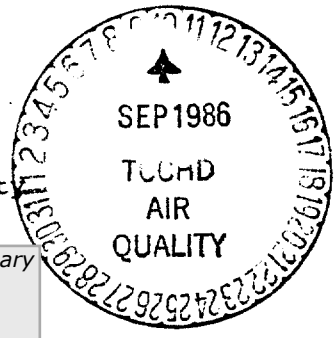
Environmental Test Report

Ogden Martin Systems of Tulsa, Inc.
2122 South Yukon Avenue
Tulsa, Oklahoma 74104

Walter B. Hall Resource Recovery Facility
Units 1 and 2



Test Purpose: Compliance with Tulsa City County Health Department Permit No. T84-23 and U.S. EPA Permit PSD-OK-556M-1

Testing Firm: Ogden Projects, Inc.
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Introduction

On June 16, 1986 through June 27, 1986, Ogden Martin Systems, Inc. performed a series of emission tests at the Walter B. Hall Resource Recovery Facility, a Waste-to-Energy Facility owned and operated by Ogden Martin Systems of Tulsa, Incorporated.

Two MSW-fired boilers (Units 1 and 2) each with a 375 tons per day (TPD) capacity were tested for various gaseous and solid air pollutant emissions at the common stack and from the Electrostatic Precipitator outlet of each boiler. This testing was for determination of compliance with Tulsa City-County Health Department (TCCHD) Authority to Construct permit No. T84-23 and with the U.S. EPA Region VI permit PSD-OK-556M-1.

The test program, as per the source test plan submitted to the TCCHD and U.S. EPA on June 11, 1986, is outlined as follows:

Parameter	Method	Location
TSP	U.S. EPA Method 5	Boilers 1 and 2
Trace Chlorinated Organics	U.S. EPA Modified Method 5	Common Stack
Oxides of Nitrogen	U.S. EPA Method 7E	Boilers 1 and 2
H_2SO_4, SO_2, HF, HCL	U.S. EPA Method 8/13A	Boilers 1 and 2
Opacity	U.S. EPA Method 9	Common Stack
CO	U.S. EPA Method 10	Boilers 1 and 2
Pb, Be	U.S. EPA Method 12/104	Common Stack
VOC	California Air Resources Board Method 100	Boilers 1 and 2
Hg	U.S. EPA Method 101A	Common Stack
CO_2	NDIR Analyzer	Boilers 1 and 2
O_2	Paramagnetic Analyzer	Boilers 1 and 2

Variations to the source test plan are outlined in section VI.

The testing was supervised by Mr. Henry Von DemFange and performed by Messrs. Ronald Zurlinden, Matthew Turner and John Scholz, all of Ogden Projects, Inc. The exception was the continuous emission monitoring compliance testing of NO_x, CO, and VOC, by Mr. Andy Winkler of Petrochem Environmental Services of Bakersfield, California. The laboratory analysis of TSP, H_2SO_4, SO_2 and HCl were performed by Ogden Projects, Inc. at its Emeryville laboratory and the analysis of Pb, Be and Hg was conducted by Brown and Caldwell Laboratories of Emeryville, California, a California certified hazardous waste laboratory. The isomer specific analyses of PCDDs and PCDFs were performed by Triangle Laboratories, Inc., of Research Triangle Park, North Carolina.

Mr. Ray Bishop and Mr. James Van Sandt representing TCCHD, and, Mr. Robert E. Cullen, P.E. and Mr. Grant Marburger representing the Oklahoma State Department of Health, were observers during the test program.

