	309	248	253	44	105	91	3.1
1	115	796.21	.69	1.57	6.21	6	308	248	253	44	105	91	3.2
1	120	799.54	.69	1.57	9.54	6	308	247	251	44	105	91	3.2
	(1249)												
	θ = 120	Vm = 93.24		ΔH = 1.91							Avg. = 985		

C-5

S-0037R

INTERPOLL LABORATORIES EPA METHOD 5 FIELD DATA SHEET

Job VIRGINIA P.W. Operator C.HOUE Pitot No. 2414 Cp .84
Source NO 10 BOILER STACK Meter Box No. 15 Bar. Press. 28 Delta H2O (Y)
Date 7-27-94 Test 1 Run 3 Coefficient 1.0005 Nozzle No. 1-7 Nozzle Dia .250 IN.

Traverse Point No.	Sampling Time (min)	Sample Volume (cf)	Velocity Head (inH2O)	Orifice Meter (inH2O)	Dev. Vol. (cf)	VAC. inHg	Temperatures (°F) Stack	Probe	Oven	Impg.	Gas/In	Gas/Out	Oxygen (%v/v)
	1310	800.000											
D 3	5	803.44	.65	1.48	3.44	6	310	249	251	42	96	89	3.5
3	10	806.90	.67	1.50	6.90	6	313	251	252	43	97	89	3.2
2	15	810.43	.70	1.57	0.43	6	314	252	251	44	103	90	3.1
2	20	813.99	.70	1.58	3.99	6	314	255	256	45	103	90	3.1
1	25	817.47	.65	1.47	7.42	6	312	255	257	46	105	91	3.1
1	30	820.85	.65	1.46	0.85	6	316	254	259	48	105	91	3.1
C 3	35	824.53	.75	1.69	4.53	6	316	259	258	46	105	92	3.1
3	40	828.07	.69	1.56	8.07	6	316	261	254	46	105	92	3.1
2	45	831.63	.70	1.58	1.63	6	315	263	255	47	108	93	3.0
2	50	835.21	.70	1.59	5.21	6	315	257	258	46	107	93	3.1
1	55	838.67	.65	1.48	8.67	6	310	209	257	41	108	93	3.0
1	60	842.18	.67	1.53	2.18	7	312	260	260	42	108	94	3.0
B 3	65	846.67	1.1	2.51	6.67	10	311	261	259	42	107	94	3.0
3	70	851.16	1.1	2.50	1.16	10	311	265	264	46	107	94	3.0
2	75	855.43	1.0	2.26	5.43	10	315	265	266	45	107	94	3.1
2	80	859.70	1.0	2.26	9.70	10	315	265	2262	46	107	94	3.1
1	85	864.17	1.1	2.49	4.17	10	315	266	262	45	107	94	3.0
1	90	868.65	1.1	2.49	8.65	10	314	264	267	46	106	94	3.0
A 3	95	872.86	.97	2.20	2.86	10	312	262	260	41	103	94	3.1
3	100	877.01	.95	2.15	7.01	10	312	263	259	41	103	95	3.1
2	105	881.19	.96	2.17	1.19	10	314	262	258	42	104	97	3.1
2	110	885.33	.94	2.13	5.33	11	314	261	259	43	106	97	3.0
1	115	889.14	.79	1.80	9.14	11	313	262	258	44	106	98	3.0
1	120	892.96	.79	1.80	2.96	11	313	263	259	44	106	98	3.0
	(1514)												
	θ = 120	Vm = 92.96		ΔH = 1.89							Avg. = 99.1		

C-7

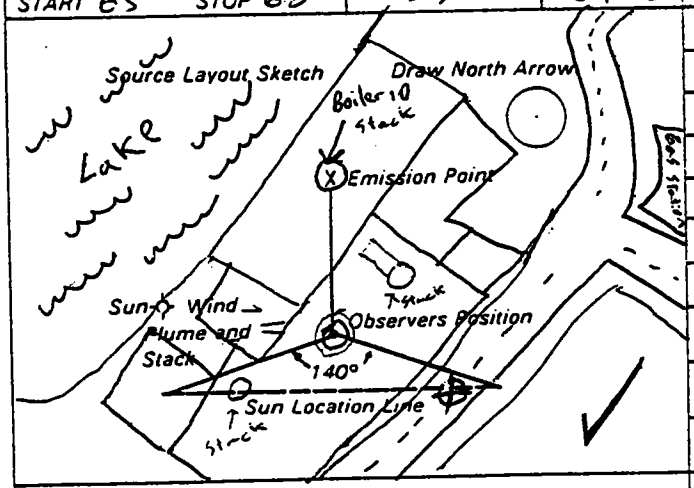
S-0037R

Interpoll Laboratories
(612)786-6020

Visible Emissions Form

Test 1-1

SOURCE NAME: VIRGINIA PU	OBSERVATION DATE: 7-27-94
ADDRESS:	START TIME: 0850
CITY: Virginia / STATE: MN / ZIP:	STOP TIME: 0950
PHONE: / SOURCE ID NUMBER:	
PROCESS EQUIPMENT: Gas Fired Boiler 10 / OPERATING MODE: 90%	
CONTROL EQUIPMENT: None / OPERATING MODE: N/A	
DESCRIBE EMISSION POINT: START Gas Fired Boiler 10 STOP SAME	
HEIGHT ABOVE GROUND LEVEL: START ~250 STOP SAME / HEIGHT RELATIVE TO OBSERVER: START ~16' STOP SAME	
DISTANCE FROM OBSERVER: START ~ 79' STOP / DIRECTION FROM OBSERVER: START ~300° STOP SAME	
DESCRIBE EMISSIONS: START NONE STOP SAME	
EMISSION COLOR: START NONE STOP SAME / PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐	
WATER DROPLETS PRESENT: NO ☒ YES ☐ SAME / IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐	
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START Above Stack Exit STOP SAME	
DESCRIBE BACKGROUND: START SKY STOP SAME	
BACKGROUND COLOR: START BLUE STOP SAME / SKY CONDITIONS: START Clear STOP SAME	
WIND SPEED: START ~ 5 mph STOP SAME / WIND DIRECTION: START ~350° STOP SAME	
AMBIENT TEMP.: START 65° STOP 68° / WET BULB TEMP.: 57° / RH, percent: 61%	



