



TERRY E. BRANSTAD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES
LARRY J. WILSON, DIRECTOR

 September 3, 1998

Roy Huntley
Emission Factor and Inventory Group
Office of Air Quality Planning and Standards
US Environmental Protection Agency
Research Triangle Park, NC 27711

Re: Generator stack tests.

Dear Mr. ^{Roy}Huntley:

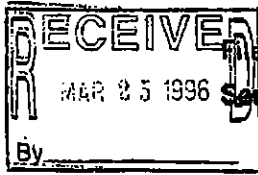
Enclosed with this letter are six stack test reports for generators. I had sent you some test reports a while back. These reports were finally put on roll film and sent back to the Department. You should now have all of the same reports that I had in determining the emission factor for TSP/PM₁₀ that the State of Iowa uses (0.14 lb/MMBTU). Besides the PM tests, there are also some NO_x tests that are included.

If you have any questions, feel free to contact me at (515) 242-6002 or send me an email.

Sincerely,



Christopher A. Roling, E.I.
Environmental Engineer
Air Quality Bureau, IDNR



RECORD

Name 202 10-1 64-01-045

Senders Initials ms

EMISSION TEST REPORT
for
INDUSTRIAL ENERGY APPLICATIONS
on the
Marshalltown Hy-Vee Standby Generator
located in
Marshalltown, Iowa

TEST

February 29, 1996

**T
E
C**

Thompson Environmental Consulting, Inc.

a member of THE COMPLIANCE GROUP

Environmental Engineering, Permitting and Compliance Services

**Iowa Department of Natural Resources
Stack Test Observation Form**

Facility Name: 713 Location: 713
 Source: _____ Permit No.: _____
 ER Stds.: _____ Test Method: _____

Control Equipment: _____ Pressure Drop: _____
 Operating Capacity: 705 kW Rated Capacity: _____
 Permitted Stack Flow: 2400 scfm Is The Stack Round? (V/N)
 Dimensions Of The Stack: 9.5"

Consultants: _____ Crew Chief: HANK TETUS
 Address: _____
 Test Equipment Used: _____ No. in Crew: 3

Calibration Data

Cp: 0.99 γ: 0.994 dHO: 1.925 Dn: 0.155

RUN DATA

Min./pt.: 5 Total Points: 12

Run	One	Two	Three	Four
Date	<u>2-29-76</u>	<u>2-29-76</u>	<u>2-29-76</u>	<u>2-29-76</u>
Est. Bws	<u>9 6</u>	<u>9 6</u>	<u>9 6</u>	<u>9 6</u>
Bp	<u>30.30</u>	<u>30.30</u>	<u>30.50</u>	<u>30.30</u>
Static Pressure	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>	<u>1.5</u>
Pre Leak Check	<u>0.008515"</u>	<u>0.008813"</u>	<u>0.008515"</u>	<u>0.01613"</u>
Start Time	<u>10:13</u>	<u>11:38</u>	<u>1:21</u>	<u>2:45</u>
Initial DGM Reading	<u>441.357</u>		<u>516.179</u>	
Approx. Ts	<u>8-10</u>		<u>850</u>	
Approx. Tm	<u>66</u>		<u>77</u>	
Approx. dP	<u>3.7</u>		<u>3.7</u>	
Approx. dH	<u>1.1</u>		<u>1.1</u>	
Highest Vacuum	<u>3"</u>		<u>4"</u>	
Post Leak Check	<u>0.00864</u>	<u>0.00864</u>	<u>0.00864</u>	
Pitot Leak Check		<u>Failed</u>		
Stop Time	<u>11:15</u>	<u>12:50</u>	<u>2:25</u>	
Final DGM Reading	<u>477.100</u>		<u>552.177</u>	
VolMStd	<u>30.24</u>			
Stack Velocity	<u>190.95</u>			
Isokinetics	<u>1078</u>			

SAMPLE RECOVERY

Run	One	Two	Three
Probe Wash Color	Black	Black	
Probe Wash Deposits	L M H	L M H	L M H
Filter Color	Black		
Filter Deposits	L M H	L M H	L M H
Impinger Color	yellow / chunky	yellow / chunky	
Impinger Deposits	L M H	L M H	L M H

L=Light M=Medium H=Heavy

Run 1 Comments:

Point location was A.
 - 1st impinger liquid was yellow.

Down Time: None

Run 2 Comments: Failed the final leak test, the liner somehow detached from the fitting causing the leak. Still covered the sample (dry gas 47% - 52% as usual) * Filter # F316
 Run 2.B 1st impinger is yellow (F 317)

Down Time: ^{2.B} None

Run 3 Comments:

Down Time: _____

- | | | |
|---|--------------------------------------|----|
| Equipment Set Up Satisfactorily ? | <input checked="" type="radio"/> Yes | No |
| Equipment Disassembled Satisfactorily ? | <input checked="" type="radio"/> Yes | No |
| Meter Box Operation Satisfactory ? | <input checked="" type="radio"/> Yes | No |
| Sample Preparation Satisfactory ? | <input checked="" type="radio"/> Yes | No |
| Equipment Calibrated ? | <input checked="" type="radio"/> Yes | No |

Signature of Observer: Shawn D. [Signature] Date: 2-29-96

Facility: IEA (Hy-Vee)
Location: Marshalltown, Iowa
Source: Standby Generator
Permit Number: 94-A-597
Test Date: 2-29-96
Reviewer: S. Dodge
Review Date: 3-29-96

Run	ts (deg F)	Moisture (%)	Fan Flow (acfm)	Fan Flow (dscfm)	Vmstd (dscf)	Mass Catch (mg)	c (gr/dscf)	c (gr/scf)	e (lb/hr)	IKR %
1	839.2	8%	5.7E+03	2.2E+03	3.6E+01	8.9E+01	0.0379	0.0360	0.70	104.8%
2	855.1	7%	5.6E+03	2.1E+03	3.5E+01	1.0E+02	0.0438	0.0408	0.80	103.5%
3	852.1	8%	5.7E+03	2.2E+03	3.6E+01	1.0E+02	0.0442	0.0409	0.82	104.3%
avg	849	7%	5.7E+03	2.1E+03	3.6E+01	9.7E+01	0.042	0.039	0.77	104.2%
cc	16	1%	7E+01	2E+01	8E-01	1E+01	0.007	0.006	0.11	1.2%

	PM10	PM2.5	NOx
Run 1	1906.4	29.47	7.37
Run 2	1934.4	30.44	7.61
Run 3	1926.6	29.44	7.36
Average	1922.4	29.78	7.45

based on 500 operating hours.

Flow - 2320.3 OK

Process -
 Treat: 53 gal/hr
 Retent: 56.5 gal/hr OK

PM10 - Limit 0.56 lbs/hr - Limit 0.19 tons/yr (500 hr)
 - Actual 0.77 lbs/hr **Violation** - Actual 0.19 tons/yr OK

NOx Limit 6.4 tons/yr (500 hr)
 Actual 7.45 tons/yr (500 hr) **Violation**

**IEA-Marshalltown,Iowa
Standby Generator**

Data		NOx	
Run:	1	ppm(avg)	1909.6
Pts:	12	Proticol 1 gas conc.	1764
Min/Pt:	5.0	Cal. Initial	1767.1
Stack Diameter (in):	9.5	Cal. Final	1767.1
Nozzle Diameter (in):	0.166	Zero cal initial	1.25
Dry Gas Calibration Factor:	0.994	Zero cal final	1.25
Pilot Coefficient:	0.89	Bws	0
Barometric Pressure (in Hg):	30.30	Q(dscfm)	2158
Static Pressure (in H2O):	1.50	MW	46
CO%:	0.0 %	Total hours	500
CO2%:	7.8 %	Conc. Corrected for drift (ppmdv)	1906.4
O2%:	10.1 %	Conc. (ppmwv)	1906.4
Moisture Collected (ml):	84.7	E(lb/hr)	29.47
Metered Volume (dacf):	35.749	E(tons/yr)	7.369
Leak Correction (acf):	0.016		
Avg Stack Temp (deg F):	839.2		
Avg Meter Temp (deg F):	87.3		
Avg Delta H (in H2O):	1.11		
Avg Sqrt Delta P (in H2O) ⁶ :	1.8593		
Particulate Catch (mg):	88.8		

Calculations	
Tstd (deg R):	528
Pstd (in Hg):	29.92
Vm (dacf):	35.55
Tm (deg R):	527.3
Pm (in Hg):	30.38
Vmstd (dscf):	36.147
Vliquid (scf):	3.047
Vtotal (scf):	39.194
Moisture (%):	7.8%
N2(%):	82.1%
Md (lb/lb-mole):	29.85
Ms (lb/lb-mole):	28.75
Ts (deg R)	1299.2
Ps (in Hg):	30.41
vs (ft/sec):	191.8
As (sq ft):	0.49
Q (acfm):	5666
Q (scfm):	2340
Q (dscfm):	2158
An (sq ft):	0.000131
Run Length (min):	60
vn (ft/s):	201.1
IKR (%):	105%
c (gr/acf):	0.0350
c (gr/dscf):	0.0379
e (lb/hr):	0.7014

FIELD DATA EVALUATION SHEET							RUN 1
POINT #	Ts	Ml	Mo	Tm	ΔH	ΔP	$\Delta P^{*.5}$
1	831	60	60	60	1.1	3.4	1.8439
2	845	62	61	61.5	1.2	3.7	1.9235
3	847	65	62	63.5	1.1	3.6	1.8974
4	844	67	63	65	1.1	3.4	1.8439
5	831	69	64	66.5	1.1	3.4	1.8439
6	831	70	65	67.5	1.1	3.3	1.8168
7	835	68	67	67.5	1.1	3.5	1.8708
8	836	72	67	69.5	1.2	3.7	1.9235
9	846	73	68	70.5	1.1	3.5	1.8708
10	848	74	69	71.5	1.1	3.4	1.8439
11	844	74	70	72	1.1	3.4	1.8439
12	832	74	70	72	1	3.2	1.7889
	839.2			67.3	1.1083	3.4583	1.8593

**IEA-Marshalltown,Iowa
Standby Generator**

Data		NOx	
Run:	2	ppm(avg)	1898.6
Pls:	12	Protocol 1 gas conc.	1764
Min/Plt:	5.0	Cal. Initial	1731.65
Stack Diameter (In):	10	Cal. Final	1731.65
Nozzle Diameter (In):	0.155	Zero cal initial	2.9
Dry Gas Calibration Factor:	0.994	Zero cal final	2.9
Pitot Coefficient:	0.99	Bws	0
Barometric Pressure (in Hg):	30.30	Q(dscfm)	2197
Static Pressure (in H2O):	1.50	MW	46
CO%:	0.0 %	Total hours	500
CO2%:	7.2 %	Conc. Corrected for	
O2%:	11.0 %	drift (ppmdv)	1934.4
Moisture Collected (ml):	58.2	Conc. (ppmwv)	1934.4
Metered Volume (dacf):	35.498	E(lb/hr)	30.44
Leak Correction (acf):	0.010	E(tons/yr)	7.811
Avg Stack Temp (deg F):	855.1		
Avg Meter Temp (deg F):	76.3		
Avg Delta H (in H2O):	1.092		
Avg Sqrt Delta P (in H2O) ^{0.5} :	1.8344		
Particulate Catch (mg):	100.2		

used the failed flow from run 2
to calculate lbs/hr

Calculations	
Tstd (deg R):	528
Pstd (in Hg):	29.92
Vm (dacf):	35.29
Tm (deg R):	836.3
Pm (in Hg):	30.38
Vmstd (dscf):	35.283
Vliquid (scf):	2.647
Vtotal (scf):	37.930
Moisture (%):	7.0%
N2(%):	81.8%
Md (lb/lb-mole):	29.59
Ms (lb/lb-mole):	28.78
Ts (deg R)	1315.1
Ps (in Hg):	30.41
vs (ft/sec):	190.3
As (sq ft):	0.49
Q (acfm):	5620
Q (scfm):	2294
Q (dscfm):	2133
An (sq ft):	0.000131
Run Length (min):	60
vn (ft/s):	197.0
IKR (%):	104%
c (gr/scf):	0.0408
c (gr/dscf):	0.0438
e (lb/hr):	0.8014

FIELD DATA EVALUATION SHEET							RUN 2
POINT #	Ts	Ml	Mo	Tm	ΔH	ΔP	$\Delta P^*.S$
1	847	76	76	76	1.2	3.6	1.8974
2	862	71	76	73.5	1.1	3.6	1.8974
3	862	73	76	74.5	1.1	3.5	1.8708
4	860	74	76	75	1.1	3.4	1.8439
5	853	75	77	76	1.1	3.3	1.8166
6	832	76	77	76.5	1.1	3.3	1.8166
7	863	77	77	77	1.1	3.5	1.8708
8	862	76	78	77	1	3.2	1.7889
9	869	76	78	77	1	3.2	1.7889
10	865	77	78	77.5	1.1	3.3	1.8166
11	854	77	78	77.5	1.1	3.3	1.8166
12	832	77	79	76	1.1	3.2	1.7889
	855.1			76.3	1.0917	3.3667	1.8344

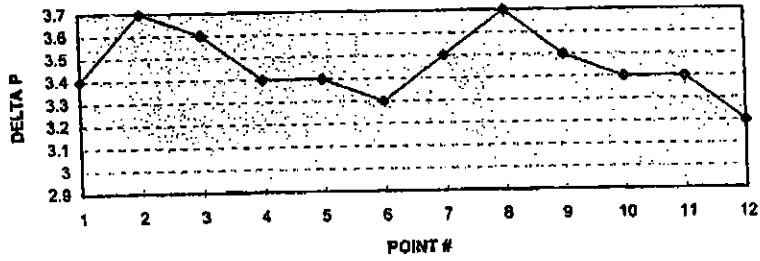
**IEA-Marshalltown,Iowa
Standby Generator**

Data		NOx	
Run:	3	ppm(avg)	1891
Pls:	12	Protocol 1 gas conc.	1764
Min/Pt:	5.0	Cal. Initial	1731.65
Stack Diameter (in):	10	Cal. Final	1731.65
Nozzle Diameter (in):	0.155	Zero cal initial	2.9
Dry Gas Calibration Factor:	0.994	Zero cal final	2.9
Pitot Coefficient:	0.99	Øws	0
Barometric Pressure (in Hg):	30.30	Q(dscfm)	2133
Static Pressure (in H2O):	1.50	MW	46
CO%:	0.0 %	Total hours	500
CO2%:	7.2 %	Conc. Corrected for	
O2%:	11.0 %	drift (ppmdv)	1926.6
Moisture Collected (ml):	62.4	Conc. (ppmwv)	1926.6
Metered Volume (dacf):	36.175	E(lb/hr)	28.44
Leak Correction (acf):	0.002	E(tons/yr)	7.359
Avg Stack Temp (deg F):	852.1	used the flow from the last run to calculate lbs/hr	
Avg Meter Temp (deg F):	78.1		
Avg Delta H (in H2O):	1.108		
Avg Sqrt Delta P (in H2O) ^{0.5} :	1.8571		
Particulate Catch (mg):	102.7		