II. SUMMARY OF RESULTS

SCHEDULE OF TESTING

Date	Method	Run	Time
Boiler #1			
6-23-86	U.S. EPA Method 5	1	1000 - 1145
6-23-86	U.S. EPA Method 5	2	1354 - 1544
6-23-86	U.S. EPA Method 5	3	1745 - 1925
6-23-86	U.S. EPA Methods 8/13A	1 (2)	1439 - 1611
6-27-86	U.S. EPA Methods 8/13A	2 (5)	0945 - 1113
6-27-86	U.S. EPA Methods 8/13A	3 (6)	1242 - 1406
6-27-86	U.S. EPA Methods 7A, 10 and CARB Method 100	1,2,3,4,5	0920 - 1445
Boiler #2			
6-24-86	U.S. EPA Method 5	1 (2)	1339 - 1507
6-24-86	U.S. EPA Method 5	2 (3)	1642 - 1809
6-24-86	U.S. EPA Method 5	3 (4)	1925 - 2043
6-24-86	U.S. EPA Methods 8/13A	1 (2)	1341 - 1510
7-1-86	U.S. EPA Methods 8/13A	2 (6)	1845 - 2005
7-2-86	U.S. EPA Methods 8/13A	3 (7)	0858 - 1022
6-24-86	U.S. EPA Methods 7A, 10 and CARB Method 100	1,2,3,4,5	1200 - 1755
Common Stack			
6-25-86	U.S. EPA Modified Method 5	1	1250 - 1510
6-25-86	U.S. EPA Modified Method 5	Blank	1250 - 1510
6-26-86	U.S. EPA Modified Method 5	2	1050 - 1632
6-26-86	U.S. EPA Modified Method 5	3	1125 - 1555
6-30-86	U.S. EPA Method 101A	1	1040 - 1327
6-30-86	U.S. EPA Method 101A	2	1032 - 1334
6-30-86	U.S. EPA Method 101A	3	1550 - 1740
7-1-86	U.S. EPA Methods 12/104	1	0920 - 1440
7-1-86	U.S. EPA Methods 12/104	2	1020 - 1530
7-1-86	U.S. EPA Methods 12/104	3	1020 - 1305
6-23-86	U.S. EPA Method 9	1	1010 - 1110
6-24-86	U.S. EPA Method 9	2	1425 - 1525
7-1-86	U.S. EPA Method 9	3	1005 - 1035
7-2-96	U.S. EPA Method 9	4	955 - 1055

( ) indicates corresponding stack test run in appendix

SUMMARY OF SOURCE TEST RESULTS

POLLUTANT	Unit #1 lb/hr	Unit #2 lb/hr	Emission Rates for Both Units		
			lb/hr	gr/dscf at 12% CO_2	TPY
TSP	7.06	5.40	12.46	0.022	54.6
SO_2	31.06	33.24	64.30		282.6
NO_x	89.2	96.1	185.3		812
VOC	0.1	0.1	<0.2		<0.9
CO	3.1	3.7	6.8		29.8
Pb	--	--	0.107		0.469
Hg	--	--	0.109		0.477
Be	--	--	$<7.85 \times 10^{-7}$		$<3.44 \times 10^{-6}$
Total F	0.70	0.68	1.38		6.04
H_2SO_4	5.23	5.40	10.63	0.018	46.6
HCl	80.4	80.0	160.4		702

Opacity	Visible Emissions	0%

Permit Emission Rates

POLLUTANT	Unit #1 lb/hr	Unit #2 lb/hr	Emission Rates Both Units lb/hr	gr/dscf at 12% CO_2	TPY
TSP	17.1	17.1	34.2	0.06	150.0
SO_2	50.45	50.45	100.9		441.9
NO_x	51.55	51.55	103.1		451.6
VOC	2.3	2.3	4.6		20.1
CO	20.8	20.8	41.6		182.2
Pb	.1	.1	0.2		0.9
Hg	.0313	.0313	0.0625		0.3
Be	2.565×10^{-6}	2.565×10^{-6}	5.13×10^{-6}		2.25×10^{-5}
HF	1.65	1.65	3.3		14.5
H_2SO_4	.625	.625	1.25		5.5

Opacity — Visible Emissions — 10%

Average of PCDD and PCDF concentrations
in the combustion flue gas.

COMPOUND	RUN 1	RUN 2	RUN 3	Average ng/Nm3 @ 12% CO2
2378 TCDD	0.094	0.099	0.111	0.101
TCDD	1.782	1.425	1.631	1.613
12378 PCDD	0.211	0.170	0.188	0.189
PCDD	3.009	2.694	3.261	2.988
123478 HxCDD	0.152	0.143	0.149	0.148
123678 HxCDD	0.371	0.370	0.387	0.376
123789 HxCDD	0.000	0.000	0.000	0.000
HxCDD	5.193	5.018	5.073	5.095
1234678 HpCDD	1.944	2.125	2.525	2.198
HpCDD	4.122	4.278	4.881	4.427
OCDD	4.103	4.569	5.756	4.810
TOTAL PCDD	18.210	17.983	20.602	18.932
2378 TCDF	3.341	2.675	2.699	2.905
TCDF	8.033	6.668	7.222	7.308
12378 PCDF	0.449	0.430	0.480	0.453
23478 PCDF	1.028	0.806	0.953	0.929
PCDF	3.354	3.068	3.584	3.335
123478 HxCDF	0.526	0.490	0.620	0.545
123678 HxCDF	0.195	0.196	0.262	0.218
234678 HxCDF	0.598	0.567	0.588	0.584
123789 HxCDF	0.104	0.112	0.054	0.090
HxCDF	1.754	1.733	1.975	1.821
1234678 HpCDF	1.383	1.315	1.690	1.463
1234789 HpCDF	0.160	0.161	0.183	0.168
HpCDF	2.210	2.154	2.686	2.350
OCDF	0.703	0.620	0.796	0.706
TOTAL PCDF	16.053	14.243	16.264	15.520
TOTAL PCDD & PCDF	34.263	32.226	36.866	34.452