SEC / MIN	0	15	30	45	MIN	0	15	30	45
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
30	0	0	0	0	60	0	0	0	0

AVERAGE OPACITY FOR HIGHEST PERIOD: 0	NUMBER OF READINGS ABOVE % WERE: 0
RANGE OF OPACITY READINGS: MINIMUM 0	MAXIMUM 0
OBSERVER'S NAME (PRINT): Edward H. Juers III	
OBSERVER'S SIGNATURE:	DATE: 7-27-94
ORGANIZATION: Interpoll Labs	
CERTIFIED BY: Eastern Tech. Assoc	DATE: 4-6-94
VERIFIED BY:	DATE:

COMMENTS: Observation Done From Stack Platform

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

S-0079R

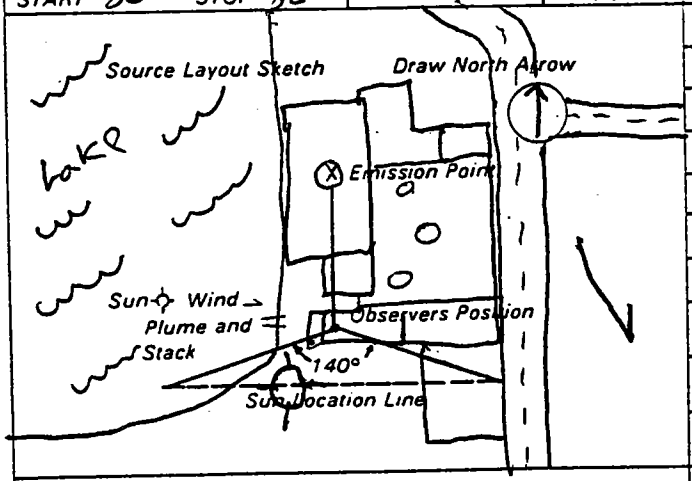
Interpoll Laboratories
(612)786-6020

Visible Emissions Form

Test 1-3

SOURCE NAME: Virginia PU	OBSERVATION DATE: 7-27-94	START TIME: 1320
ADDRESS:		STOP TIME: 1420
CITY: Virginia / STATE: MN / ZIP:		
PHONE / SOURCE ID NUMBER:		
PROCESS EQUIPMENT: Gas Fired Boiler 10 / OPERATING MODE: 80%		
CONTROL EQUIPMENT: NONE / OPERATING MODE: N/A		
DESCRIBE EMISSION POINT: START Boiler 10 Stack STOP SAME		
HEIGHT ABOVE GROUND LEVEL: START ~250 STOP SAME / HEIGHT RELATIVE TO OBSERVER: START ~44' STOP SAME		
DISTANCE FROM OBSERVER: START ~439' STOP SAME / DIRECTION FROM OBSERVER: START ~360° STOP SAME		
DESCRIBE EMISSIONS: START NONE STOP SAME		
EMISSION COLOR: START NONE STOP SAME / PLUME TYPE: CONTINUOUS ☐ FUGITIVE ☐ INTERMITTENT ☐		
WATER DROPLETS PRESENT: NO ☒ YES ☐ / IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐		
POINT IN THE PLUME AT WHICH OPACITY WAS DETERMINED: START Above Stack Exit STOP SAME		
DESCRIBE BACKGROUND: START SKY STOP SAME		
BACKGROUND COLOR: START Blue STOP SAME / SKY CONDITIONS: START Clear STOP SAME		
WIND SPEED: START ~5mph STOP SAME / WIND DIRECTION: START ~350° STOP SAME		
AMBIENT TEMP: START 80° STOP 82° / WET BULB TEMP: 65 / RH.percent: 45%		

SEC / MIN	0	15	30	45	MIN	0	15	30	45
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
30	0	0	0	0	60	0	0	0	0



AVERAGE OPACITY FOR HIGHEST PERIOD: 0	NUMBER OF READINGS ABOVE % WERE: 0
RANGE OF OPACITY READINGS: MINIMUM 0	MAXIMUM 0
OBSERVER'S NAME (PRINT): Edward H. Ivers III	
OBSERVER'S SIGNATURE:	DATE: 7-27-94
ORGANIZATION: Interpoll Labs	
CERTIFIED BY: ETR	DATE: 4-6-94
VERIFIED BY	DATE

COMMENTS

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

S-0079R

APPENDIX D

INTERPOLL LABORATORIES ANALYTICAL DATA

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Probe/Cyclone Wash

Job Virginia P.U.
Team Leader GH
Date Submitted 8-1-94
Test No. 1
Date of Analysis 8-2-94
Transport Leakage [None] [ ] ml

Source #10 Boiler
Test Site Stack
Date of Test 7-27-94
No. of Runs Completed 3
Technician C. Helgeson
Solvent Acetone