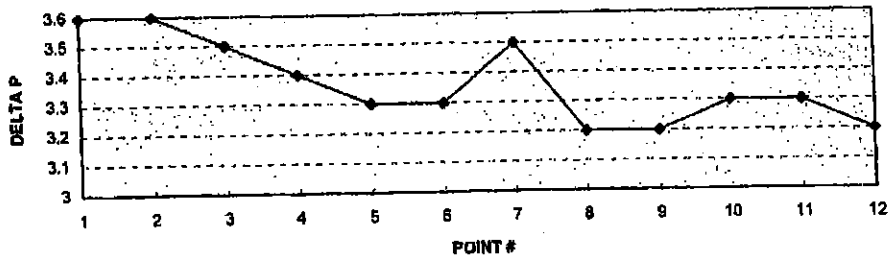
Calculations	
Tstd (deg R):	528
Pstd (in Hg):	29.92
Vm (dacf):	35.96
Tm (deg R):	538.1
Pm (in Hg):	30.38
Vmstd (dscf):	35.829
Vliquid (acf):	2.939
Vtotal (scf):	38.768
Moisture (%):	7.6%
N2(%):	81.8%
Md (lb/lb-mole):	29.59
Ms (lb/lb-mole):	28.71
Ts (deg R)	1312.1
Ps (in Hg):	30.41
vs (ft/sec):	192.7
As (sq ft):	0.49
Q (acfm):	5690
Q (scfm):	2327
Q (dscfm):	2151
An (sq ft):	0.000131
Run Length (min):	60
vn (ft/s):	200.9
IKR (%):	104%
c (gr/scf):	0.0408
c (gr/dscf):	0.0442
e (lb/hr):	0.8155

FIELD DATA EVALUATION SHEET							RUN 3
POINT #	Ts	Ml	Mo	Tm	ΔH	ΔP	ΔP ^{0.5}
1	860	79	79	79	1.1	3.5	1.8708
2	863	74	79	75.5	1.2	3.6	1.8974
3	869	76	79	77.5	1.1	3.6	1.8974
4	858	77	80	78.5	1.1	3.4	1.8439
5	845	78	80	79	1.1	3.4	1.8439
6	836	77	80	78.5	1	3.2	1.7889
7	845	79	79	79	1.1	3.5	1.8708
8	861	77	79	78	1.2	3.6	1.8974
9	865	77	79	78	1.1	3.5	1.8708
10	855	77	79	78	1.1	3.4	1.8439
11	837	77	79	78	1.1	3.4	1.8439
12	831	77	78	77.5	1.1	3.3	1.8166
	852.1			78.1	1.1083	3.4500	1.8571

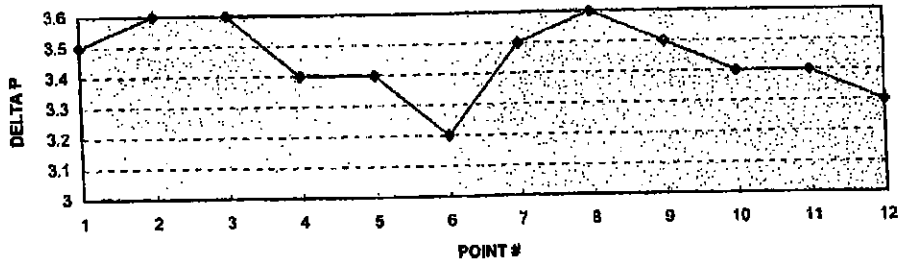
RUN 1



RUN 2



RUN 3



Facility: IEA (Hy-Vee)
Location: Marshalltown, Iowa
Source: Standby Generator
Permit Number: 94-A-597
Test Date: 2-29-96
Reviewer: S. Dodge
Review Date: 3-29-96

Process = 53 gal/hr *OK*
 Flow = 250 scfm *OK*

Run	ts (deg F)	Moisture (%)	Fan Flow (acfm)	Fan Flow (dscfm)	Vmatd (dscf)	Mass Catch (mg)	c (gr/dscf)	c (gr/scf)	e (lb/hr)	IKR %
1	839.2	8%	5.7E+03	2.2E+03	3.6E+01	8.9E+01	0.0379	0.0350	0.70	104.9%
2	855.1	7%	5.6E+03	2.1E+03	3.5E+01	1.0E+02	0.0438	0.0408	0.80	103.6%
3	852.1	8%	5.7E+03	2.2E+03	3.6E+01	1.0E+02	0.0442	0.0409	0.82	104.3%
avg	849	7%	5.7E+03	2.1E+03	3.6E+01	9.7E+01	0.042	0.039	0.77	104.2%
cc	16	1%	7E+01	2E+01	8E-01	1E+01	0.007	0.008	0.11	1.2%

Max 500 hrs

PM₁₀ Tons/yr = 0.1925

NO_x Tons/yr =

**IEA-Marshalltown,Iowa
Standby Generator**

Data	
Run:	1
Pts:	12
Min/Pt:	5.0
Stack Diameter (in):	9.5
Nozzle Diameter (in):	0.155
Dry Gas Calibration Factor:	0.994
Pitot Coefficient:	0.99
Barometric Pressure (in Hg):	30.30
Static Pressure (in H2O):	1.50
CO%:	0.0 %
CO2%:	7.8 %
O2%:	10.1 %
Moisture Collected (ml):	64.7
Metered Volume (dacf):	35.749
Leak Correction (acf):	0.016
Avg Stack Temp (deg F):	839.2
Avg Meter Temp (deg F):	87.3
Avg Delta H (in H2O):	1.11
Avg Sqrt Delta P (in H2O) ³ :	1.8593
Particulate Catch (mg):	88.8

Calculations	
Tstd (deg R):	528
Pstd (in Hg):	29.92
Vm (dacf):	35.55
Tm (deg R):	827.3
Pm (in Hg):	30.38
Vmstd (dscf):	36.147
Vliquid (acf):	3.047
Vtotal (scf):	39.194
Moisture (%):	7.8%
N2(%):	82.1%
Md (lb/lb-mole):	29.65
Ms (lb/lb-mole):	28.75
Ts (deg R):	1289.2
Ps (in Hg):	30.41
vs (ft/sec):	181.8
As (sq ft):	0.49
Q (acfm):	5666
Q (scfm):	2340
Q (dscfm):	2158
An (sq ft):	0.000131
Run Length (min):	60
vn (ft/s):	201.1
IKR (%):	105%
c (gr/acf):	0.0350
c (gr/dscf):	0.0379
e (lb/hr):	0.7014

POINT #	FIELD DATA EVALUATION SHEET						RUN 1
	Ts	Mi	Mo	Tm	ΔH	ΔP	
1	831	60	60	60	1.1	3.4	1.8439
2	845	62	81	81.5	1.2	3.7	1.9235
3	847	65	62	63.5	1.1	3.6	1.8974
4	844	67	63	65	1.1	3.4	1.8439
5	831	69	64	66.5	1.1	3.4	1.8439
6	831	70	65	67.5	1.1	3.3	1.8166
7	835	68	67	67.5	1.1	3.5	1.8708
8	836	72	67	69.5	1.2	3.7	1.9235
9	848	73	68	70.5	1.1	3.5	1.8708
10	848	74	69	71.5	1.1	3.4	1.8439
11	844	74	70	72	1.1	3.4	1.8439
12	832	74	70	72	1	3.2	1.7889
	839.2			67.3	1.1083	3.4683	1.8693

**IEA-Marshalltown,Iowa
Standby Generator**

Data	
Run:	2
Pts:	12
Min/Pt:	5.0
Stack Diameter (in):	10
Nozzle Diameter (in):	0.155
Dry Gas Calibration Factor:	0.994
Pitot Coefficient:	0.99
Barometric Pressure (in Hg):	30.30
Static Pressure (in H2O):	1.50
CO%:	0.0 %
CO2%:	7.2 %
O2%:	11.0 %
Moisture Collected (mi):	56.2
Metered Volume (dacf):	35.498
Leak Correction (acf):	0.010
Avg Stack Temp (deg F):	855.1
Avg Meter Temp (deg F):	76.3
Avg Delta H (in H2O):	1.092
Avg Sqrt Delta P (in H2O) ^{0.5} :	1.8344
Particulate Catch (mg):	100.2

Calculations	
Tstd (deg R):	528
Pstd (in Hg):	29.92
Vm (dacf):	35.28
Tm (deg R):	536.3
Pm (in Hg):	30.38
Vmstd (dscf):	35.283
Vliquid (scf):	2.647
Vtotal (acf):	37.930
Moisture (%):	7.0%
N2(%):	81.6%
Md (lb/lb-mole):	29.58
Ms (lb/lb-mole):	28.78
Ts (deg R):	1315.1
Ps (in Hg):	30.41
vs (ft/sec):	190.3
As (sq ft):	0.49
Q (acfm):	5620
Q (scfm):	2294
Q (dscfm):	2133
An (sq ft):	0.000131
Run Length (min):	60
vn (ft/s):	197.0
IKR (%):	104%
c (gr/scf):	0.0408
c (gr/dscf):	0.0438
e (lb/hr):	0.8014

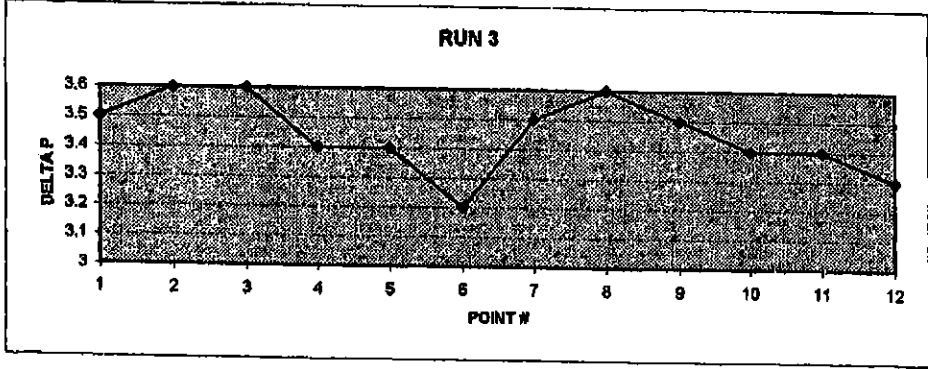
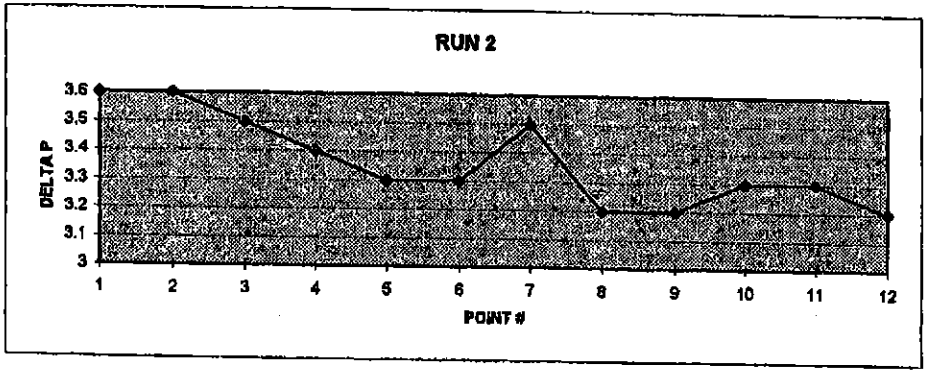
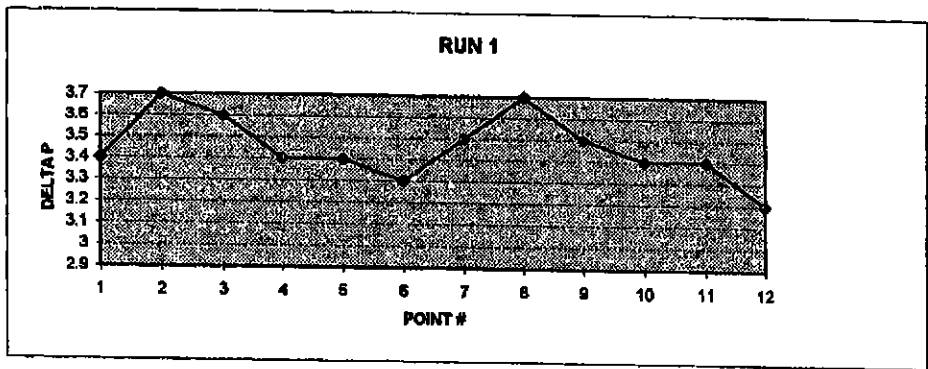
FIELD DATA EVALUATION SHEET								RUN 2
POINT #	Ts	Ml	Mo	Tm	ΔH	ΔP	ΔP ^{0.5}	
1	847	76	76	76	1.2	3.6	1.8974	
2	862	71	76	73.5	1.1	3.6	1.8974	
3	862	73	76	74.5	1.1	3.5	1.8708	
4	860	74	76	75	1.1	3.4	1.8439	
5	853	75	77	76	1.1	3.3	1.8166	
6	832	79	77	76.5	1.1	3.3	1.8166	
7	863	77	77	77	1.1	3.5	1.8708	
8	862	76	78	77	1	3.2	1.7889	
9	869	76	78	77	1	3.2	1.7889	
10	865	77	78	77.5	1.1	3.3	1.8166	
11	854	77	78	77.5	1.1	3.3	1.8166	
12	832	77	79	78	1.1	3.2	1.7889	
	865.1			76.3	1.0917	3.3667	1.8344	

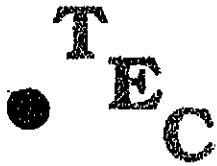
**IEA-Marshalltown,Iowa
Standby Generator**

Data	
Run:	3
Pts:	12
Min/Pt:	6.0
Stack Diameter (in):	10
Nozzle Diameter (in):	0.155
Dry Gas Calibration Factor:	0.994
Pitot Coefficient:	0.99
Barometric Pressure (in Hg):	30.30
Static Pressure (in H2O):	1.50
CO%:	0.0 %
CO2%:	7.2 %
O2%:	11.0 %
Moisture Collected (ml):	62.4
Metered Volume (dacf):	36.175
Leak Correction (acf):	0.002
Avg Stack Temp (deg F):	852.1
Avg Meter Temp (deg F):	78.1
Avg Delta H (in H2O):	1.108
Avg Sqrt Delta P (in H2O) ^{0.5} :	1.8571
Particulate Catch (mg):	102.7