2, 3, 7, 8 - TCDD toxic equivalent of PCDD and PCDF emissions from the Tulsa facility using 1985 U.S. EPA equivalence factors

COMPOUND	Multiplying factor	Tulsa Average	Toxic Equivalent
2378 TCDD	1.00000	0.101	0.101
Other TCDD	0.01000	1.512	0.015
12378 PCDD	0.50000	0.189	0.095
Other PCDD	0.00500	2.799	0.014
123478 HxCDD	0.04000	0.148	0.006
123678 HxCDD	0.04000	0.376	0.015
123789 HxCDD	0.04000	0.000	0.000
Other HxCDD	0.00040	4.571	0.002
1234678 HpCDD	0.00100	2.198	0.002
Other HpCDD	0.00001	2.229	.000
OCDD	0.00000	4.810	0.000
TOTAL PCDD			0.250
2378 TCDF	0.10000	2.905	0.291
Other TCDF	0.00100	4.403	0.004
12378 PCDF	0.10000	0.453	0.045
23478 PCDF	0.10000	0.929	0.093
Other PCDF	0.00100	1.953	0.002
123478 HxCDF	0.01000	0.545	0.005
123678 HxCDF	0.01000	0.218	0.002
234678 HxCDF	0.01000	0.584	0.006
123789 HxCDF	0.01000	0.090	0.001
Other HxCDF	0.00010	0.384	.000
1234678 HpCDF	0.00100	1.463	0.001
1234789 HpCDF	0.00100	0.168	.000
Other HpCDF	0.00100	0.719	0.001
OCDF	0.00000	0.706	0.000
TOTAL PCDF			0.452
Total Toxic Equivalent (2,3,7,8-TCDD Equivalents)			0.701

2, 3, 7, 8 - TCDD toxic equivalent
of PCDD and PCDF emissions from the Tulsa facility
using 1985 California DOHS equivalence factors (scenario 4)

COMPOUND	Multiplying factor	ng/NM3 @ Average	Toxic Equivalent
2378 TCDD	1.00	0.101	0.101
Other TCDD	0.00	1.512	0.000
12378 PCDD	1.00	0.189	0.189
Other PCDD	0.00	2.799	0.000
123478 HxCDD	0.03	0.148	0.004
123678 HxCDD	0.03	0.376	0.011
123789 HxCDD	0.03	0.000	0.000
Other HxCDD	0.00	4.571	0.000
1234678 HpCDD	0.03	2.198	0.066
Other HpCDD	0.00	2.229	0.000
OCDD	0.00	4.810	0.000
TOTAL PCDD			0.372
2378 TCDF	1.00	2.905	2.905
Other TCDF	0.00	4.403	0.000
12378 PCDF	1.00	0.453	0.453
23478 PCDF	1.00	0.929	0.929
Other PCDF	0.00	1.953	0.000
123478 HxCDF	0.03	0.545	0.016
123678 HxCDF	0.03	0.218	0.007
234678 HxCDF	0.03	0.584	0.018
123789 HxCDF	0.03	0.090	0.003
Other HxCDF	0.00	0.384	0.000
1234678 HpCDF	0.03	1.463	0.044
1234789 HpCDF	0.03	0.168	0.005
Other HpCDF	0.00	0.719	0.000
OCDF	0.00	0.706	0.000
TOTAL PCDF			4.379
Total Toxic Equivalent (2,3,7,8-TCDD Equivalents)			4.751

2, 3, 7, 8 - toxic equivalent of PCDD and PCDF emissions from the Tulsa facility using EADON equivalence factors