0
Test 1 Run 0
Field Blank
Log Number 5469-01P
Vol. of Solvent 100 ml
*Solvent Residue 2.00 ug/ml

Dish No. 3
Dish Tare Wt. 52.1189 g
Dish+Sample Wt. 52.1191 g
Sample Wt. 0.0002 g

1
Test 1 Run 1
Vol. of Solvent 240 ml
Log Number -02P
Comments

Dish No. 4
Dish Tare Wt. 47.3782 g
Dish+Sample Wt. 47.3892 g
Sample Wt. 0.0110 g

2
Test 1 Run 2
Vol. of Solvent 140 ml
Log Number -03P
Comments

Dish No. 5
Dish Tare Wt. 50.6818 g
Dish+Sample Wt. 50.6923 g
Sample Wt. 0.0105 g

3
Test 1 Run 3
Vol. of Solvent 160 ml
Log Number -04P
Comments

Dish No. 6
Dish Tare Wt. 48.2710 g
Dish+Sample Wt. 48.2953 g
Sample Wt. 0.0243 g

4
Test ____ Run ____
Vol. of Solvent ____ ml
Log Number
Comments

Dish No.
Dish Tare Wt. g
Dish+Sample Wt. g
Sample Wt. g

5
Test ____ Run ____
Vol. of Solvent ____ ml
Log Number
Comments

Dish No.
Dish Tare Wt. g
Dish+Sample Wt. g
Sample Wt. g

*Solvent Residue 2.00 ug/ml = [(Sample Wt. 0.0002 g)(10^6)]/Vol. of Sol. 100 ml
EPA-MS Acetone Residue Blank Spec. (7.8 ug/ml

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0105	0.0102	0.0240		

D-3

LSC-01YR

Interpoll Laboratories
(612) 786-6020

EPA Method 3 Data Reporting Sheet
Orsat Analysis

Job Virginia P.U.
Team Leader GH
Date Submitted 8-1-94
Test No. 1
Date of Analysis 8-1-94

Source #10 Boiler
Test Site Stack
Date of Test 7-27-94
No. of Runs Completed 3
Technician C. Helseson

Test/Run	Sample Log Number and Type	No. of An.	Buret Readings (ml) Zero Pt.	After CO_2	After O_2	Conc. CO_2 %v/v Dry	Conc. O_2 %v/v Dry	F_o
1/1	3469-05	1	0.00	10.60	13.10	10.60	2.50	1.74
		2	0.00	10.60	13.10	10.60	2.50	1.74
	☑ B ☐ F	Avg				10.60	2.50	
1/2	-06	1	0.00	10.50	13.20	10.50	2.70	1.73
		2	0.00	10.50	13.20	10.50	2.70	1.73
	☑ B ☐ F	Avg				10.50	2.70	
1/3	-07	1	0.00	10.50	13.20	10.50	2.70	1.73
		2	0.00	10.50	13.20	10.50	2.70	1.73
	☑ B ☐ F	Avg				10.50	2.70	
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						
		1						
		2						
	☐ B ☐ F	Avg						

☑ Ambient Air QA Check
☑ Orsat Analyzer System Leak Check
☑ F_o Within EPA M-3 Guidelines for fuel type.

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

F=Flask (250 cc all glass)
B=Tedlar Bag (5-layer)

EPA Method 3 Guidelines

Fuel Type	F0 Range
Coal:	
Anthracite/Lignite	1.016-1.130
Bituminous	1.083-1.230
Oil:	
Distillate	1.260-1.413
Residual	1.210-1.370
Gas:	
*Natural	1.600-1.836
Propane	1.434-1.586
Butane	1.405-1.553
Wood/Wood Bark	1.000-1.130

LSC-04-BR

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Impinger Catch/Minnesota Protocol

Job Virginia P.U.
Team Leader GH
Date Submitted 8-1-94
Test No. 1
Date of Analysis 8-2-94

Source #10 Boiler
Test Site Stack
Date of Test 7-27-94
No. of Runs Completed 3
Technician C. Helgeson

0	Test 1 Run 0 Field Blank Log Number 3469-01 I Comments	Dish No. 8 Dish Tare Wt. 46.9753 g Dish+Sample Wt. 46.9757 g Sample Wt. 0.0004 g
1	Test 1 Run 1 Log Number -02 I Comments	Dish No. 12 Dish Tare Wt. 48.1486 g Dish+Sample Wt. 48.1555 g Sample Wt. 0.0069 g
2	Test 1 Run 2 Log Number -03 I Comments	Dish No. 13 Dish Tare Wt. 45.7197 g Dish+Sample Wt. 45.7280 g Sample Wt. 0.0083 g
3	Test 1 Run 3 Log Number -04 I Comments	Dish No. 17 Dish Tare Wt. 48.3900 g Dish+Sample Wt. 48.4027 g Sample Wt. 0.0127 g
4	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g
5	Test ____ Run ____ Log Number Comments	Dish No. Dish Tare Wt. g Dish+Sample Wt. g Sample Wt. g

Blank Solvent Wt. .0004 g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0065	0.0079	0.0123	D-2	

LSC-03.GR

TEST PLAN FOR BOILERS PERFORMANCE TEST

PART 1. GENERAL INFORMATION

Test Plan Date: July 11, 1994
Test Date: July 26, 1994

Name and address of emission facility: City of Virginia,
Department of Public Utilities
618 South Second Street
Virginia, Minnesota 58792

Permittee contact persion: Doug Ganoe
Environmental/Safety Coordinator
(218)741-0740

Permit File No. 622-92-OT-1

Independent Testing Company: Interpoll Laboratories, Inc.
Contact: Dan Despen/Kathy Eickstadt (612)786-6020

Tests are mandated by the referenced permit.

A sketch of the source point to be tested showing test port location, stack diameter, and other pertinent information are included with this plan.

PART II. TESTING REQUIREMENTS

EP#	Pollutant	Emission Limit	Applicable Rule	Method	Run Length
6	PM	0.03 LB/10^6BTU	40 CFR 60 subp. Da	5	120 min
6	NO_x	0.1 LB/10^6BTU	To remain as a nonmajor under 40 CFR 52.21	7A	60 min
6	Opacity	20% (6-minute average) except for one 6-minute period per hour of not more than 27% opacity	40 CFR 60 subp. Da	9	60 min

Fuel sampling: N/A (natural gas-fired)

PART III. OPERATING CONDITIONS

1. Process Equipment Description: Virginia Power Plant will provide data for feedwater flow, steam flow and gas flow; CEM data will be collected by VDPU.