Calculations	
Tstd (deg R):	528
Pstd (in Hg):	29.92
Vm (dacf):	35.96
Tm (deg R):	538.1
Pm (in Hg):	30.38
Vmstd (dscf):	35.829
Vliquid (scf):	2.938
Vtotal (scf):	38.768
Moisture (%):	7.6%
N2(%):	81.8%
Md (lb/lb-mole):	29.59
Ms (lb/lb-mole):	29.71
Ts (deg R):	1312.1
Ps (in Hg):	30.41
vs (ft/sec):	192.7
Ae (sq ft):	0.49
Q (acfm):	5690
Q (scfm):	2327
Q (dscfm):	2151
An (sq ft):	0.000131
Run Length (min):	60
vn (ft/s):	200.9
IKR (%):	104%
c (gr/scf):	0.0409
c (gr/dscf):	0.0442
e (lb/hr):	0.8155

		FIELD DATA EVALUATION SHEET					RUN 3
POINT #	T _h	Mi	Mo	Tm	ΔH	ΔP	ΔP ^{0.5}
1	860	79	79	79	1.1	3.5	1.8706
2	863	74	79	76.5	1.2	3.8	1.8974
3	869	76	79	77.5	1.1	3.6	1.8974
4	858	77	80	78.5	1.1	3.4	1.8439
5	845	78	80	79	1.1	3.4	1.8439
6	836	77	80	78.5	1	3.2	1.7689
7	845	79	79	79	1.1	3.5	1.8708
8	861	77	79	78	1.2	3.6	1.8974
9	865	77	79	78	1.1	3.5	1.8708
10	855	77	79	78	1.1	3.4	1.8439
11	837	77	79	78	1.1	3.4	1.8439
12	831	77	78	77.5	1.1	3.3	1.8166
	852.1			78.1	1.1083	3.4500	1.8571



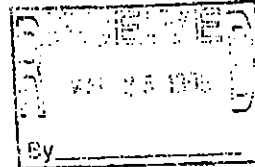


Thompson Environmental Consulting, Inc.

a member of THE COMPLIANCE GROUP

March 22, 1996

Iowa Department of Natural Resources
Environmental Protection Division
Air Quality Bureau
Wallace State Office Building
900 East Grand Avenue
Des Moines, IA 50319



Attention: Doug Campbell

Subject: Industrial Energy Applications
Compliance Test Results, IEA, Hy Vee, Marshalltown, IA

Dear Doug:

Enclosed are the results of particulate and NOx compliance tests conducted on the back up generator located at the Hy Vee store in Marshalltown, IA on February 29, 1996. The results of these tests indicate that the generator is not in compliance with its emission limits. This generator will be re-permitted to emission limits which are based on the results of these tests and also protect the ambient air quality. The permit applications will be submitted to IDNR by May 22, 1996. This constitutes our proposed compliance plan for this facility.

If you have any comments or require additional information, please call me or David Charles (319/378-6536). Thank you.

Sincerely,

THOMPSON ENVIRONMENTAL CONSULTING

Melody Faler
Melody Faler
Project Engineer

cc Chris Moore
David Charles

Environmental Engineering, Permitting and Compliance Services

4950 Pleasant Street · West Des Moines, Iowa 50266 · Tel: 515-225-4303 · Fax: 515-225-4193

EMISSION TEST REPORT
for
INDUSTRIAL ENERGY APPLICATIONS
on the
Marshalltown Hy-Vee Standby Generator
located in
Marshalltown, Iowa

February 29, 1996

Conducted by

Comprehensive Emission Services
1112 Maple Street
West Des Moines, Iowa 50265
(515) 225-7372

Project No. 8895

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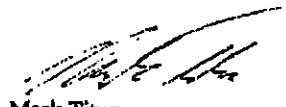
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PREFACE

This report summarizes the results of the data collected on a compliance demonstration test at the Industrial Energy Applications, Hy-Vee facility in Marshalltown, Iowa. To the best of our knowledge, the data in this report is accurate and complete. Any questions concerning this report should be directed to Mr. Mike Ankerstjerne or Mr. Mark Titus. Mr. Ankerstjerne and Mr. Titus may be reached by phone at (515) 225-7372.



Mark Titus
Test Leader



Mike Ankerstjerne
Reviewed by

March 1, 1996

INTRODUCTION

An emission test was conducted by Comprehensive Emission Services on the Industrial Energy Applications, Hy-Vee standby generator in Marshalltown, Iowa. Three particulate and three Nitrogen Oxide sampling runs were performed. The testing fulfills the requirements for testing established in the IDNR Permit #94-A-597. The testing was performed on February 29, 1996.

Coordinating the field tests:

Tim Titus - Comprehensive Emission Services
Chris Eastburn - Industrial Energy Applications
David Charles - Industrial Energy Applications
Melody Faler - Thompson Environmental Consulting

Conducting the field tests:

Mike Ankerstjerne - Comprehensive Emission Services
Mark Titus - Comprehensive Emission Services
Jay Titus - Comprehensive Emission Services

Witnessing the field tests for the IDNR:

Shane Dodge - University of Iowa Hygienic Laboratory

The appendices to this report contain the following information and data:

Appendix A: Example Calculations
Appendix B: Laboratory Data Forms
Appendix C: Field Data Forms
Appendix D: Pretest Calibrations
Appendix E: Posttest Calibrations
Appendix F: Process Data
Appendix G: CEM Data

SUMMARY OF RESULTS

Table 1 summarizes the test results for testing performed on the Industrial Energy Applications, Marshalltown, Hy-Vee standby generator. The final leak check for particulates on run 2 failed and was not used.

The allowable limit for particulates is 0.76 lbs/hr.

The allowable limit for NO_x is 6.40 ton/yr..

Testing and analysis was performed according to EPA Method 5, 202 Method 7E.

No blank corrections were performed.

Table 1
Summary of Test Results

February 29, 1996	units	Run 1	Run 2	Run 3	Run 4
Particulate Net Weight	g	0.0888	*	0.1002	0.1027
Particulate Emissions	gr/dscf	0.0379	*	0.0438	0.0442
Particulate Emission Rate	lb/hr	0.70	*	0.80	0.82
NO _x Concentration	ppm	1906.3	1934.3	1926.6	*
NO _x Emission Rate	lb/hr	29.48	30.44	29.45	*
Isokinetics	%	104.5	*	103.2	104.0
Flow Rate	dscfm	2,158	2,197	2,134	2,151

SAMPLING AND ANALYTICAL PROCEDURES

Sampling Procedures

Particulate emissions were determined by U.S. Environmental Protection Agency (EPA) Methods 1, 2C, 3, 4, and 5. Nitrogen Oxide emissions were determined by U.S. Environmental Protection Agency (EPA) Method 7E. These Methods are titled;

- Method 1 - "Sample and Velocity Traverse for Stationary Sources"
- Method 2C - "Determination of Stack Gas Velocity and Volumetric Flow Rate (Standard Type Pitot Tube)"
- Method 3 - "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air and Dry Molecular Weight"
- Method 4 - "Determination for Moisture Content in Stack Gases"
- Method 5 - "Determination of Particulate Emissions from Stationary Sources"
- Method 7E - "Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure)"

These methods appear in detail in Title 40, Code of Federal Regulations (CFR), Part 60, Appendix A, and in the Iowa Compliance Sampling Manual.

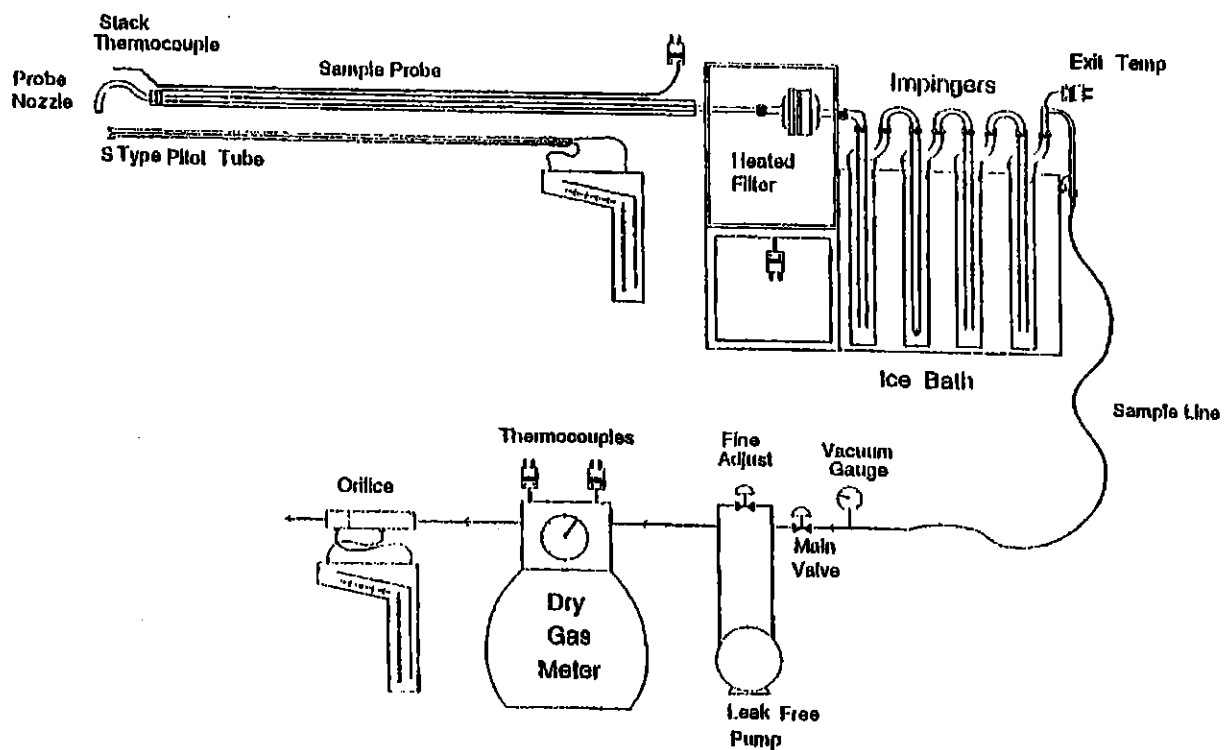
The particulate sampling apparatus is shown in Figure 1 on Page 6. All equipment was calibrated at Comprehensive Emission Services' office prior to shipment to the test site.

Sampling Locations

The stack sampling point locations can be found in Appendix C.

Analytical Procedures

The particulate emission rate was determined following procedures detailed in Method 5. Particulate samples collected on Whatman glass fiber filters were analyzed gravimetrically. The probe and nozzles were rinsed with acetone. The rinse was transferred to tarred beakers and evaporated to dryness.



Schematic of Method 5 Sampling Train
Figure 1

**Table 2
Particulate Emission Results**

Parameters	Units	Run 1	Run 3	Run 4
Particulate Emissions				
Actual	gr/dscf	0.0379	0.0438	0.0442
Weight Collected	g	0.0888	0.1002	0.1027
Particulate Emission Rate				
Emission Rate	lb/hr	0.70	0.80	0.82
Stack Flow Rates				
Velocity	ft/min	11,510	11,418	11,560
Actual	acfm	5,666	5,620	5,690
Standard Conditions	dscfm	2,158	2,134	2,151
Sampling Results				
Isokinetics	%	104.5	103.2	104.0
Sample Volume	dscf	36.134	35.274	35.826
Ave. Stack Temperature	°F	839	855	852
Ave. Square Root ΔP	inches H ₂ O	1.8593	1.8344	1.8571
Ave. ΔH	inches H ₂ O	1.11	1.09	1.11
Ave. Meter Temperature	°F	67.3	76.3	78.1
Oxygen	%	10.10	11.00	11.00
Carbon Dioxide	%	7.80	7.20	7.20
Moisture Collected	ml	64.7	56.2	62.4
Moisture	% H ₂ O	7.8	7.0	7.6
Run Start Time	HH:MM	10:13	13:21	14:44
Sampling Time	minutes	60.0	60.0	60.0

Appendix A

Example Calculation

NOMENCLATURE

<u>Symbol</u>	<u>Description</u>
acfm	Actual cubic feet per minute
A_s	Area of stack
B_{ws}	Percent water
C_p	Pitot tube calibration coefficient
C_{std}	Concentration of particulate dry basis, standard conditions
D_n	Diameter of nozzle
dscfm	Dry standard cubic feet per minute
gr/dscfm	Grains per dry standard cubic feet per minute
ID	Inside diameter of stack
M_d	Molecular weight, dry stack gas
M_s	Molecular weight, stack gas
Q_{std}	Stack flow rate, dry standard conditions
P_b	Barometric pressure
P_s	Stack pressure
SP	Static pressure
T_m	Average meter temperature
T_s	Temperature of stack gas
V_i	Initial meter reading
V_f	Final meter reading
V_m	Volume meter, actual
$V_{m, std}$	Volume meter, standard conditions
V_s	Average stack gas velocity
W_c	Total moisture collected
$W_{t, std}$	Total particulate matter collected
Y	Meter correction factor
θ	Sampling time
% H ₂ O	Percent moisture by volume
% CO ₂	Percent carbon dioxide by volume, dry
% O ₂	Percent oxygen by volume, dry
% I	Percent isokinetic
ΔH	Pressure drop across orifice meter
ΔP	Gas velocity pressure

PARTICULATE CALCULATION EQUATIONS

Run 1

1. Volume meter

$$\begin{aligned}V_m &= (V_r - V_i) Y \\&= (477.100 - 441.351) 0.994 \\&= 35.535 \text{ ft}^3\end{aligned}$$

2. Volume meter, standard conditions (70°, 29.92 in. Hg)

$$\begin{aligned}V_{m_{\text{STD}}} &= \frac{17.7 V_m \left(P_b + \frac{\Delta H}{13.6} \right)}{T_m + 460} \\&= \frac{17.7 (35.535) \left(30.30 + \frac{1.11}{13.6} \right)}{839 + 460} \\&= 36.134 \text{ ft}^3\end{aligned}$$

3. Percent moisture by volume

$$\begin{aligned}B_{\text{ws}} &= \frac{100 \times 0.04707 (W_c)}{0.04707 (W_c) + V_{m_{\text{STD}}}} \\&= \frac{100 \times 0.04707 (64.7)}{0.04707 (64.7) + 36.134} \\&= 7.8 \%\end{aligned}$$