COMPOUND	Multiplying factor	Tulsa Average	Toxic Equivalent	Suggested Swedish Environmental Protection Board Guidelines for 2, 3, 7, 8 - TCDD Toxic Equivalence
2378 TCDD	1.00	0.101	0.101	
Other TCDD	0.00	1.512	0.000	
12378 PCDD	1.00	0.189	0.189	
Other PCDD	0.00	2.799	0.000	
123478 HxCDD	0.03	0.148	0.004	
123678 HxCDD	0.03	0.376	0.011	
123789 HxCDD	0.03	0.000	0.000	
Other HxCDD	0.00	4.571	0.000	
1234678 HpCDD	0.00	2.198	0.000	
Other HpCDD	0.00	2.229	0.000	
OCDD	0.00	4.810	0.000	
TOTAL PCDD			0.306	
2378 TCDF	0.33	2.905	0.959	
Other TCDF	0.00	4.403	0.000	
12378 PCDF	0.33	0.453	0.149	
23478 PCDF	0.33	0.929	0.307	
Other PCDF	0.00	1.953	0.000	
123478 HxCDF	0.01	0.545	0.005	
123678 HxCDF	0.01	0.218	0.002	
234678 HxCDF	0.01	0.584	0.006	
123789 HxCDF	0.01	0.090	0.001	
Other HxCDF	0.00	0.384	0.000	
1234678 HpCDF	0.00	1.463	0.000	
1234789 HpCDF	0.00	0.168	0.000	
Other HpCDF	0.00	0.719	0.000	
OCDF	0.00	0.706	0.000	
TOTAL PCDF			1.429	
Total Toxic Equivalent (2,3,7,8-TCDD Equivalents)			1.735	0.6 - 2.4

III. SOURCE TEST DATA SUMMARY

A. Stoker/Boiler 1 Emission Data

PARTICULATE RESULTS
Front and Back Half
Boiler 1, Run 1

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	20.9	0.0061	0.0049	0.0071	1.89
Filter:	14.8	0.0043	0.0035	0.0051	1.34
Condensibles:	46.5	0.0135	0.0109	0.0159	4.20
Total:	82.2	0.0239	0.0193	0.0281	7.43

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1000	1145	9.3	10.2	19.1	53.05	36245

PARTICULATE RESULTS
Front and Back Half
Boiler 1, Run 2

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	21.5	0.0054	0.0044	0.0061	1.88
Filter:	11.0	0.0028	0.0022	0.0031	0.96
Condensibles:	41.4	0.0104	0.0084	0.0118	3.63
Total:	73.9	0.0186	0.0150	0.0211	6.47

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1354	1544	8.5	10.6	19.3	61.16	40545

PARTICULATE RESULTS
Front and Back Half
Boiler 1, Run 3

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	9.9	0.0026	0.0023	0.0031	0.94
Filter:	12.1	0.0032	0.0028	0.0038	1.15
Condensibles:	54.5	0.0143	0.0125	0.0172	5.19
Total:	76.5	0.0201	0.0175	0.0241	7.28

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1745	1925	9.5	10.0	13.1	58.54	42168

PARTICULATE RESULTS
EPA Front Half
Boiler 1, Run 1

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	20.9	0.0061	0.0049	0.0071	1.89
Filter:	14.8	0.0043	0.0035	0.0051	1.34
Total:	35.7	0.0104	0.0084	0.0122	3.23

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1000	1145	9.3	10.2	19.1	53.05	36245

PARTICULATE RESULTS
EPA Front Half
Boiler 1, Run 2

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	21.5	0.0054	0.0044	0.0061	1.88
Filter:	11.0	0.0028	0.0022	0.0031	0.96
Total:	32.5	0.0082	0.0066	0.0093	2.84

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1354	1544	8.5	10.6	19.3	61.16	40545

PARTICULATE RESULTS
EPA Front Half
Boiler 1, Run 3

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	9.9	0.0026	0.0023	0.0031	0.94
Filter:	12.1	0.0032	0.0028	0.0038	1.15
Total:	22.0	0.0058	0.0050	0.0069	2.09

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1745	1925	9.5	10.0	13.1	58.54	42168

Backhalf Condensable Analysis - Boiler #1

	mg, titrametric			mg, gravimetric	weight %	
RUN	H_2SO_4	HCL	Total	Total	H_2SO_4	HCL
1	64.6	1.5	66.1	46.5	138	3
2	48.1	1.5	49.6	41.4	116	4
3	44.6	1.2	45.8	54.5	97	2
Average	52.4	1.4	53.8	47.5	117	3