Interpoll Laboratories
(612) 786-6020

EPA Method 5 Data Reporting Sheet
Filter Gravimetrics

Job Virginia P.O.
Team Leader GH
Date Submitted 8-1-94
Test No. 1
Date of Analysis 8-1-94

Source #10 Boiler
Test Site Stack
Date of Test 7-27-84
No. of Runs Completed 3
Technician C. Helgeson

0	Test 1 Run 0 Field Blank Log Number 3469-01F Comments	Filter No. 6243 Filter Type 4"6F Filter Tare Wt. .9121 g Filter+Sample Wt. .9124 g Sample Wt. 0.0003 g
1	Test 1 Run 1 Log Number -02F Comments	Filter No. 6796 Filter Type 4"6F Filter Tare Wt. .9325 g Filter+Sample Wt. .9476 g Sample Wt. 0.0051 g
2	Test 1 Run 2 Log Number -03F Comments	Filter No. 6670 Filter Type 4"6F Filter Tare Wt. .9425 g Filter+Sample Wt. .9452 g Sample Wt. 0.0027 g
3	Test 1 Run 3 Log Number -04F Comments	Filter No. 6669 Filter Type 4"6F Filter Tare Wt. .9456 g Filter+Sample Wt. .9469 g Sample Wt. 0.0013 g
4	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g
5	Test ____ Run ____ Log Number ____ Comments	Filter No. ____ Filter Type ____ Filter Tare Wt. ____ g Filter+Sample Wt. ____ g Sample Wt. ____ g

Results:

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0051	0.0027	0.0013		

Field Blk.	Run 1	Run 2	Run 3	Run 4	Run 5
	0.0221	0.0208	0.0376		

LSC-02PR

Interpoll Laboratories
(612)786-6020

EPA Method 7A Recovery and Analysis Data Sheet (2)

	Sample Log ID No.	Flask No.	Test/ Run	Final Flask Conditions t_f (°F)	+	-	ΔPg (IN.HG.)	Chrom Run No.	DF	Nitrate Concentration (ug/ml) Uncorr. for blank C_{RS}	Corr. for blank ($C_{RS} - C_B$)	Total nitrate in Sample (ug) ($M_{NO_3^-}$)
1	3461-08	13	1/1/A	72°		✓	2.2		1	0.434	0.277	139
2	-09	14	1/1/B	↓		↓	0.4		1	0.467	0.310	155
3	-10	15	1/1/C				1.4		1	0.483	0.326	163
4	-11	16	1/1/A				0.5		1	0.508	0.351	176
5	-12	17	1/2/B				0.6		1	0.508	0.351	176
6	-13	18	1/2/C				0.4		1	0.504	0.347	174
7	-14	7	1/2/A				0.8		1	0.501	0.344	172
8	-15	55	1/2/B				~~0.4~~ 2.0		1	0.516	0.359	180
9	-16	56	1/3/C				~~1.4~~ 1.5		1	0.526	0.369	185
10	-17	57	1/3/A				1.8		1	0.478	0.321	161
11	-18	59	1/3/B				0.9		1	0.261	0.104	52.0
12	-19	60	1/3/C	↓		↓	1.4		1	0.538	0.381	191
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
Blank 1	-20	11		↓			—	1	1	CB1 0.157		
Blank 2									1	CB2		
Blank 3									1	CB3		

$\bar{C}_B$ = 0.157

S-340(2) R-9/85

APPENDIX E

BOILER INFORMATION SHEET

INTERPOLL LABORATORIES, INC.
612 (786-6020)

Boiler Information Sheet

Company	Virginia Public Utilities
Location	Virginia, Minnesota
Boiler No.	10
Manufacturer	Zurn
Class and Type	Keystone "O" Type
Year Built	1992
Firing Equipment	
☒ Economizer	Gas Temp. In_____°F Gas Temp. Out_____°F
☐ Air Preheater	Gas Temp. In_____°F Gas Temp. Out_____°F
Fuel (State, County, Mine)	_____ BTU/LB:_____
Steaming Capacity	200,000 LB/HR Natural Gas Only
Design Steam Pressure	
Design Steam Temperature	
Normal Steam Load	Approx. 100,000 Summer 130,000 winter

Steam Data:
☐ Saturated
☒ Superheated

Normal Steam Pressure 600 PSIG
Normal Steam Temp. 830 °F

Feedwater Temp. 240 °F (if superheated)

Pollution Control Equipment:

☐Mechanical collector
No. of tubes _____
Tube Dia. _____
Manuf. _____
Press. Drop _____
Rated Effic. _____

☐Scrubber
Type _____
Liquid flow _____ GPM
Manuf. _____
Press. Drop _____ IN.WC

☐ESP
☐Hotside ☐Coldside
No. of sections _____
Voltage _____ KV
Manuf. _____
Press. Drop _____ IN.WC

☐Baghouse
No. of Sections _____
Cleaning mechanism _____
_____
No. of Sections _____
Cloth area/bag _____ SQ.FT.
Manuf. _____
Press. Drop _____ IN.WC

Type of Stack	Steel Dual Wall
Stack Height	150' Above grade
Stack Diameter	5' - 0"
Units Emitting through Stack	one (No. 10 Boiler Only)
Rated Boiler Efficiency	84-87%

013194-G:\STACK\WP\FORMS\S-0075RRR

APPENDIX F

BOILER OPERATIONAL DATA

OPERATING DATA SUMMARY FOR COMBUSTION SOURCES 05/17/94

Company Name: DEPARTMENT OF PUBLIC UTILITIES OF VIRGINIA, MN.
Date of Performance Test: JULY 27, 1994
Summary prepared by: Jeff McCormick (Signature)

A. Fuel Input

1. Itemize all fuels and materials that are added to the combustion process during the test period. Attach ultimate/proximate analysis of the fuel. List the specific fuel (list ratios if applicable) used during testing (e.g., Western sub-bituminous coal (Antelope mines) topped with natural gas (70% ratio).