4. Molecular weight, dry stack gas

$$\begin{aligned}M_d &= 0.16 (\% \text{CO}_2) + 0.04 (\% \text{O}_2) + 28.0 \\&= 0.16 (7.80) + 0.04 (10.10) + 28.0 \\&= 29.65\end{aligned}$$

5. Molecular weight, stack gas

$$\begin{aligned}
 M_s &= M_d \left(1 - \frac{B_{ws}}{100} \right) + 18 \left(\frac{B_{ws}}{100} \right) \\
 &= 29.65 \left(1 - \frac{7.8}{100} \right) + 18 \left(\frac{7.8}{100} \right) \\
 &= 28.75
 \end{aligned}$$

6. Stack Pressure

$$\begin{aligned}
 P_s &= P_b + \frac{SP}{13.6} \\
 &= 30.30 + \frac{1.50}{13.6} \\
 &= 30.41 \text{ inch. Hg}
 \end{aligned}$$

7. Velocity of stack gas

$$\begin{aligned}
 V_s &= 60 \times 85.49 C_p \sqrt{\frac{T_s + 460}{P_s \times M_s}} (\sqrt{\Delta p})_{avg} \\
 &= 60 \times 85.49 (0.99) \sqrt{\frac{839 + 460}{30.41 \times 28.75}} (1.8593) \\
 &= 11,510 \text{ ft/min}
 \end{aligned}$$

8. Percent isokinetic

$$\begin{aligned}
 \% I &= \frac{100 (T_s + 460) V_{m(Std)}}{17.7 \theta V_s P_s \left(1 - \frac{B_w}{100} \right) \pi \left(\frac{D_n}{24} \right)^2} \\
 &= \frac{100 (839 + 460) 36.134}{17.7 (60) (11,510) 30.41 \left(1 - \frac{7.8}{100} \right) \pi \left(\frac{0.155}{24} \right)^2} \\
 &= 104.5 \%
 \end{aligned}$$

9. Area of stack

$$\begin{aligned}A_s &= \pi \left(\frac{ID}{24} \right)^2 \\&= \pi \left(\frac{9.5}{24} \right)^2 \\&= 0.49 \text{ ft}^2\end{aligned}$$

10. Stack volumetric flow rate actual conditions

$$\begin{aligned}Q_a &= V_s A_s \\&= (11,510) (0.49) \\&= 5,666 \text{ acfm}\end{aligned}$$

11. Stack volumetric flow rate, standard conditions (70°, 29.92 in. Hg)

$$\begin{aligned}Q_{std} &= \frac{17.7 \times V_s A_s P_s \left(1 - \frac{B_{WE}}{100} \right)}{T_s + 460} \\&= \frac{17.7 (11,510) (0.49) (30.41) \left(1 - \frac{7.8}{100} \right)}{839 + 460} \\&= 2,158 \text{ dscfm}\end{aligned}$$

12. Grains per dry standard cubic feet

$$\begin{aligned}C_{std} &= \frac{15.43 Wt_{gain}}{V_{(STD)}} \\&= \frac{15.43 (0.0888)}{36.134} \\&= 0.0379 \text{ gr/dscf}\end{aligned}$$

13. Emission rate

$$\text{lb/hr} = \frac{60 \text{ Wt}_{\text{gain}} (Q_v)}{453.5924 V_{\text{std}}}$$

$$= \frac{60 (0.0888) (2,158)}{453.5924 (36.134)}$$

$$= 0.70 \text{ lb/hr}$$

Appendix B

Laboratory Data Forms

Project Number: 8895
 Plant Name: Hy Veg - M40LW/IEA
 Date: 3/2/96
 Analysis Type: MS/202

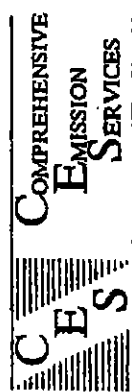


Run 1				
Type	Identification Number	Final Weight	Tare Weight	Net Weight
Filter	F315	3.0549	3.0314	.0235
Probe Rinse (ml)	B671	76.9357	76.9280	.0077
Organic (ml)	D275	162.0460	162.0779	-.0071
Inorganic	D276	162.1487	162.0982	.0505
Total Net Weight				.0888
Run 3				
Type	Identification Number	Final Weight	Tare Weight	Net Weight
Filter	F317	3.0499	3.0213	.0286
Probe Rinse (ml)	B672	75.7023	75.6941	.0082
Organic (ml)	D277	175.2600	175.2497	.0103
Inorganic	D278	163.5173	163.4642	.0531
Total Net Weight				.1002
Run 4				
Type	Identification Number	Final Weight	Tare Weight	Net Weight
Filter	F318	3.0623	3.0320	.0303
Probe Rinse (ml)	B673	64.8061	64.7986	.0075
Organic (ml)	D279	171.3143	171.3061	.0052
Inorganic	D280	177.4972	177.4375	.0597
Total Net Weight				.1027
Blanks				
Type	Identification Number	Final Weight	Tare Weight	Net Weight
Water Blank (ml)				
Aceone Blank (ml)				
MeC ₂ Blank (ml)				

Identification
 F = 3 inch filter P = 47mm filter B = 150ml Beaker C = 250ml Beaker D = 400ml Beaker

FINAL WEIGHT
WEIGHING SHEET

Time	Date	Analyst	Run	Weighing (grams)					Average Final Weight	Tare Weight	Net Weight
				1	2	3	4	5			
10:00	3/2	J.T.									
	3/2	J.T.	1	3.0548	3.0550						
			3	3.0499	3.0500						
			4	3.0423	3.0423						

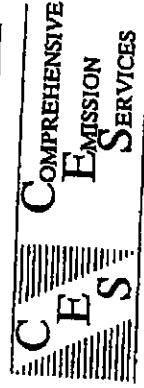


Notes:

FINAL WEIGHT WEIGHING SHEET

Time	Date	Analyst	Run	Weighing (grams)					Average Final Weight	Tare Weight	Net Weight
				1	2	3	4	5			
8:30	3/4/94	J.R.									
	15:15	3/4/96									
		J.R.									
B 671			1	76.9368	76.9356	76.9358					
B 672			3	75.7033	75.7022	75.7023					
B 673			4	64.8070	64.8061	64.8061					
D 275			1	167.0864	167.0850	167.0850					
D 277			3	175.2618	175.2599	175.2600					
D 279			4	171.3159	171.3142	171.3143					
D 274			1	162.1495	162.1486	162.1486					
D 278			3	163.5189	163.5172	163.5173					
D 280			4	177.4968	177.4978	177.4972					

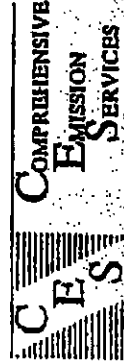
Notes:



**TARE WEIGHT
WEIGHING SHEET**

Tare	Date	Analyst	ID No.	Weighting (grams)					Average
				1	2	3	4	5	
8-45	2-15	JT							
2/9/96	2/12/96	JT							
8668				76.8223	76.8216	76.8215			76.8218
8669				64.5540	64.5535				64.5537
670				75.6940	75.6976				75.6978
671				76.9284	76.9278	76.9278			76.9280
672				75.6947	75.6937	75.6940			75.6941
673				64.7991	64.7992	64.7994			64.7986
674				63.0613	63.0603	63.0602			63.0606
675				64.1351	64.1341	64.1339			64.1345
676				67.2826	67.2813	67.2815			67.2818
677				77.2774	77.2765	77.2760			77.2766
678				78.6476	78.6467	78.6462			78.6568
679				76.5806	76.5799	76.5797			76.5800

Notes



**TARE WEIGHT
WEIGHING SHEET**

Time	Date	Analyst	Weighing (grams)					Average
			1	2	3	4	5	
9:10	12/07	TT						
F307			3.0362	3.0384				3.0363
308			3.0317	3.0318				3.0318
309			3.0324	3.0324				3.0324
310			3.0205	3.0207				3.0206
311			3.0077	3.0078				3.0078
312			3.0229	3.0229				3.0229
313			3.0264	3.0265				3.0265
314			3.0225	3.0226				3.0226
315			3.0312	3.0315				3.0314
316			3.0183	3.0183				3.0183
317			3.0212	3.0213				3.0213
318			3.0319	3.0320				3.0320

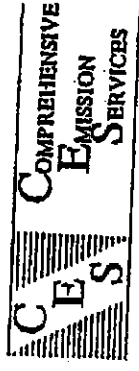
Notes



**TARE WEIGHT
WEIGHING SHEET**

Time	Date	Analyst	ID No.	Weighing (grams)					Average
				1	2	3	4	5	
15:40	2/9/96	J.T.							
	2/9/96	J.T.		175.2495	175.2499				175.2497
				163.4639	163.4644				163.4642
				171.3078	171.3083				171.3081
				177.4373	177.4377				177.4375
				170.3679	170.3683				170.3681
				176.9938	176.9943				176.9941
				171.5018	171.5015				171.5016
				168.9082	168.9073		168.9075		168.9077
				171.0079	171.0075				171.0077
				162.2683	162.2675		162.2677		162.2677
				169.7597	169.7592				169.7594
				170.6269	170.6261		170.6261		170.6264

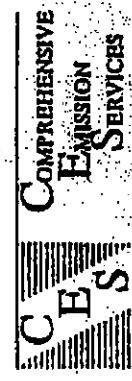
Notes:



TARE WEIGHT WEIGHING SHEET

ID No.	Time	Date	Analyst	Weighing (grams)					Average
				1	2	3	4	5	
	15:00	2/8/96	TT						
D265				167.9551	167.9556				167.9554
266				167.6435	167.6440				167.6438
267				169.3992	169.3996				169.3994
268				170.2188	170.2193				170.2191
269				167.6439	167.6444				167.6442
270				167.2335	167.2339				167.2337
271				176.9049	176.9054				176.9052
272				167.9172	167.9177				167.9175
273				178.3462	178.3466				178.3464
274				167.3517	167.3521				167.3519
275				167.0777	167.0781				167.0779
276				162.0980	162.0984				162.0982

Notes:



Appendix C

Field Data Forms

Run No.	1
Location:	Hy Vee Marshalltown
Date:	Feb 29 1996
Project #	8895
% Isokinetic=	104.5
Initial Meter Volume (Cubic Feet)=	441.351
Final Meter Volume (Cubic Feet)=	477.100
Meter Factor=	0.994
Final Leak Rate (cu Ft/min)=	0.016
Net meter Volume (Cubic Feet)=	35.535
Gas Volume (Dry Std Cubic Feet 68 Deg)=	36.134
Barometric Pressure (in Hg) =	30.30
Static Pressure (Inches H2O)=	1.50
Stack Pressure (in Hg)=	30.41
Percent Oxygen =	10.10
Percent Carbon Dioxide=	7.80
Moisture Collected(ml)=	64.7
Percent Water=	7.8
Average Meter Temperature (F)=	67.3 ✓
Average Delta H (in H2O)=	1.11 ✓
Average Delta P (Inches H2O)=	3.4583 ✓
Average Stack Temp (F)=	839 ✓
Dry Molecular Weight=	29.65 ✓
Wet Molecular Weight=	28.75 ✓
Sampling Time (Minutes)=	60.0
Nozzle Diameter(Inches)=	0.155
Stack Diameter (Inches)=	9.50
Stack Area (Square Feet) =	0.49
Pitot Coefficient=	0.99 ✓
Average Square Root of Delta P (Inches H2O)=	1.8593 ✓
Stack Velocity (Actual, ft/min)=	11,510 ✓
Flow Rate (Actual, Cubic ft/min)=	5,686 ✓
Flow Rate (Std, Dry, Cubic ft/min 68 Deg)=	2,158 ✓
Particulate Loading - Front Half	
Particulate Weight Net (g)=	0.0312
Particulate Loading, Dry Std. 68 Deg (gr/scf)=	0.0133
Emission Rate (lb/hr)=	0.25
Particulate Loading - Total Catch Including Impingers	
Particulate Weight Net (g)=	0.0888 ✓
Particulate Loading, Dry Std. 68 Deg (gr/scf)=	0.0379 ✓
Emission Rate (lb/hr)=	0.70 ✓
Percent Impinger Catch=	64.86
NOx ppm =	1906.3 ✓
NOx lb/hr =	29.48 ✓

Run No.		2
Location:	Hy Vee Marshalltown	
Date:		Feb 29 199
Project #		8895
% Isokinetic=		103.2
Initial Meter Volume (Cubic Feet)=		477.543
Final Meter Volume (Cubic Feet)=		513.961
Meter Factor=		0.994
Final Leak Rate (cu Ft/min)=	fail	
Net meter Volume (Cubic Feet)=		36.199
Gas Volume (Dry Std Cubic Feet 68 Deg)=		36.338
Barometric Pressure (in Hg) =		30.30
Static Pressure (Inches H2O)=		1.50
Stack Pressure (In Hg)=		30.41
Percent Oxygen =		11.00
Percent Carbon Dioxide=		7.20
Molsture Collected(ml)=		44.9
Percent Water=		5.5
Average Meter Temperature (F)=		74.1
Average Delta H (in H2O)=		1.13
Average Delta P (inches H2O)=		3.4583
Average Stack Temp (F)=		847
Dry Molecular Weight=		29.59
Wet Molecular Weight=		28.96
Sampling Time (Minutes)=		60.0
Nozzle Diameter(Inches)=		0.155
Stack Diameter (Inches)=		9.50
Stack Area (Square Feet) =		0.49
Pitot Coefficient=		0.99
Average Square Root of Delta P (inches H2O)=		1.8594
Stack Velocity (Actual, ft/min)=		11,505
Flow Rate (Actual, Cubic ft/min)=		5,663
Flow Rate (Std, Dry, Cubic ft/min 68 Deg)=		2,197
Particulate Loading - Front Half		
Particulate Weight Net (g)=		0.0000
Paticulate Loading, Dry Std. 68 Deg (gr/scf)=		0.0000
Emission Rate (lb/hr)=		0.00
Particulate Loading - Total Catch Including Impingers		
Particulate Weight Net (g)=		0.0000
Particulate Loading, Dry Std. 68 Deg (gr/scf)=		0.0000
Emission Rate (lb/hr)=		0.00
Percent Impinger Catch=		ERR
NOx ppm =		1934.3 ✓
NOx lb/hr =		30.44 ✓

fail

Run No.	3
Location: Hy Vee Marshalltown	
Date:	Feb 29 199
Project #	8895
% Isokinetic=	103.2 ✓
Initial Meter Volume (Cubic Feet)=	516.679
Final Meter Volume (Cubic Feet)=	552.177
Meter Factor=	0.994
Final Leak Rate (cu Ft/min)=	0.010
Net meter Volume (Cubic Feet)=	35.285
Gas Volume (Dry Std Cubic Feet 68 Deg)=	35.274
Barometric Pressure (in Hg) =	30.30
Static Pressure (Inches H2O)=	1.50
Stack Pressure (in Hg)=	30.41
Percent Oxygen =	11.00
Percent Carbon Dioxide=	7.20
Moisture Collected(ml)=	56.2
Percent Water=	7.0
Average Meter Temperature (F)=	76.3 ✓
Average Delta H (in H2O)=	1.09 ✓
Average Delta P (inches H2O)=	3.3667 ✓
Average Stack Temp (F)=	855 ✓
Dry Molecular Weight=	29.59 ✓
Wet Molecular Weight=	28.78 ✓
Sampling Time (Minutes)=	60.0
Nozzle Diameter(Inches)=	0.155
Stack Diameter (Inches)=	9.50
Stack Area (Square Feet) =	0.49
Pitot Coefficient=	0.99 ✓
Average Square Root of Delta P (Inches H2O)=	1.8344 ✓
Stack Velocity (Actual, ft/min)=	11,418 ✓
Flow Rate (Actual, Cubic ft/min)=	6,620 ✓
Flow Rate (Std, Dry, Cubic ft/min 68 Deg)=	2,134 ✓
Particulate Loading - Front Half	
Particulate Weight Net (g)=	0.0368
Particulate Loading, Dry Std. 68 Deg (gr/scf)=	0.0161
Emission Rate (lb/hr)=	0.29
Particulate Loading - Total Catch Including Impingers	
Particulate Weight Net (g)=	0.1002 ✓
Particulate Loading, Dry Std. 68 Deg (gr/scf)=	0.0438 ✓
Emission Rate (lb/hr)=	0.80 ✓
Percent impinger Catch=	63.27 ✓
NOx ppm =	1926.6 ✓
NOx lb/hr =	29.45 ✓