SO2 AND SULFATE RESULTS

Boiler 1, Run 1

SULFATE RESULTS:	Dilution	Vt	gr/dscf	gr/dscf @ 12% CO2	ppm (H2SO4)	lbs/hr
Probe & Nozzle:	50	0.90	0.0064	0.0074	3.5	2.15
Demister Filter:	5	3.45	0.0024	0.0028	1.4	0.83
IPA Impinger	50	2.10	0.0149	0.0172	8.2	5.03
		Total:	0.0237	0.0274	13.1	8.01

SULFUR DIOXIDE RESULTS: N BaCL	Vs/Va	dilution	Vt	ppm,dry	ppm,dry @ 12% CO2	ppm,dry @ 7% O2	lbs/hr
0.0097	50	1	19.9	78.2	90.2	91.3	30.62

ADDITIONAL DATA:

TIME start	finish	%O2	%CO2	%H2O	Vm(std)	SDCFM
1439	1611	9.0	10.4	18.4	51.61	39314

SO2 AND SULFATE RESULTS

Boiler 1, Run 2

SULFATE RESULTS:	Vol aliq	Vol samp Vt	gr/dscf	gr/dscf @ 12% CO2	ppm (H2SO4)	lbs/hr
Probe & Nozzle:	20	0.95	0.0023	0.0029	1.3	0.83
Demister Filter:	5	1.25	0.0008	0.0010	0.4	0.27
IPA Impinger	50	1.60	0.0098	0.0123	5.4	3.48
		Total:	0.0129	0.0162	7.1	4.58

SULFUR DIOXIDE RESULTS: N BaCL	Vs/Va	dilution	Vt	ppm,dry @	ppm,dry @ 12% CO2	ppm,dry @ 7% O2	lbs/hr
0.0097	50	1	25.10	84.8	107.1	110.2	35.07

ADDITIONAL DATA:

TIME start	finish	%O2	%CO2	%H2O	Vm(std)	SDCFM
945	1113	10.2	9.5	17.1	60.00	41505

SO2 AND SULFATE RESULTS

Boiler 1, Run 3

SULFATE RESULTS:	Vol aliq	Vt	gr/dscf	gr/dscf @ 12% CO2	ppm (H2SO4)	lbs/hr
Probe & Nozzle:	40	0.60	0.0028	0.0036	1.6	0.96
Demister Filter:	5	1.10	0.0006	0.0008	0.4	0.22
IPA Impinger	50	0.95	0.0056	0.0070	3.1	1.91
		Total:	0.0090	0.0114	5.0	3.09

SULFUR DIOXIDE RESULTS: N BaCL	Vs/Va	dilution	Vt	ppm,dry	ppm,dry @ 12% CO2	ppm,dry @ 7% O2	lbs/hr
0.0097	50	1	21.30	69.3	87.5	90.0	27.50

ADDITIONAL DATA:

TIME start	finish	%O2	%CO2	%H2O	Vm(std)	SDCFM
1242	1406	10.2	9.5	15.9	62.35	39853

Fluoride Results

Boiler 1, Run 1

Sample	Vol. Sample	mg/L	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	250	0.62	0.13	0.15	0.15	0.02
Impinger	250	28	6.06	6.99	7.08	0.70
Total			6.19	7.14	7.23	0.72

Additional Data:

Time Start	Finish	%O_2	%CO_2	% H_2O	Vm(std)	DSCFM
1439	1618	9.0	10.4	18.4	51.61	39314

Fluoride Results

Boiler 1, Run 2

Sample	Vol. Sample	mg/L	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	100	0.77	0.06	0.08	0.08	0.01
Impinger	250	37	6.89	8.70	8.95	0.85
Total			6.95	8.78	9.03	0.86

Additional Data:

Time						
Start	**Finish**	**%O_2**	**%CO_2**	**% H_2O**	**Vm(std)**	**DSCFM**
0945	1113	10.2	9.5	17.1	60.00	41505

Fluoride Results

Boiler 1, Run 3

Sample	Vol. Sample	mg/L	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	200	0.19	0.03	0.04	0.04	0.00
Impinger	250	25	4.48	5.66	5.81	0.53
Total			4.51	5.70	5.85	0.53

Additional Data:

Time						
Start	Finish	%O_2	%CO_2	% H_2O	Vm(std)	DSCFM
1242	1406	10.2	9.5	15.9	62.35	39853