NATURAL GAS 100%

TEST	RATE OF FUEL INPUT (list units)	MOISTURE CONTENT (as received)	HEAT CONTENT (e.g. Btu/lb, Btu/gal- as received)	HEAT INPUT (x 10^6 Btu/hr)	MW Production	Steam Load (x 10^3 lbs/hr)
Run 1	520 MCF		1,000,000 BTU/MCF		14	171
Run 2	505 MCF		"		14	172
Run 3	498 MCF		"		14	171

2. Are the above fuels substantially the same as those normally burned ? YES
If not, explain

3. Are the above fuels normally burned in the proportions shown above ? YES
If not, explain

4. Describe any changes anticipated for procurement of fuels within the next twelve (12) months.
NONE

B. Equipment & Operating Data:

1. Furnace No. #10
2. Furnace Manufacturer: ZURN
3. Type of Firing: NATURAL GAS
4. Was the furnace operated under normal operating conditions? Yes
If not, explain Normal operation is 100,000-125,000#/hr
5. Specify normal soot blowing frequency:
   a) source operating time blowing soot: N/A minutes/shift
   b) number of shifts per day N/A

DEPT. OF PUBLIC UTILITIES
VIRGINIA, MINN.

BOILER NO. #10

TIME	STM FLOW M LBS.	WTR FLOW M LBS.	STEAM TEMP PRI OUT	STEAM TEMP SEC OUT	% O_2	GAS FLOW MCF	TEMPERATURES WTR FROM STG HTR	WTR FROM ECON	FAN ROOM	BLR GAS OUT	ECON GAS OUT	AIR HTR GAS OUT	STM FLOW M LBS	WTR FLOW M LBS	STM TEMP SEC OUT	% O_2	GAS FLOW MCF	GAS PRES	M AMPS	M AIR TEM
0100	96	93				134	118													
0200	95	97				134														
0300	97	94				134	112													
0400	96	97				133														
0500	96	99				135	115													
0600	100	97				136														
0700	135	127				171	112													
0800	167	160				230	114													
0900	171	165				240	115													
1000	170	164				236	116													
1100	171	164				241	118													
1200	172	164				241	119													
1300	171	164				243	122													
1400	171	162				239	123													
1500	170	160				251	126													
1600	143	136			12%	201														
1700	113	107			26	162														
1800	110	105			26	161														
1900	94	95			12%	135														
2000	100	94				141														
2100	91	91			12%	127														
2200	93	91				145														
2300	87	86			13	134														
2400	91	97				134														

NO. 10 BOILER FLOW METERS

READING	GAS	STEAM	WATER	COAL SCALES 7A	COAL SCALES 7B
PRESENT	310781				
PREVIOUS	300[illegible]		209248	249371	
DIFFERENCE					
CONSTANT	1540	1200	1200	200	200
TOTALS					

NO. 8 BOILER

GAS 3"	GAS 6"/OIL	STEAM
500	2.3211	1800

APPENDIX G

PROCEDURES

Particulate Loading and Emission Rates

The particulate emission rates were determined per EPA Methods 1 - 5, CFR Title 40, Part 60, Appendix A (revised July 1, 1992). In this procedure, a preliminary velocity profile of the gases in the flue is obtained by means of a temperature and velocity traverse. On the basis of these values, sampling nozzles of appropriate diameter are selected to allow isokinetic sampling, a necessary prerequisite for obtaining a representative sample.

The sampling train consists of a heated glass or stainless steel-lined sampling probe equipped with a Type S pitot and a thermocouple. The probe is attached to a sampling module which houses the all-glass in line filter holder in a temperature controlled oven. In addition, the sampling module also houses the impinger case and a Drierite drying column. The sampling module is connected by means of an umbilical cord to the control module which houses the dry test gas meter, the calibrated orifice, a leakless pump, two inclined manometers, and all controls required for operating the sampling train.

Particulate samples were collected as follows: The sample gas was drawn in through the sampling probe isokinetically and passed through a 4-inch diameter Gelman Type A/E glass fiber filter. The particulates were removed at this point and collected on the filter. The gases then passed through an ice-cooled impinger train and a desiccant-packed drying column which quantitatively absorb all moisture from the sample gas stream after which the sample gas passes through the pump and the dry test gas meter which integrates the sample gas flow throughout the course of the test. A calibrated orifice attached to the outlet of the gas meter provides instantaneous flow rate data.

A representative particulate sample was acquired by sampling for equal periods of time at the centroid of a number of equal area regions in the duct. The sampling rate is adjusted at each site such that an isokinetic sampling condition prevails. Nomographs are used to aid in the rapid determination of the sampling rate.

Condensible Organic Compounds Analysis

(State of Minnesota - MPCA Exhibit C)

Method II-8672-MN

Equipment: Separatory funnel - 500 cc with Teflon stopcock

Powder funnel - 75 mm ID with a 17 mm stem

Evaporating dish(es) - 200 cc or 250 cc beaker

Reagents: Diethyl ether - reagent grade

Chloroform - reagent grade

Sodium sulfate - (ACS) granular anhydrous

Toluene - (if 3% hydrogen peroxide is used to collect the samples)

Glass wool (Pyrex microfiber)

PREPARATION

1. Place 1 kg of granular anhydrous sodium sulfate in a shallow tray and heat to 200°C for at least four hours. Store in a tightly sealed glass container.