Run No.	4
Location:	Hy Vee Marshalltown
Date:	Feb 29 199
Project #	8895
% Isokinetic=	104.0
Initial Meter Volume (Cubic Feet)=	552.480
Final Meter Volume (Cubic Feet)=	588.655
Meter Factor=	0.994
Final Leak Rate (cu Ft/min)=	0.002
Net meter Volume (Cubic Feet)=	35.958
Gas Volume (Dry Std Cubic Feet 68 Deg)=	35.826
Barometric Pressure (in Hg) =	30.30
Static Pressure (Inches H ₂ O)=	1.50
Stack Pressure (in Hg)=	30.41
Percent Oxygen =	11.00
Percent Carbon Dioxide=	7.20
Molsture Collected(ml)=	62.4
Percent Water=	7.6
Average Meter Temperature (F)=	78.1 ✓
Average Delta H (in H ₂ O)=	1.11 ✓
Average Delta P (inches H ₂ O)=	3.4500 ✓
Average Stack Temp (F)=	852 ✓
Dry Molecular Weight=	29.59 ✓
Wet Molecular Weight=	28.71 ✓
Sampling Time (Minutes)=	60.0
Nozzle Diameter(Inches)=	0.155
Stack Diameter (Inches)=	9.50
Stack Area (Square Feet) =	0.49
Pitot Coefficient=	0.99 ✓
Average Square Root of Delta P (Inches H ₂ O)=	1.8571 ✓
Stack Velocity (Actual, ft/min)=	11,560
Flow Rate (Actual, Cubic ft/min)=	5,690 ✓
Flow Rate (Std, Dry, Cubic ft/min 68 Deg)=	2,151 ✓
Particulate Loading - Front Half	
Particulate Weight Net (g)=	0.0378
Paticulate Loading, Dry Std. 68 Deg (gr/scf)=	0.0163
Emission Rate (lb/hr)=	0.30
Particulate Loading - Total Catch Including Impingers	
Particulate Weight Net (g)=	0.1027 ✓
Particulate Loading, Dry Std. 68 Deg (gr/scf)=	0.0442 ✓
Emission Rate (lb/hr)=	0.82 ✓
Percent Impinger Catch=	63.19

C E S **COMPREHENSIVE
EMISSION
SERVICES**

Project Number 8595 Project Leader Mark Titus
 Run Number 1 Meter Operator Jay Titus
 Date 2-29-95 Lab Person _____
 Sample Type RSP Support Personnel Mike
 Plant HV-Vec - ISA Gen.
 Location Marshalltown

Assumed Moisture % 9 Meter Number 2
 Minutes Per Point (min.) 5 Oven Number 2
 Sampling Time (min.) 60 Umbilical Number 100'
 Meter Factor Y 0.994 Pitot Number 3
 Meter ΔH@ 1.925 Probe Number 3
 Pitot Coefficient Cp 0.99 Probe Length 3'
 Stack Axis 1 (inch.) 9.9 Nozzle Type SS
 Stack Axis 2 (inch.) 9.9
 Barometric Pressure (in. Hg) 30.30
 Static Pressure (in. H₂O) 1.5
 Nozzle Diameter (inch.) 0.155



Schematic of Testing Location

Initial Meter Volume (ft ³)	441.351
Final Meter Volume (ft ³)	477.108
Leak Rate Before	0.03 CFM@ ≥ 15 in. Hg
Leak Rate After	0.16 CFM@ 4 in. Hg
Pitot Leak Check	OK Before OK After

RECOVERY DATA

Orsat

Impingers

Trial	%CO ₂	%CO ₂ +%O ₂	%O ₂	Final	Initial	Difference
1	CEM			127	100	27
2				119	100	19
3				109	100	9
Avg	7.8		10.1	656.0	646.3	9.7
				Condition/Color	Total	64.7

Notes:

Filter Number: F319

Field Data Sheet

Run No. 1
 Project No. 8395
 Location HY-620 Mountain - P.E.S.
 Date 2-29-99
 Operator J.I.
 Start Time 10:13
 Stop Time 11:14



Traverse Point	Sample Time (min)	Dry Gas Meter ft ³ Initial	Velocity Head ΔP in. H ₂ O	Stack Temp. °F	Dry Gas Meter Temp. °F		Critical ΔH in H ₂ O	Pump VAC. in. Hg	Oven Temp. °F	Exit Temp. °F	Probe Temp. °F
					Inlet	Outlet					
1		444.290	3.4	831	60	60	1.1	3	253	35	256
2		447.340	3.7	845	62	61	1.2	3	247	44	255
3		450.320	3.6	847	65	62	1.1	3	253	40	254
4		453.290	3.4	844	67	63	1.1	3	256	38	253
5		456.270	3.4	831	69	64	1.1	3	261	38	254
6		459.254	3.3	831	70	65	1.1	3	255	36	256
			3.5	82							
1		442.200	3.5	835	68	67	1.1	3	252	34	253
2		465.230	3.7	836	72	67	1.2	3	258	34	252
3		468.230	3.5	844	73	68	1.1	3	243	37	253
4		471.190	3.4	848	74	69	1.1	3	257	39	254
5		474.170	3.4	844	74	70	1.1	3	253	40	252
6		477.100	3.2	832	74	70	1.0	3	248	48	252

Notes:



C E S **COMPREHENSIVE
EMISSION
SERVICES**

Project Number 5895
 Run Number 2
 Date 2-29-76
 Sample Type TSP
 Plant Hy-Vee - IEA Gen.
 Location Marshall, Iowa

Project Leader M.T.
 Meter Operator J.P.
 Lab Person _____
 Support Personnel M.A.

Assumed Moisture % 9 Meter Number 2
 Minutes Per Point (min.) 5 Oven Number 2
 Sampling Time (min.) 60 Umbilical Number 100'
 Meter Factor Y 0.994 Pitot Number 3
 Meter ΔH@ 1.925 Probe Number 3
 Pitot Coefficient Cp 0.99 Probe Length 3'
 Stack Axis 1 (inch.) 9.5 Nozzle Type SS
 Stack Axis 2 (inch.) 9.5
 Barometric Pressure (in. Hg) 30.30
 Static Pressure (in. H₂O) 1.5
 Nozzle Diameter (inch.) 0.155

See run 1

Schematic of Testing Location

Initial Meter Volume (ft ³)	477.543
Final Meter Volume (ft ³)	513.961
Leak Rate Before	.00 CFM@ ≥ 15 in. Hg
Leak Rate After	CFM@ in. Hg
Pitot Leak Check	OK Before After

RECOVERY DATA

Orsat

Impingers

Trial	%CO ₂	%CO ₂ +%O ₂	%O ₂
1			
2			
3			
Avg			

	Final	Initial	Difference
Impinger 1	125	100	25
Impinger 2	110	100	10
Impinger 3	102	100	2
Impinger 4	681.4	681.4	7.9
Condition/Color		Total	44.9

Notes:

Filter Number: E316

Field Data Sheet

Run No. 2
 Project No. 2809
 Location MS-122 4700 - ISA Gen.
 Date 2-20-00
 Operator J.T
 Start Time 11:36
 Stop Time 12:39

See run

Traverse Point	Sample Time (min)	Dry Gas Meter ft ³ Inlet	Velocity Head ΔP in. H ₂ O	Stack Temp. °F	Dry Gas Meter Temp. °F		Critical ΔH in H ₂ O	Pump VAC. in. Hg	Oven Temp. °F	Exit Temp. °F	Probe Temp. °F
					Inlet	Outlet					
1		477.543	3.7	847	71	71	1.2	3	245	37	254
2		483.930	3.5	843	70	71	1.1	2	249	43	254
3		496.930	3.5	857	72	72	1.1	2	253	40	254
4		499.930	3.4	854	74	72	1.0	2	240	38	255
5		492.890	3.4	849	74	73	1.1	2	256	37	259
6		---	3.3	831	75	74	1.1	2	255	38	260
1		499.020	3.6	846	75	75	1.2	2	242	38	257
2		502.060	3.3	850	75	74	1.1	2	260	36	252
3		505.050	3.6	854	76	75	1.2	2	251	37	251
4		508.040	3.5	853	77	76	1.1	2	245	37	254
5		510.980	3.4	853	77	76	1.1	2	246	37	250
6		512.961	3.4	835	78	76	1.1	2	246	38	258

Notes:



C E S **COMPREHENSIVE
EMISSION
SERVICES**

Project Number 5395 Project Leader M.T.
 Run Number 3 Meter Operator J.D.
 Date 2-29-94 Lab Person _____
 Sample Type ISD Support Personnel M.A.
 Plant Hy-Vee - IFA Gen.
 Location _____

Assumed Moisture % 9 Meter Number 2
 Minutes Per Point (min.) 5 Oven Number 2
 Sampling Time (min.) 60 Umbilical Number 100'
 Meter Factor Y 0.994 Pitot Number 3
 Meter ΔH@ 1.925 Probe Number 3
 Pitot Coefficient Cp 0.99 Probe Length 3'
 Stack Axis 1 (inch.) 9.5 Nozzle Type 55
 Stack Axis 2 (inch.) 9.5
 Barometric Pressure (in. Hg) 30.30
 Static Pressure (in. H₂O) 1.5
 Nozzle Diameter (inch.) 0.154

See run!

Schematic of Testing Location

Initial Meter Volume (ft ³)	514.479
Final Meter Volume (ft ³)	552.177
Leak Rate Before	0.48 CFM@ ≥ 15 in. Hg
Leak Rate After	0.10 CFM@ 4 in. Hg
Pitot Leak Check	OK Before 0.12 After

RECOVERY DATA

Orsat

Trial	%CO ₂	%CO ₂ +%O ₂	%O ₂
1	CEM		
2			
3			
Avg			

Impingers

	Final	Initial	Difference
Impinger 1	135	100	35
Impinger 2	110	100	10
Impinger 3	103	100	3
Impinger 4	754.3	744.1	8.2
Condition/Color		Total	54.2

Notes:

Filter Number: 317

Field Data Sheet

Run No. 3
 Project No. 8397
 Location HY-Vee-ISA Gen M Town
 Date 2-29-96
 Operator J.P.
 Start Time 1:21
 Stop Time 2:23

See run 1

Traverse Point	Sample Time (min)	Dry Gas Meter ft ³ Initial	Velocity Head ΔP in. H ₂ O	Stack Temp. °F	Dry Gas Meter Temp. °F		Orifice ΔH in H ₂ O	Pump VAC. in. Hg	Oven Temp. °F	Exit Temp. °F	Probe Temp. °F
					Inlet	Outlet					
1	5	519.850	3.6	847	76	74	1.2	3	177	39	260
2	10	522.860	3.6	862	71	76	1.1	3	244	43	255
3	15	525.800	3.5	862	73	76	1.1	3	246	42	254
4	20	528.730	3.4	860	74	76	1.1	3	255	43	253
5	25	531.620	3.3	853	75	77	1.1	3	257	42	255
6	30	—	3.3	832	76	77	1.1	3	257	43	254
1	5	537.500	3.5	863	77	77	1.1	4	252	43	252
2	10	540.380	3.2	862	76	78	1.0	4	259	40	252
3	15	543.270	3.2	869	76	78	1.0	4	255	39	252
4	20	546.220	3.3	865	77	78	1.1	4	244	38	252
5	25	549.200	3.3	854	77	78	1.1	4	248	38	256
6	30	552.177	3.2	832	77	79	1.1	4	247	39	250

Notes:



C E S **COMPREHENSIVE
EMISSION
SERVICES**

Project Number 8895 Project Leader M.T.
 Run Number 4 Meter Operator J.T.
 Date 2-29-94 Lab Person _____
 Sample Type PSD Support Personnel M.A.
 Plant Hy-lce-ISA Gen.
 Location Mars Hill, Tenn

Assumed Moisture % 9 Meter Number 2
 Minutes Per Point (min.) 5 Oven Number 2
 Sampling Time (min.) 40 Umbilical Number 100'
 Meter Factor Y 0.794 Pitot Number 3
 Meter ΔH@ 1.925 Probe Number 3
 Pitot Coefficient Cp 0.99 Probe Length 3'
 Stack Axis 1 (inch.) 9.5 Nozzle Type SS
 Stack Axis 2 (inch.) 9.5
 Barometric Pressure (in. Hg) 30.00
 Static Pressure (in. H₂O) 1.5
 Nozzle Diameter (inch.) 0.155

See run 1

Schematic of Testing Location

Initial Meter Volume (ft ³)	552.480
Final Meter Volume (ft ³)	584.455
Leak Rate Before	.010 CFM@ ≥ 15 in. Hg
Leak Rate After	.002 CFM@ 4 in. Hg
Pitot Leak Check	OK Before OK After

RECOVERY DATA

Orsat

Trial	%CO ₂	%CO ₂ +%O ₂	%O ₂
1	CEA ₅		
2			
3			
Avg			

Impingers

	Final	Initial	Difference
Impinger 1	137	100	37
Impinger 2	112	100	12
Impinger 3	101	100	1
Impinger 4	702.8	490.4	212.4
Condition/Color		Total	62.4

Notes:

Filter Number: F318

Field Data Sheet

Run No. 4
 Project No. 8875
 Location HY-lice MOUNTAIN - DEAGEN
 Date 2-29-86
 Operator J.J.
 Start Time 2:44
 Stop Time 3:44

See run 1

Traverse Point	Sample Time (min)	Dry Gas Meter R ³ Initial <u>552.480</u>	Velocity Head ΔP in. H ₂ O	Stack Temp. °F	Dry Gas Meter Temp. °F		Orifice ΔH in H ₂ O	Pump VAC. in. Hg	Oven Temp. °F	Exit Temp. °F	Probe Temp. °F
					Inlet	Outlet					
1	5	555.540	3.5	860	79	79	1.1	3	242	45	262
2	10	558.610	3.4	883	74	79	1.2	3	253	44	245
3	15	561.610	3.4	869	74	79	1.1	3	245	44	254
4	20	564.670	3.4	858	77	80	1.1	3	251	43	259
9	25	567.600	3.4	845	78	80	1.1	3	248	39	253
4	30	---	3.2	876	77	80	1.0	3	259	39	260
1	9	5757.440	3.5	845	79	79	1.1	3	255	41	253
2	10	576.540	3.4	861	77	79	1.2	3	252	41	251
3	15	579.590	3.5	865	77	79	1.1	3	257	46	252
4	20	582.650	3.4	855	77	79	1.1	3	252	46	252
5	25	585.640	3.4	837	77	79	1.1	3	251	44	252
4	30	588.655	3.3	831	77	78	1.1	3	249	42	258

Notes:



Preliminary Velocity

Plant Project No. 7895
 Date 2-29-96
 Location HY-Vee Marshalltown
 Stack I.D. 9.5
 Pitot Cp. 0.99
 Static Pressure in H₂O 1.5
 Barometer Pressure in. Hg 30.70
 Start Time _____
 Stop Time _____
 Operators J.T.
 M.T.