2. Place a plug of clean glass wool in the stem of the powder funnel. The plug must be of sufficient size so that it is held snugly in place by its own pressure. Add a one-inch layer of dry sodium sulfate.

I. ORGANICS

Caution! Work in vented hood!!!

A. Organic Blank Determination

1. Pour 125 ml of ethyl ether and 125 ml of chloroform into a tared beaker.

2. Evaporate solvent in hood at 70°F or less until no solvent remains.

3. Desiccate the sample in dish for two hours.

4. Weigh the sample to nearest 0.1 mg, record and report on Form LSC-03G.

B. Organic Sample Determination

1. Test for peroxide in sample ether using KI strips. (If KI strip shows positive, contact your supervisor before proceeding.)

2. Transfer the sample solution quantitatively to a 500 ml separatory funnel. Use the first of three 25 ml chloroform aliquots to rinse the sample container.

3. Extract with three 25 ml portions of chloroform. (Shake and vent to release pressure about 4 to 5 times each.) Allow the phases to separate. (Bottom layer is chloroform.) Draw off the bottom layer, transferring the solvent with a funnel containing a plug of sodium sulfate into a tared beaker. (Do not draw off any of the aqueous layer.)

4. After the three chloroform extractions, use two 25 ml portions of chloroform to rinse the sodium sulfate, collecting the rinses in the same tared beaker as the extracts.

4. Cool the dried sample in the desiccator and desiccate until a constant weight is obtained.

5. Report the results to the nearest 0.1 mg on Form LSC-03G.

B. Inorganic Sample Determination

Follow steps 1-5 in Section A above.

NOTES

1. For the organics determination, in the rare event that the impinger catch resulted from a Modified Method 6 determination (SO_2), whereby the solution contains dilute hydrogen peroxide ($\geq$ 3%), do not use ether as an extraction solvent. Substitute toluene for ethyl ether in Section I. (Ether in the presence of peroxide forms explosive hydroperoxide.)

2. In the organics determination, more than three extractions may be required to extract all of the organics. Additional extractions should be performed if the aqueous phase is still cloudy.

3. Special state requirements:
   Michigan - Total sample evaporated in tared evaporating dish on steam bath.
   Iowa - Organics and inorganics separately, as required.
   Wisconsin - Use Method II-8672-WI.
   Rest of states - Organics only.

REFERENCES

Proposed standards of Performance for New Stationary Sources, Federal Register 36(159) Part II, August 1, 1979.

Minnesota Pollution Control Agency, Exhibit C.

Flow

Flow determinations were carried out in accordance with EPA Method 2, CFR Title 40, Part 60, Appendix A (Revised July 1, 1987). A type S pitot was used to sense velocity pressure and an inclined manometer was used to measure velocity pressures. Gas temperatures were measured using a calibrated Type K thermocouple and digital temperature meter. Gas density (i.e. molecular weight) was calculated from the composition of the gas which was determined by Orsat.

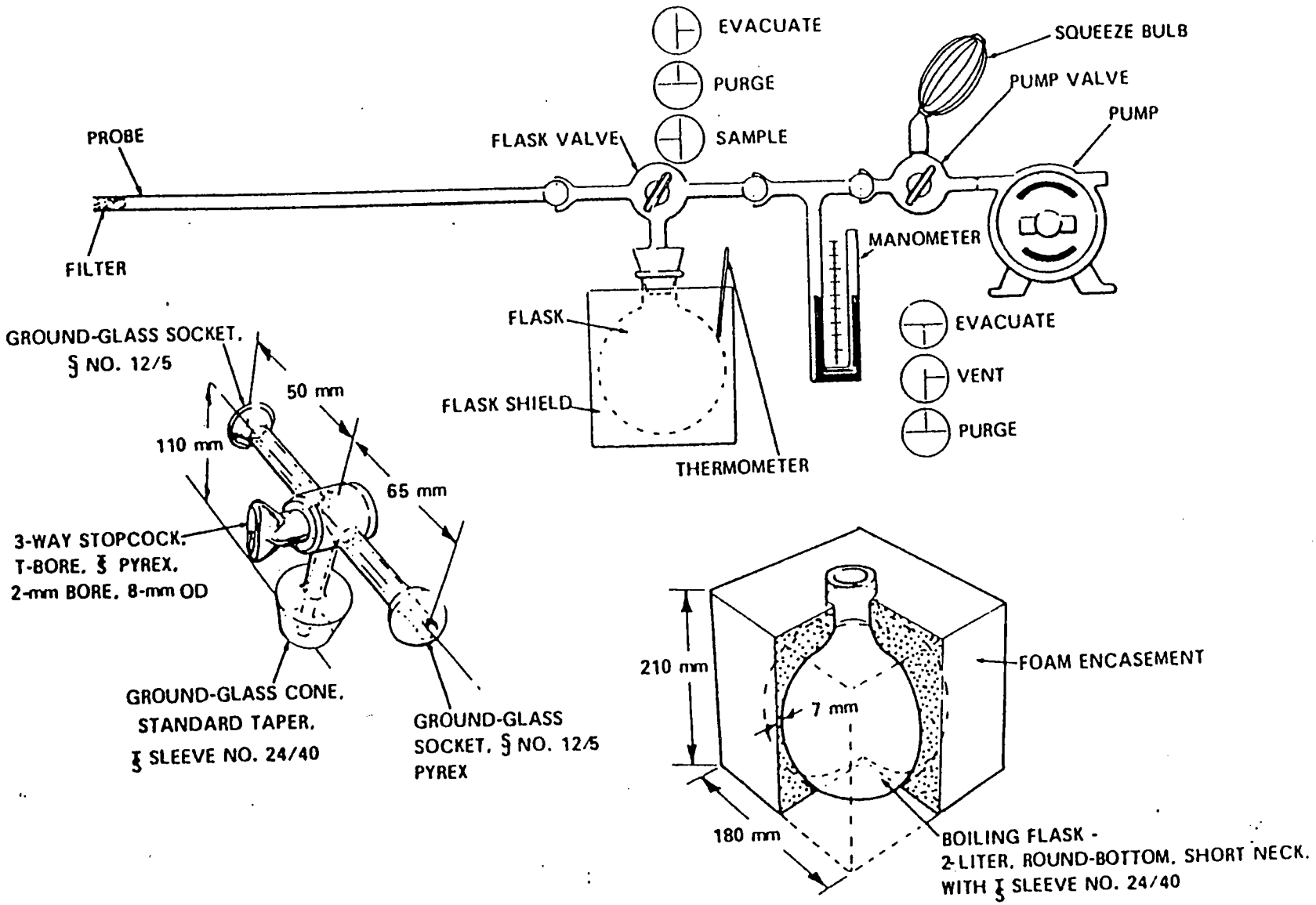
Gas Flow Density

Gas compositions were determined as per Method 3 by Orsat analysis of an integrated gas sample collected from the stack during the oxides of nitrogen determinations. Standard commercially prepared solutions were used in the Orsat analyzer (sat. KOH for carbon dioxide and reduced methylene blue for oxygen).

Oxides of Nitrogen

Oxides of nitrogen concentrations were collected in accordance with EPA Method 7 (see above-cited reference) with a specially designed all glass manifold and valving assembly and a heated stainless steel-lined probe. Samples were collected in two-liter evacuated insulated flasks which contained 25 cc of acidified peroxide solution (Method 7 reagent). Nine sets or more of three samples each were collected over a period of 4.5 to 5 hours.

The sampling train was leak checked through the probe at the beginning and end of the test and, in addition, the system leak checked at the time of evacuation of each flask. Before the samples were collected, the probe was purged to eliminate dead volume effects and to raise the temperature of the probe outlet and manifold assembly to minimize condensation of moisture. A plug of microfiber glass wool inserted in the probe inlet was used to prevent particulate material from entering into the flask. The temperature of the flask, vacuum in the



Sampling train, flask valve, and flask.

APPENDIX H

CALCULATION EQUATIONS

METHOD 2
CALCULATION EQUATIONS

$$\overline{V_s} = 85.49\ C_p\ (\sqrt{\Delta p})_{avg}\ \sqrt{\frac{T_{s(avg)}}{P_s\ M_s}}$$

$$Q_{s,\,d} = 60\ (1\ -B_{ws})\ \overline{V_s}\ A\ (\frac{528}{T_{s\ (avg)}})\ (\frac{P_s}{29.92})$$

$$Q_a = 60\ \overline{V_s}\ A$$

$$\dot{m}_g = \frac{4.995\ Q_{s,\,d}\ G_d}{1\ -\ B_{ws}}$$

$$RH^* = 100\ (vp_{twb}\ -\ 0.0003641\ P_s\ (T_{db}\ -\ T_{wb}))/vp_{tdb}$$

$$B^*_{ws} = RH(vp_{tdb})/P_s$$

$$\rho = \frac{4.585\ x\ 10^{-2}\ P_s M_s}{T_s\ (avg)}$$

*Alternate equations for calculating moisture content from wet bulb and dry bulb data.

T_{db}	=	Dry bulb temperature of stack gas, °F
T_{wb}	=	Wet bulb temperature of stack gas, °F
$T_{m(avg)}$	=	Absolute average dry gas meter temperature, °R
$T_{s(avg)}$	=	Absolute average stack temperature, °R
T_{std}	=	Standard absolute temperature, 528 °R (68 °F)
θ	=	Total sampling time, min.
V_{lc}	=	Total volume of liquid collected in impingers and silica gel, ml
V_m	=	Volume of gas sample as measured by dry gas meter, CF
$V_{m(std)}$	=	Volume of gas sample measured by the dry gas meter corrected to standard conditions, DSCF
$V_{w(std)}$	=	Volume of water vapor in the gas sample corrected to standard conditions, SCF
$\bar{V}_s$	=	Average actual stack gas velocity, FT/SEC
vp_{tdb}	=	Vapor pressure at T_{db}, IN. HG.
vp_{twb}	=	Vapor pressure at T_{wb}, IN. HG.
$\overline{\Delta H}$	=	Average pressure differential across the orifice meter, IN. WC.
ΔP	=	Velocity pressure of stack gas, IN. WC.
γ	=	Dry test meter correction coefficient, dimensionless
ρ	=	Actual gas density, LB/ACF

METHOD 5
CALCULATION EQUATIONS

$$V_{m(std)} = 17.65\ V_m\ \gamma\ \left(\frac{P_{bar} + \overline{\Delta H}/13.6}{T_{m(avg)}}\right)$$

$$V_{w(std)} = 0.0472\ V_{lc}$$

$$B_{ws} = \frac{V_{w(std)}}{V_{w(std)} + V_{m(std)}}$$

$$I = 0.0944\ \left(\frac{T_{s(avg)}\ V_{m(std)}}{P_s\ V_s\ A_n\ \theta\ (I - B_{ws})}\right)$$