SCHEMATIC OF TRAVERSE POINT LAYOUT

Final Pitot Leak Check at $\geq 3''$ H₂O P / F

Traverse Point Number	Velocity Head ΔP in. H ₂ O	Stack Temp. °F	Cyclonic Flow Determination	
			ΔP at 0° Reference	Angle Which Yields a Null ΔP
1	3.8			
2	3.5			
3	3.6			
4	3.4			
5	3.3			
6	3.3			

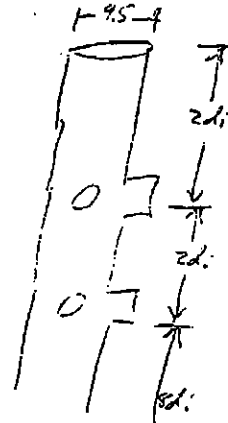
Traverse Point Number	Velocity Head ΔP in. H ₂ O	Stack Temp. °F	Cyclonic Flow Determination	
			ΔP at 0° Reference	Angle Which Yields a Null ΔP
1	2.5			
2	2.6			
3	3.7			
4	3.4			
5	3.4			
6	3.3			

Notes:



TRAVERSE POINT LOCATION

Project No. 8896
 Plant H-7/12, Marshalltown - IEA
 Date 2/29/96
 Sampling Location Stack
 Port length (in.) —
 Stack I. D. (in.) 4.5
 Nearest Upstream Disturbance (in.) 2d.
 Nearest Downstream Disturbance (in.) 8d.
 Operator MT



DRAWING OF STACK

Traverse Point Number	Fraction of Stack I.D.	Stack I.D.	Product Of Columns 2 and 3	Port Length	Traverse Point Location From Outside Of Nipple (Sum of Columns 4 & 5)	
					Decimal	Fraction to nearest 1/8 in.
1	4.4	4.5	0.4			
2	14.6		1.4			
3	29.6		2.8			
4	70.4		6.7			
5	85.4		8.1			
6	95.6		9.1			
7						
8						
9						
10						
11						
12						

Notes:



Appendix D
Pretest Calibrations

METER CALIBRATION

/PPGPQ

Operator	M.A.	K Factor	0.6426
Date	Feb. 14, 1996	Meter Number	1
Previous Y Factor	0.971	Orifice Number	2

0.8278

		RUN 1	RUN 2
Meter Volume			
	Final	Cubic Feet	103.978
	Initial	Cubic Feet	109.829
	Net	Cubic Feet	98.300
			104.100
			5.678
			5.729

		RUN 1	RUN 2
Meter Temperature			
Inlet			
	Initial	Deg. F	59.0
	Final	Deg. F	55.0
Outlet			
	Initial	Deg. F	53.0
	Final	Deg. F	60.0
			67
	Initial	Deg. F	52.0
	Final	Deg. F	48.0
Avg. Meter Temp		Deg. F	48.0
			53.0
			54.0

0.6266 0.6289

Time	sec	420.0	420.0
Meter Delta H	inches H2O	2.20	2.20
Barometric Pressure	inches Hg	29.60	29.60

		RUN 1	RUN 2
Room Temperature			
	Initial	Deg. F	73.0
	Final	Deg. F	67.0
Avg. Room Temperature		Deg. F	66.0
			65.0
			69.5
			68.0

Pump Vacuum	inches Hg	18	18
-------------	-----------	----	----

Vcr (std)	dscf	5.786	5.805
Vm (std)	dscf	5.811	5.852
Y Factor		0.998	0.992
Delta H@		1.957	1.893

Average Y	0.994
Average Delta H@	1.925

+/- 2% Criteria	
Percent of Avg Y	0.18
	PASS

+/- 5% Criteria	
	2.31
	PASS

CONSOLE WORK SHEET

Operator: M.A. K Factor: 0.6426
 Date: 2/14/96 Meter I.D. II
 Previous Y Factor: 0.971 Orifice Number: 2

		Run Number	
METER VOLUME	Units	1	2
Final	ft ³	103.978	109.829
Initial	ft ³	98.300	104.100
Meter Temperature			
INLET			
Initial	°F	59	55
Final	°F	53	68
OUTLET			
Initial	°F	52	48
Final	°F	48	53
Time	sec	420	420
Meter ΔH	in. H ₂ O	2.2	2.2
Barometric Pressure	in. Hg	29.60	29.60
Room Temperature			
Initial	°F	73	67
Final	°F	66	65
Pump Vacuum	in. Hg	18	18



ORFICE BRACKETING

/PPGPQ

Operator	M.A.	BRACKET ORFICES:	
Date	Feb. 14, 1996	Orifice No. 1	2
		K Factor	0.6426
Meter Y Factor	0.994	Orifice No. 2	3
		K Factor	0.3271

Meter Volume			ORFICE #1	ORFICE #2
	Final	Cubic Feet	116.803	121.513
	Initial	Cubic Feet	110.000	115.900
	Net	Cubic Feet	5.803	5.613

Meter Temperature				
Inlet				
	Initial	Deg. F	62.0	65.0
	Final	Deg. F	67.0	68.0
Outlet				
	Initial	Deg. F	58.0	61.0
	Final	Deg. F	60.0	65.0
Avg. Meter Temp		Deg. F	61.8	64.8

Time		sec	420.0	780.0
Meter Delta H		inches H2O	2.20	0.55
Barometric Pressure		inches Hg	29.60	29.60

Room Temperature				
	Initial	Deg. F	68.0	67.0
	Final	Deg. F	68.0	70.0
Avg. Room Temperature		Deg. F	68.0	68.5

Pump Vacuum		inches Hg	18	22
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Vcr (std)		dscf	5.794	5.475
Vm (std)		dscf	5.839	5.593
Y Factor (brackets)			0.982	0.979

+/- 2% Criteria				
Percent of Y			0.17	1.51
		PASS		PASS

BRACKETING WORK SHEET

Operator: M.A. Meter I.D. II
 Date: 2/14/90 K Factor No. 1 0.6426 #2
 Previous Y Factor 0.994 K Factor No. 2 0.3271 #2

METER VOLUME	Units	1	2
Final	ft ³	115.803	121.513
Initial	ft ³	110.000	115.900
Meter Temperature			
INLET			
Initial	°F	62	65
Final	°F	67	68
OUTLET			
Initial	°F	58	61
Final	°F	60	65
Time	sec	420	780
Meter ΔH	in. H ₂ O	2.2	0.55
Barometric Pressure	in. Hg	29.69	29.60
Room Temperature			
Initial	°F	68	67
Final	°F	68	70
Pump Vacuum	in. Hg	18	22


**COMPREHENSIVE
EMISSION
SERVICES**

Appendix E

Posttest Calibrations

METER CALIBRATION

Operator	J.T.	K Factor	0.6428
Date	March, 1, 1996	Meter Number	2
Previous Y Factor	0.994	Orifice Number	2

			RUN 1	RUN 2
Meter Volume				
	Final	Cubic Feet	594.933	600.962
	Initial	Cubic Feet	589.000	595.000
	Net	Cubic Feet	5.933	5.962

Meter Temperature				
Inlet				
	Initial	Deg. F	59.0	62.0
	Final	Deg. F	62.0	65.0
Outlet				
	Initial	Deg. F	60.0	62.0
	Final	Deg. F	62.0	64.0
Avg. Meter Temp		Deg. F	60.8	63.3

Time	sec	420.0	420.0
Meter Delta H	inches H2O	2.20	2.20
Barometric Pressure	inches Hg	29.85	29.85

Room Temperature				
	Initial	Deg. F	64.0	70.0
	Final	Deg. F	70.0	70.0
Avg. Room Temperature		Deg. F	67.0	70.0

Pump Vacuum	inches Hg	19	19
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Vcr (std)	dscf	5.849	6.832
Vm (std)	dscf	6.032	6.032
Y Factor		0.970	0.967
Delta H@		1.735	1.729

Average Y	0.968
Average Delta H@	1.732

+/- 2% Criteria	
Percent of Avg Y	0.15
	PASS

+/- 5% Criteria	
	2.65
	PASS

CONSOLE WORK SHEET

Operator: J.T. K Factor: 0.6426
 Date: 3-1-96 Meter I.D. II
 Previous Y Factor: 0.994 Orifice Number: 2

		Run Number	
METER VOLUME	Units	1	2
Final	ft ³	594,933	600,962
Initial	ft ³	589,000	595,000
Meter Temperature			
INLET			
Initial	°F	59	62
Final	°F	62	65
OUTLET			
Initial	°F	60	62
Final	°F	62	64
Time	sec	420	420
Meter ΔH	in. H ₂ O	2.2	2.2
Barometric Pressure	in. Hg	29.85	29.89
Room Temperature			
Initial	°F	64	70
Final	°F	70	70
Pump Vacuum	in. Hg	19	19



ORFICE BRACKETING

Operator J.T.
Date March, 1, 1996

BRACKET ORFICES:

Orifice No. 1 2
K Factor 0.6426
Orifice No. 2 3
K Factor 0.3271

Meter Y Factor 0.968

Meter Volume			ORFICE #1	ORFICE #2
	Final	Cubic Feet	607.048	613.018
	Initial	Cubic Feet	601.100	607.300
	Net	Cubic Feet	5.948	5.718

Meter Temperature			ORFICE #1	ORFICE #2
Inlet				
	Initial	Deg. F	65.0	67.0
	Final	Deg. F	67.0	69.0
Outlet				
	Initial	Deg. F	65.0	66.0
	Final	Deg. F	66.0	68.0
	Avg. Meter Temp	Deg. F	65.8	67.5

Time	sec	420.0	780.0
Meter Delta H	inches H2O	2.20	0.56
Barometric Pressure	inches Hg	29.85	29.85

Room Temperature			ORFICE #1	ORFICE #2
	Initial	Deg. F	70.0	70.0
	Final	Deg. F	70.0	70.0
	Avg. Room Temperature	Deg. F	70.0	70.0

Pump Vacuum	inches Hg	19	23
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Vcr (std)	dscf	5.832	5.514
Vm (std)	dscf	5.989	5.716
Y Factor (brackets)		0.974	0.965

+/- 2% Criteria			
Percent of Y		0.60	0.35

PASS

PASS

BRACKETING WORK SHEET

Operator: J.T. Meter I.D. 2
 Date: 3-1-96 K Factor No. 1 0.6426
 Previous Y Factor 0.969 K Factor No. 2 0.3271

METER VOLUME		Units	1	2
Final		ft ³	607.049	613.018
Initial		ft ³	601.100	607.300
Meter Temperature				
INLET				
Initial		°F	65	67
Final		°F	67	69
OUTLET				
Initial		°F	65	66
Final		°F	66	68
Time		sec	420	780
Meter ΔH		in. H ₂ O	2.2	0.56
Barometric Pressure		in. Hg	29.85	29.85
Room Temperature				
Initial		°F	70	70
Final		°F	70	70
Pump Vacuum		in. Hg	19	23



COMPREHENSIVE
EMISSION
SERVICES

Appendix F
Process Data

OPERATING DATA
(Type of Source)

Owner HYVEE MARSHMOUNT (IEA) Run No. _____
Source I.D. _____ Date 2/29/96

Maximum Continuous Process Weight (Manufacturer's Rating) _____ lbs./hr.
Historical Average Process Weight _____ lbs./hr.
Historical Maximum Process Weight _____ lbs./hr.
Type and Sources of Fuels Normally Burned NO. 2 DIESEL

Approximate Quantities of Each of Above Fuels Burned Annually _____

Recycling Capability: Yes _____ No _____

Process Data During Run (Averaged)

Process Weight (Dry) _____ lbs./hr.
Percent Moisture _____ %
Process Weight (Wet) _____ lbs./hr.
How Process Weight Determined _____

Type of Fuel Burned During Run 53 GAL/hr

Recycling in Progress: Yes _____ No _____

Person Responsible for Data: CHRIS EASTBURN
Signature: _____
Title/Position: MAINTENANCE SUPERVISOR

Averages of operating data taken during actual test run unless requested otherwise.