$$C_s = \frac{15.43\ M_p}{V_{m(std)}}$$

$$C_a = \frac{272.3\ M_p\ P_s}{T_{s(avg)}\ (V_{w(std)} + V_{m(std)})}$$

$$(\dot{m}_p)_1 = 8.5714\ x\ 10^{-3}\ C_s\ Q_{s,d}$$

CALCULATION EQUATIONS

METHOD 7

$$V_{m(std)} = 17.64\ (V_f - 25)\ [\frac{P_f}{T_f} - \frac{P_i}{T_i}]$$

$$C_s = 6.243\ x\ 10^{-5}\ \frac{M}{V_{m(std)}}$$

$$E = \frac{2090\ C_s F}{20.9 - \overline{B}_{O_2}}$$

$$C_s\ (GR/DSCF) = 7000\ C_s$$

$$C_s\ (MG/DSCM) = 1.60186\ x\ 10^7\ C_s$$

$$C_s\ (ppm\text{-}dry) = 8.37552\ x\ 10^6\ C_s$$

$$C_s\ (ppm\text{-}3\%\ O_2) = 8.37552\ x\ 10^6\ C_s\ \{1 + [\frac{\overline{B}'_{O_2} - 3}{20.9 - B'_{O_2}}]\}$$

$$C_s\ (ppm\text{-}wet) = 8.37552\ x\ 10^6\ C_s\ (1 - \frac{MC}{100})$$

G:\STACK\WP\METHODS\EQ.M7

APPENDIX I

SAMPLING TRAIN CALIBRATION DATA

28350

INTERPOLL LABORATORIES
EPA Method 5 Gas Metering System
Quality Control Check Data Sheet

Job VIRGINIA PUBLIC UTILITIES Date 7-27-94

Operator G HOVE Module No. 15

Instructions: Operate the control module at a flow rate equal to ^H@ for 10 minutes before attaching the umbilical. Record the following data:

Bar press 28.335 in. Hg. Y_T = 1.0005 ^H@ 1.94 in. W.C.

Time (min)	Volume (CF)	Meter Temp. (°F)	
		Inlet	Outlet
[redacted]	(608.30)	[redacted]	
2.5	612.12	82	81
5.0	612.12	84	81
7.5	614.11	86	80
10	615.93	87	79
[redacted]	V_m= 7.63	Avg(t_m)= 82.5	°F

Calculate Y_{cn} as follows:

$$Y_{cn} = \frac{1.786}{Y_T V_m}\left[\frac{(t_m + 460)}{P_b}\right]^{0.5}$$

$$Y_{cn} = \frac{1.786}{(1.0005)(7.63)}\left[\frac{(82.5) + 460}{(28.335)}\right]^{0.5}$$

Y_{cn} = 1.023

If Y_{cn} is not within the range of 0.97 to 1.03, "the volume metering system should be investigated before beginning."

CFR Title 40, Part 60, Appendix A, Method 5, Section 4.4.1

S-432

Date 1-12-94

Bar. Press. 29.02 in. Hg

INTERPOLL LABORATORIES, INC.
METER CALIBRATION SHEET
EPA METHOD 6

Control Module No. 15
Serial No. DTM 1334122
Wet Test Meter No. AL-20
Technician E TROWBRIDGE

ΔH (in. WC)		Gas Volume Wet Test Meter (ft^3)	* Cal. Index Y (%)	* Diff. Wet Test Meter ΔP_w (in. WC)	Gas Volume Dry test meter (ft^3)		Gas temperatures			Time θ (min/sec)	Meter Coeff. Y	Orifice Const. ΔH@	C_f
							Wet Test	Dry Test					
nominal	actual				V_{di}	V_{df}	t_w (°F)	t_{di} (°F)	t_{do} (°F)				
0.5	.5	2	99.85	0.01	24.500	26.540	66.5	81	71	5/05	.9952	1.83	
1.2	1.2	3	99.91	0.025	21.000	24.050	66.5	79	71	5/05	.9954	1.95	
2.0	2.0	3	99.93	0.055	27.000	30.054	66.5	87	72	3/58	1.0006	1.96	
3.3	3.3	5	100.00	0.09	30.500	35.569	66.5	91	72	5/11	1.0057	1.98	
4.7	4.7	5	100.02	0.12	36.000	41.067	66.5	93	73	4/22	1.0056	1.99	
											1.0005	1.94	

Positive leak check performed by ET

Meter was in tolerance ☒

Meter was not in tolerance ☐; readjusted linkage

Meter was not in tolerance ☐; changed dry test meters

Approved by [signature] Date 1/14/94

* Based on AL-20 wet test meter calibration in Nov. 1991 against Bell Prover (NBS Traceable) - Carl Poe Co.

Interpoll Laboratories, Inc.
(612) 786-6020

Nozzle Calibration
Data Sheet

Date of Calibration: 07-27-94
Technician: Gary Hove

Nozzle Number 1-4

The nozzle is rotated in 60 degree increments and the diameter at each point is measured to the nearest 0.001 inch. The observed readings and average are shown below.

Position	Diameter (inches)
1	.249
2	.251
3	.250
Average:	.250

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S-Type Pitot Tube Inspection Sheet

Pitot Tube No. 24-4

Pitot tube dimensions:

1. External tubing diameter (D_t) .316 IN.
2. Base to Side A opening plane (P_A) .460 IN.
3. Base to Side B opening plane (P_B) .460 IN.

Alignment:

4. α_1 < 10° 0
5. α_2 < 10° 0

6. B_1 < 5° 0
7. B_2 < 5° 0

8. Z <.125" .02
9. W <.0625" .01

Distance from Pitot to Probe Components:

10. Pitot to 0.500 IN. nozzle .750 IN.
11. Pitot to probe sheath 3.0 IN.
12. Pitot to thermocouple (parallel to probe) 3.0 IN.
13. Pitot to thermocouple (perpendicular to probe) .760 IN.

☒ Meets all EPA design criteria thus C_p = 0.84
☐ Does not meet EPA design criteria - thus calibrate in wind tunnel.
C_p = _____

Date of Inspection:

1-8-94

Inspected by:

CFR Title 40 Part 60 Appenidix A Method 2

S-348

APPENDIX J

TEST PLAN