Appendix G

CEM DATA

Comprehensive Emission Services Run 1
 IEA Generator Hy-Vee
 Marshalltown, Iowa Run 1
 DATE 02-29-1999
 TIME 10:02:56

Time sec/day	O2 %	CO2 %	NOx ppm
10:04:00	9.93	7.76	1910.9
10:05:00	9.64	7.77	1917.1
10:06:00	9.97	7.78	1918
10:07:00	10.24	7.76	1908.2
10:08:00	10.2	7.77	1909.1
10:09:00	10.23	7.8	1902.4
10:10:00	10.23	7.79	1909.9
10:11:00	10.2	7.81	1908.2
10:12:00	10.23	7.8	1907
10:13:00	10.22	7.79	1903.1
10:14:00	10.19	7.83	1908.3
10:15:00	10.22	7.79	1904.3
10:16:00	10.22	7.79	1904.2
10:17:00	10.22	7.79	1907.5
10:18:00	10.21	7.79	1903.1
10:19:00	10.2	7.8	1907
10:20:00	10.19	7.81	1905.5
10:21:00	10.2	7.81	1909.4
10:22:00	10.19	7.81	1908.5
10:23:00	10.18	7.82	1907.7
10:24:00	10.18	7.82	1905.8
10:25:00	10.18	7.84	1904.9
10:26:00	10.18	7.83	1905.8
10:27:00	10.17	7.82	1904.6
10:28:00	10.15	7.83	1901.2
10:29:00	10.14	7.83	1901
10:30:00	10.14	7.83	1906.6
10:31:00	10.15	7.82	1900.2
10:32:00	10.15	7.82	1897.7
10:33:00	10.13	7.83	1890.7
10:34:00	10.15	7.82	1890.8
10:35:00	10.14	7.82	1901.1
10:36:00	10.16	7.82	1895.9
10:37:00	10.13	7.83	1904.7
10:38:00	10.14	7.84	1900
10:39:00	10.15	7.83	1911.4
10:40:00	10.15	7.82	1909.8
10:41:00	10.15	7.82	1909.3
10:42:00	10.15	7.82	1907.2
10:43:00	10.15	7.82	1909.9
10:44:00	10.14	7.82	1913.2
10:45:00	10.14	7.82	1912.6
10:46:00	10.12	7.83	1911.8
10:47:00	10.11	7.84	1912.9
10:48:00	10.1	7.84	1909.5
10:49:00	10.08	7.86	1900.3
10:50:00	10.11	7.84	1908.8
10:51:00	10.08	7.86	1912.3
10:52:00	10.08	7.86	1908.3
10:53:00	10.08	7.86	1908.9
10:54:00	10.09	7.88	1902
10:55:00	10.1	7.85	1897.2
10:56:00	10.08	7.86	1898.7
10:57:00	10.04	7.88	1906.3
10:58:00	10.05	7.88	1905.9
10:59:00	10.05	7.88	1908.5
11:00:00	10.04	7.88	1912.8
11:01:00	10.07	7.86	1902.3
11:02:00	10.08	7.87	1904.8
11:03:00	10.06	7.86	1899
12:30:00	10.44	7.51	1886.13
12:31:00	10.45	7.51	1888.15
12:32:00	10.43	7.61	1886.17

Average 10.1 7.8 1909.6

Adjusted for Bias

Dry	O2	CO2	NOx
	10.1	7.8	1908.3
	0.01	-0.01	1.25
	8.58	10.39	1767.10

Comprehensive Emission Services Run 2
 IEA Generator Hy-Vee
 Marshalltown, Iowa
 DATE 02-28-1995
 TIME 11:28:01

Time sec/day	O2 %	CO2 %	NOx ppm
11:28:00	9.87	7.87	1919.6
11:29:00	9.97	7.87	1918.1
11:30:00	9.86	7.88	1916.6
11:31:00	9.86	7.87	1920.7
11:32:00	9.97	7.88	1920.8
11:33:00	9.97	7.88	1917.1
11:34:00	9.86	7.88	1919.2
11:35:00	9.94	7.88	1918.5
11:36:00	9.85	7.88	1910.1
11:37:00	9.94	7.88	1918.2
11:38:00	9.93	7.89	1908.6
11:39:00	9.95	7.89	1910.4
11:40:00	9.86	7.87	1910.7
11:41:00	9.93	7.88	1907.5
11:42:00	9.92	7.89	1898
11:43:00	9.93	7.89	1906.8
11:44:00	9.93	7.89	1906.3
11:45:00	9.92	7.89	1905.4
11:46:00	9.93	7.89	1898.2
11:47:00	9.93	7.89	1898.9
11:48:00	9.75	5.98	1891
11:49:00	9.92	7.89	1888.8
11:50:00	9.93	7.89	1890.2
11:51:00	9.92	7.89	1885
11:52:00	9.93	7.88	1885.1
11:53:00	9.92	7.89	1891.2
11:54:00	9.93	7.88	1883.1
11:55:00	9.93	7.87	1874.2
11:56:00	9.92	7.89	1879.2
11:57:00	9.89	7.81	1882.4
11:58:00	9.93	7.88	1885.4
11:59:00	9.92	7.88	1889.3
12:00:00	9.9	7.9	1895.1
12:01:00	9.87	7.91	1890
12:02:00	9.87	7.92	1896.7
12:03:00	9.89	7.92	1897.2
12:04:00	9.9	7.89	1878.5
12:05:00	9.89	7.9	1890.9
12:06:00	9.9	7.89	1884.6
12:07:00	9.91	7.88	1879.4
12:08:00	9.89	7.89	1891.3
12:09:00	9.89	7.89	1861.5
12:10:00	9.9	7.9	1876
12:11:00	9.91	7.89	1877.8
12:12:00	9.89	7.89	1883.2
12:13:00	9.91	7.89	1879.1
12:14:00	9.93	7.89	1879.2
12:15:00	9.98	7.9	1889.2
12:16:00	9.98	7.92	1889
12:17:00	9.95	7.94	1886.6
12:18:00	9.97	7.91	1886.3
12:19:00	9.88	7.91	1893.1
12:20:00	9.88	7.9	1886.3
12:21:00	9.90	7.92	1893.9
12:22:00	9.94	7.94	1890.8
12:23:00	9.95	7.94	1886.1
12:24:00	9.96	7.92	1883.2
12:25:00	9.95	7.92	1885.5
12:26:00	9.93	7.93	1887.2
12:27:00	9.9	7.98	1893.5
14:18:00	10.24	7.54	1938.88
14:19:00	10.27	7.52	1937.57
14:20:00	10.26	7.52	1930.83
14:21:00	10.33	7.47	1934.95
14:22:00	10.39	7.42	1979.43

Average 9.8 7.8 1898.6

Adjusted for Bias

Dry 9.8 7.9 1934.3

Bias Correction Values

0.01 -0.02 2.90
 8.57 10.23 1731.65

Comprehensive Emission Services Run 3
 IEA Generator Hy-Vee
 Marshalltown, Iowa
 DATE 02-29-1996 Run 3
 TIME 13:10:01

Time	O2	CO2	NOx
sec/day	%	%	ppm
13:12:00	9.87	7.92	1900.6
13:13:00	9.86	7.92	1905
13:14:00	9.83	7.93	1899.9
13:15:00	9.82	7.95	1895.9
13:16:00	9.83	7.94	1899.6
13:17:00	9.84	7.93	1892.5
13:18:00	9.84	7.93	1891.8
13:19:00	9.85	7.92	1894.8
13:20:00	9.85	7.92	1890.1
13:21:00	9.85	7.93	1890.9
13:22:00	9.85	7.92	1887.8
13:23:00	9.84	7.93	1879.3
13:24:00	9.84	7.92	1879.6
13:25:00	9.82	7.94	1885.2
13:26:00	9.82	7.93	1883.1
13:27:00	9.83	7.94	1885.5
13:28:00	9.84	7.92	1868.5
13:29:00	9.83	7.91	1882.1
13:30:00	9.8	7.94	1877.2
13:31:00	9.83	7.93	1877.8
13:32:00	9.83	7.93	1882.4
13:33:00	9.83	7.92	1878
13:34:00	9.84	7.92	1877.7
13:35:00	9.85	7.91	1881.7
13:36:00	9.84	7.9	1875.4
13:37:00	9.8	7.93	1872
13:38:00	9.78	7.95	1876.4
13:39:00	9.79	7.93	1867.5
13:40:00	9.78	7.94	1868.6
13:41:00	9.74	7.94	1870.4
13:42:00	9.72	7.85	1863.1
13:43:00	9.69	7.97	1863
13:44:00	9.71	7.96	1868.7
13:45:00	9.73	7.93	1871.8
13:46:00	9.73	7.94	1869.1
13:47:00	9.72	7.93	1859.8
13:48:00	9.71	7.86	1869.2
13:49:00	9.73	7.93	1878
13:50:00	9.73	7.93	1899.5
13:51:00	9.69	7.98	1807.2
13:52:00	9.7	7.86	1917.9
13:53:00	9.69	7.97	1921.4
13:54:00	9.71	7.86	1919
13:55:00	9.72	7.86	1918.7
13:56:00	9.69	7.86	1918.8
13:57:00	9.7	7.88	1919.1
13:58:00	9.72	7.94	1906.7
13:59:00	9.71	7.96	1914.5
14:00:00	9.75	7.94	1917.4
14:01:00	9.77	7.9	1922.4
14:02:00	9.65	8	1918.2
14:03:00	9.75	7.91	1917.9
14:04:00	9.75	7.91	1912.2
14:05:00	9.78	7.89	1911.8
14:06:00	9.79	7.88	1900.4
14:07:00	9.8	7.89	1891.3
14:08:00	9.8	7.87	1897
14:09:00	9.77	7.89	1897.2
14:10:00	9.77	7.9	1894.1
14:11:00	9.76	7.89	1892.6

Average 9.8 7.9 1891.0

Adjusted for Bias

Dry	O2	CO2	NOx
	9.7	8.0	1926.5

Bias Correction Values

0.01	-0.02	2.90
8.57	10.23	1731.65

"Comprehensive Emission Services"
"IEA Generator Hy-Vee "
"Marshalltown, Iowa "
DATE 02-29-1996
TIME 10:02:56

Run 1

HR:MM:SS	O2 %	CO2 %	NOx ppm
10:04:00	9.93	7.78	1910.9
10:05:00	9.94	7.77	1917.1
10:06:00	9.97	7.78	1916.0
10:07:00	10.24	7.78	1908.2
10:08:00	10.20	7.77	1909.1
10:09:00	10.23	7.80	1902.4
10:10:00	10.23	7.79	1909.8
10:11:00	10.20	7.81	1908.2
10:12:00	10.23	7.80	1907.0
10:13:00	10.22	7.79	1903.1
10:14:00	10.19	7.83	1908.3
10:15:00	10.22	7.79	1904.3
10:16:00	10.22	7.79	1904.2
10:17:00	10.22	7.79	1907.5
10:18:00	10.21	7.79	1903.1
10:19:00	10.20	7.80	1907.0
10:20:00	10.19	7.81	1905.5
10:21:00	10.20	7.81	1909.4
10:22:00	10.19	7.81	1908.5
10:23:00	10.18	7.82	1907.7
10:24:00	10.18	7.82	1906.8
10:25:00	10.16	7.84	1904.9
10:26:00	10.16	7.83	1905.6
10:27:00	10.17	7.82	1904.6
10:28:00	10.15	7.83	1901.2
10:29:00	10.14	7.83	1901.0
10:30:00	10.14	7.83	1896.5
10:31:00	10.15	7.82	1900.2
10:32:00	10.15	7.82	1897.7
10:33:00	10.13	7.83	1890.7
10:34:00	10.15	7.82	1890.8
10:35:00	10.14	7.82	1901.1
10:36:00	10.16	7.82	1895.9
10:37:00	10.13	7.83	1904.7
10:38:00	10.14	7.84	1908.0
10:39:00	10.15	7.83	1911.4
10:40:00	10.15	7.82	1909.6
10:41:00	10.15	7.82	1909.3
10:42:00	10.15	7.82	1907.2
10:43:00	10.15	7.82	1909.9
10:44:00	10.14	7.82	1913.2
10:45:00	10.14	7.82	1912.6
10:46:00	10.12	7.83	1911.8
10:47:00	10.11	7.84	1912.9
10:48:00	10.10	7.84	1909.5
10:49:00	10.08	7.86	1900.3
10:50:00	10.11	7.84	1908.8
10:51:00	10.08	7.86	1912.3
10:52:00	10.08	7.86	1906.3
10:53:00	10.08	7.86	1905.9
10:54:00	10.09	7.86	1902.0
10:55:00	10.10	7.85	1897.2
10:56:00	10.08	7.86	1898.7
10:57:00	10.04	7.88	1906.3
10:58:00	10.05	7.88	1905.9
10:59:00	10.05	7.88	1908.5
11:00:00	10.04	7.88	1912.8

11:01:00	10.07	7.86	1902.3
11:02:00	10.06	7.87	1904.8
11:03:00	10.06	7.86	1899.0

"Comprehensive Emission Services"
"IEA Generator Hy-Vee "
"Marshalltown, Iowa"

Run 2

DATE 02-29-1996
TIME 11:26:01

HR:MM:SS	O2	CO2	NOx
	%	%	ppm
11:28:00	9.97	7.87	1919.6
11:29:00	9.97	7.87	1918.1
11:30:00	9.96	7.88	1916.6
11:31:00	9.96	7.87	1920.7
11:32:00	9.97	7.86	1920.8
11:33:00	9.97	7.86	1917.1
11:34:00	9.96	7.88	1919.2
11:35:00	9.94	7.88	1918.5
11:36:00	9.95	7.88	1910.1
11:37:00	9.94	7.88	1916.2
11:38:00	9.93	7.89	1906.6
11:39:00	9.95	7.88	1910.4
11:40:00	9.96	7.87	1910.7
11:41:00	9.93	7.88	1907.5
11:42:00	9.92	7.89	1908.0
11:43:00	9.93	7.89	1906.8
11:44:00	9.93	7.89	1906.3
11:45:00	9.92	7.89	1905.4
11:46:00	9.93	7.89	1898.2
11:47:00	9.93	7.89	1898.9
11:48:00	8.75	5.96	1891.0
11:49:00	9.92	7.89	1889.8
11:50:00	9.93	7.89	1890.2
11:51:00	9.92	7.89	1885.0
11:52:00	9.93	7.88	1886.1
11:53:00	9.92	7.89	1891.2
11:54:00	9.93	7.88	1883.1
11:55:00	9.93	7.87	1874.2
11:56:00	9.92	7.89	1879.2
11:57:00	9.89	7.91	1882.4
11:58:00	9.93	7.88	1885.4
11:59:00	9.92	7.88	1889.3
12:00:00	9.90	7.90	1895.1
12:01:00	9.87	7.91	1890.0
12:02:00	9.87	7.92	1886.7
12:03:00	9.88	7.92	1887.2
12:04:00	9.90	7.89	1879.5
12:05:00	9.89	7.90	1880.9
12:06:00	9.90	7.89	1884.6
12:07:00	9.91	7.88	1879.4
12:08:00	9.89	7.89	1881.3
12:09:00	9.89	7.89	1881.5
12:10:00	9.90	7.90	1876.0
12:11:00	9.91	7.88	1877.8
12:12:00	9.89	7.89	1883.2
12:13:00	9.91	7.89	1879.1
12:14:00	9.93	7.89	1878.2
12:15:00	9.98	7.90	1899.2
12:16:00	9.96	7.92	1889.0
12:17:00	9.95	7.94	1886.6
12:18:00	9.97	7.91	1896.3
12:19:00	9.98	7.91	1893.1
12:20:00	9.98	7.90	1888.3
12:21:00	9.96	7.92	1893.9
12:22:00	9.94	7.94	1890.6
12:23:00	9.95	7.94	1886.1
12:24:00	9.96	7.92	1893.2

12:25:00	9.95	7.92	1885.3
12:26:00	9.93	7.93	1887.2
12:27:00	9.90	7.96	1893.8

"Comprehensive Emission Services"
"IEA Generator Hy-Vee"
"Marshalltown, Iowa"

DATE 02-27-1996

TIME 13:10:01

Run 3

HR:MM:SS	O2 %	CO2 %	NOx ppm
13:12:00	9.87	7.92	1900.6
13:13:00	9.86	7.92	1905.0
13:14:00	9.83	7.93	1899.9
13:15:00	9.82	7.95	1895.9
13:16:00	9.83	7.94	1898.6
13:17:00	9.84	7.93	1892.5
13:18:00	9.84	7.93	1891.8
13:19:00	9.85	7.92	1894.8
13:20:00	9.85	7.92	1890.1
13:21:00	9.85	7.93	1890.9
13:22:00	9.85	7.92	1887.8
13:23:00	9.84	7.93	1879.3
13:24:00	9.84	7.92	1879.6
13:25:00	9.82	7.94	1885.2
13:26:00	9.82	7.93	1885.1
13:27:00	9.83	7.94	1885.5
13:28:00	9.84	7.92	1886.5
13:29:00	9.83	7.91	1882.1
13:30:00	9.80	7.94	1877.2
13:31:00	9.83	7.93	1877.8
13:32:00	9.83	7.93	1882.4
13:33:00	9.83	7.92	1878.0
13:34:00	9.84	7.92	1877.7
13:35:00	9.85	7.91	1881.7
13:36:00	9.84	7.90	1875.4
13:37:00	9.80	7.93	1872.0
13:38:00	9.78	7.95	1876.4
13:39:00	9.79	7.93	1867.5
13:40:00	9.76	7.94	1858.6
13:41:00	9.74	7.94	1870.4
13:42:00	9.72	7.95	1863.1
13:43:00	9.69	7.97	1863.0
13:44:00	9.71	7.96	1866.7
13:45:00	9.73	7.93	1871.8
13:46:00	9.73	7.94	1869.1
13:47:00	9.72	7.93	1859.8
13:48:00	9.71	7.95	1869.2
13:49:00	9.73	7.93	1878.0
13:50:00	9.73	7.93	1899.5
13:51:00	9.69	7.96	1907.2
13:52:00	9.70	7.96	1917.9
13:53:00	9.69	7.97	1921.4
13:54:00	9.71	7.96	1916.0
13:55:00	9.72	7.95	1918.7
13:56:00	9.69	7.96	1918.6
13:57:00	9.70	7.98	1919.1
13:58:00	9.72	7.94	1906.7
13:59:00	9.71	7.96	1914.5
14:00:00	9.75	7.94	1917.4
14:01:00	9.77	7.90	1922.4
14:02:00	9.65	8.00	1918.2
14:03:00	9.76	7.91	1917.9
14:04:00	9.75	7.91	1912.2
14:05:00	9.78	7.89	1911.6
14:06:00	9.79	7.88	1900.4
14:07:00	9.80	7.89	1891.3
14:08:00	9.80	7.87	1897.0
14:09:00	9.77	7.89	1897.2

14:10:00	9.77	7.90	1894.1
14:11:00	9.76	7.89	1892.6

"Comprehensive Emission Services"
 "IEA Generator Hy-Vee"
 "Marshalltown, Iowa"

ICAL

DATE 02-29-1996

TIME 09:48:07

HR:MM:SS	O2 %	CO2 %	NOx ppm
09:48:38	14.84	0.16	1108.9
09:48:48	14.48	0.03	331.7
09:48:58	14.45	0.01	17.4
09:49:08	14.46	0.00	12.2
09:49:18	14.46	-0.01	8.4
09:49:28	14.46	-0.01	6.7
09:49:38	14.46	-0.02	6.4
09:49:48	14.46	-0.03	6.4
09:49:58	14.32	-0.02	6.4
09:50:08	11.66	0.20	6.4
09:50:18	8.76	0.92	23.7
09:50:28	8.63	0.05	54.9
09:50:38	8.61	-0.02	48.4
09:50:48	8.60	-0.02	16.6
09:50:58	8.61	-0.03	4.0
09:51:08	8.60	-0.03	3.8
09:51:18	8.60	-0.03	2.5
09:51:28	8.60	-0.03	1.3
09:51:38	8.61	-0.02	1.4
09:51:48	8.60	-0.03	1.5
09:51:58	4.12	0.04	1.6
09:52:08	0.33	9.17	1.3
09:52:18	0.19	20.38	1.4
09:52:28	0.15	21.27	1.3
09:52:38	0.13	21.25	0.3
09:52:48	0.11	21.09	-0.5
09:52:58	0.11	20.68	-0.5
09:53:08	0.11	20.71	-0.7
09:53:18	0.10	20.70	-0.2
09:53:28	0.10	20.71	-0.4
09:53:38	0.10	20.71	-0.5
09:53:48	0.10	20.71	-0.4
09:53:58	0.84	20.75	-0.4
09:54:08	1.17	19.84	-0.6
09:54:18	0.06	12.65	0.7
09:54:28	0.04	10.56	2.9
09:54:38	0.04	10.48	2.4
09:54:48	0.04	10.47	0.5
09:54:58	0.04	10.46	-0.8
09:55:08	0.04	10.44	-0.6
09:55:18	0.18	10.46	-0.4
09:55:28	0.37	10.33	-0.5
09:55:38	0.03	4.81	473.6
09:55:48	-0.00	0.34	1266.6
09:55:58	0.00	0.07	1638.0
09:56:08	0.00	0.03	1729.3
09:56:18	0.00	0.02	1766.3
09:56:28	0.01	0.01	1766.3
09:56:38	0.01	0.01	1766.0
09:56:48	0.01	0.00	1766.2
09:56:58	0.01	-0.00	1764.8
09:57:08	0.01	-0.00	1763.8
09:57:18	0.01	-0.00	1771.0
09:57:28	0.01	-0.01	1771.0
09:57:38	0.01	-0.01	1766.8
09:57:48	0.01	-0.02	1766.2
09:57:58	0.01	-0.01	1766.4

09:58:08	0.01	-0.01	1767.3
09:58:18	0.01	-0.02	1766.8
09:58:28	0.16	-0.02	1766.1
09:58:38	0.59	0.05	1738.2
09:58:48	0.50	0.29	1691.9
09:58:58	0.03	0.43	1478.9
09:59:08	0.01	-0.00	1155.1
09:59:18	0.01	-0.02	1023.7
09:59:28	0.01	-0.03	1019.8
09:59:38	0.02	-0.04	1018.0
09:59:48	0.01	-0.03	1018.0
09:59:58	0.01	-0.03	1018.0
10:00:08	0.01	-0.02	1017.9

CAL 1-2

"Comprehensive Emission Services"
"IEA Generator Hy-Vee"
"Marshalltown, Iowa"

DATE 02-29-1996

TIME 11:05:57

HR:MM:SS O2

HR:MM:SS	O2 %	CO2 %	NOx ppm
11:06:10	0.00	-0.01	15.3
11:06:20	0.00	-0.01	13.1
11:06:30	0.00	-0.01	11.2
11:06:40	0.00	-0.02	10.4
11:06:50	0.00	-0.02	9.2
11:07:00	0.00	-0.01	8.6
11:07:10	0.00	-0.02	8.7
11:07:20	0.00	-0.02	8.6
11:07:30	2.15	-0.02	6.9
11:07:40	7.48	0.97	155.6
11:07:50	8.49	0.66	405.9
11:08:00	8.53	0.01	355.7
11:08:10	8.54	-0.02	105.7
11:08:20	8.55	-0.03	5.7
11:08:30	8.55	-0.02	4.0
11:08:40	8.55	-0.02	3.0
11:08:50	8.56	-0.02	3.0
11:09:00	8.56	-0.03	3.0
11:09:10	8.56	-0.03	3.0
11:09:20	8.56	-0.03	3.0
11:09:30	8.47	-0.02	3.0
11:09:40	2.44	0.09	3.0
11:09:50	0.14	5.40	3.0
11:10:00	0.08	9.95	3.0
11:10:10	0.06	10.27	3.0
11:10:20	0.05	10.29	3.0
11:10:30	0.04	10.30	3.0
11:10:40	0.04	10.31	3.0
11:10:50	0.43	10.32	3.0
11:11:00	1.19	10.26	44.6
11:11:10	0.02	6.50	113.6
11:11:20	-0.00	0.72	626.1
11:11:30	-0.00	0.06	1436.2
11:11:40	-0.00	0.02	1763.5
11:11:50	-0.01	0.01	1766.1
11:12:00	-0.01	0.00	1766.7
11:12:10	-0.00	-0.01	1766.6
11:12:20	-0.01	-0.01	1766.6
11:12:30	-0.01	-0.01	1767.8
11:12:40	-0.00	-0.02	1767.5
11:12:50	-0.01	-0.02	1766.7

"Comprehensive Emission Services"
 "IEA Generator Hy-Vee "
 "Marshalltown, Iowa"

CAL
 2-3

DATE 02-29-1996
 TIME 12:27:32

HR:MM:SS	O2 %	CO2 %	NOx ppm
12:27:49	8.60	0.17	964.4
12:27:59	8.60	0.02	460.2
12:28:09	8.60	0.00	187.0
12:28:19	8.60	-0.00	20.9
12:28:29	8.60	-0.00	17.5
12:28:39	8.59	-0.01	15.9
12:28:49	8.60	-0.01	13.8
12:28:59	5.61	0.05	18.8
12:29:09	0.21	5.12	33.7
12:29:19	0.10	10.11	35.6
12:29:29	0.08	10.24	19.1
12:29:39	0.07	10.27	8.0
12:29:49	0.06	10.28	7.8
12:29:59	0.05	10.28	8.0
12:30:09	0.05	10.28	7.6
12:30:19	0.05	10.28	6.7
12:30:29	1.23	10.28	6.9
12:30:39	0.80	9.37	110.4
12:30:49	0.00	1.66	368.4
12:30:59	-0.00	0.05	420.0
12:31:09	-0.00	0.01	162.1
12:31:19	-0.00	-0.00	5.6
12:31:29	-0.00	-0.00	3.9
12:31:39	-0.00	-0.01	3.8
12:31:49	-0.00	-0.00	3.8
12:31:59	-0.00	-0.01	3.7
12:32:09	-0.00	-0.02	3.7
12:32:19	-0.00	-0.02	2.9
12:32:29	1.36	-0.02	1.6
12:32:39	0.14	1.16	194.7
12:32:49	0.01	0.08	676.6
12:32:59	0.00	-0.02	1120.4
12:33:09	0.00	-0.02	1508.9
12:33:19	0.00	-0.02	1742.0
12:33:29	0.00	-0.03	1741.9
12:33:39	0.00	-0.03	1742.0
12:33:49	0.00	-0.03	1742.1
12:33:59	0.00	-0.02	1742.0
12:34:09	0.00	-0.03	1742.0
12:34:19	-0.00	-0.02	1742.0
12:34:29	0.01	-0.03	1742.1
12:34:39	0.00	-0.02	1741.2
12:34:49	0.00	-0.03	1740.1
12:34:59	0.00	-0.03	1740.0
12:35:09	0.00	-0.02	1740.0

"Comprehensive Emission Services"
 "IEA Generator Hy-Vee"
 "Marshalltown, Iowa"

CAL
 A3

DATE 02-29-1996
 TIME 14:13:20

HR:MM:SS	O2 %	CO2 %	NOx ppm
14:14:10	8.54	-0.02	14.0
14:14:20	8.53	-0.01	12.8
14:14:30	8.54	-0.01	11.5
14:14:40	8.53	-0.02	11.6
14:14:50	8.54	-0.01	11.7
14:15:00	8.53	-0.02	11.6
14:15:10	8.56	-0.02	11.6
14:15:20	2.95	0.19	48.1
14:15:30	0.20	2.82	141.1
14:15:40	0.12	8.05	160.0
14:15:50	0.10	9.90	65.3
14:16:00	0.09	10.06	8.4
14:16:10	0.09	10.10	8.5
14:16:20	0.08	10.11	8.4
14:16:30	0.08	10.13	8.4
14:16:40	0.08	10.14	7.5
14:16:50	0.07	10.15	6.0
14:17:00	0.07	10.15	6.3
14:17:10	0.07	10.16	6.1
14:17:20	0.07	10.16	6.2
14:17:30	0.07	10.17	6.2
14:17:40	0.06	10.18	5.2
14:17:50	0.07	10.17	3.9
14:18:00	0.06	10.17	4.8
14:18:10	-0.00	9.37	7.1
14:18:20	0.00	3.67	7.4
14:18:30	0.01	0.44	5.2
14:18:40	0.01	0.10	3.7
14:18:50	0.01	0.05	3.0
14:19:00	0.01	0.04	2.0
14:19:10	0.01	0.02	2.0
14:19:20	0.01	0.01	1.9
14:19:30	0.01	0.01	2.0
14:19:40	0.01	0.00	1.9
14:19:50	0.01	-0.00	2.0
14:20:00	0.01	-0.00	2.0
14:20:10	0.01	-0.00	2.0
14:20:20	0.24	-0.01	2.0
14:20:30	0.78	-0.00	2.0
14:20:40	0.07	0.40	282.8
14:20:50	0.01	0.39	985.8
14:21:00	0.01	0.04	1470.8
14:21:10	0.01	-0.01	1626.4
14:21:20	0.01	-0.01	1719.2
14:21:30	0.01	-0.01	1719.3
14:21:40	0.01	-0.01	1720.2
14:21:50	0.01	-0.01	1721.3
14:22:00	0.01	-0.02	1721.3
14:22:10	0.01	-0.02	1721.3
14:22:20	0.01	-0.02	1721.3
14:22:30	0.01	-0.01	1721.3
14:22:40	0.01	-0.02	1721.3
14:22:50	0.01	-0.02	1721.3
14:23:00	0.01	-0.01	1721.3
14:23:10	0.01	-0.02	1720.5
14:23:20	0.01	-0.02	1720.2
14:23:30	0.01	-0.03	1721.3
14:23:40	0.01	-0.02	1721.3