HCL Results

Boiler 1 Run 1

Sample	Vol. Aliq.	Vol. Sample	VT	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	5	250	1.35	14.91	17.2	17.4	3.33
IPA Impinger	5	250	26.50	292.64	337.6	341.8	65.30
Demister	10	25	0.50	0.27	0.32	0.32	6.16
H_2O_2 Impinger	5	250	0.90	9.93	11.47	11.61	2.22
		Total		317.75	366.59	371.13	77.01

Additional Data:

Time						
Start	Finish	%O_2	%CO_2	%H_2O	Vm(std)	DSCFM
1439	1618	9.0	10.4	18.4	51.61	39314

HCL Results

Boiler 1 Run 2

Sample	Vol. Aliq.	Vol. Sample	VT	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	5	100	0.40	1.52	1.92	1.97	0.36
IPA Impinger	5	250	37.70	358.11	452.35	465.21	84.36
Demister	10	25	0.45	0.22	0.25	0.26	0.01
H_2O_2 Impinger	5	250	1.50	14.24	18.00	18.51	3.36
	Total			374.09	472.52	485.95	88.09

Additional Data:

Time						
Start	Finish	$\%O_2$	$\%CO_2$	$\%H_2O$	Vm(std)	DSCFM
0945	1113	10.2	9.5	17.1	60.00	41505

HCL Results

Boiler 1 Run 3

Sample	Vol. Aliq.	Vol. Sample	VT	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	5	200	0.20	1.46	1.85	1.90	0.33
IPA Impinger	5	250	32.70	298.91	377.57	388.30	67.61
Demister	10	25	1.60	0.73	0.92	0.95	0.17
H_2O_2 Impinger	5	250	3.85	35.19	44.45	45.72	7.96
				336.29	424.79	436.87	76.07

Additional Data:

Time						
Start	Finish	%O_2	%CO_2	%H_2O	Vm(std)	DSCFM
1242	1406	10.2	9.5	15.9	62.35	39853

B. Stoker/Boiler 2 Emission Data

PARTICULATE RESULTS
Front and Back Half
Boiler 2, Run 1

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	6.7	0.0018	0.0015	0.0025	0.63
Filter:	8.1	0.0022	0.0018	0.0030	0.76
Condensibles:	24.6	0.0066	0.0053	0.0090	2.30
Total:	39.4	0.0106	0.0085	0.0145	3.69

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1339	1507	10.4	8.8	19.6	57.16	40413

PARTICULATE RESULTS
Front and Back Half
Boiler 2, Run 2

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	7.8	0.0021	0.0018	0.0027	0.75
Filter:	8.3	0.0022	0.0019	0.0029	0.80
Condensibles:	42.0	0.0113	0.0095	0.0147	4.06
Total:	58.1	0.0156	0.0131	0.0203	5.61

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1642	1809	10.0	9.2	15.8	57.42	42055

PARTICULATE RESULTS
Front and Back Half
Boiler 2, Run 3

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	3.8	0.0010	0.0008	0.0013	0.36
Filter:	6.9	0.0018	0.0014	0.0023	0.65
Condensibles:	62.4	0.0161	0.0131	0.0211	5.88
Total:	73.1	0.0189	0.0153	0.0247	6.89

ADDITIONAL DATA:

TIME Start	Finish	%CO	%O2	%H2O	Vm(std)	DSCFM
1[illegible]	2[illegible]	0.0	9.2	18.9	59.53	42427

FARTICULATE RESULTS
FPA Front Half
Boiler 2, Run 1

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
[illegible]:	6.7	0.0018	0.0019	0.0025	0.63
[illegible]:	8.1	0.0022	0.0018	0.0030	0.76
Total:	14.8	0.0040	0.0032	0.0054	1.39

[illegible] DATA:

Time						
[illegible]	[illegible]	%CO2	%O2	%H2O	Vm(std)	DSCFM
1500	1607	10.4	9.8	19.6	57.16	40413

PARTICULATE RESULTS
EPA Front Half
Boiler 2, Run 2

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	7.8	0.0021	0.0018	0.0027	0.75
Filter:	8.3	0.0022	0.0019	0.0029	0.80
Totals:	16.1	0.0043	0.0036	0.0056	1.55

ADDITIONAL DATA:

TIME Point	Finish	%I	%CO2	%H2O	Vm(std)	DSCFM
1240	1809	10.0	9.2	15.8	57.42	42055

PARTICULATE RESULTS
EPA Front Half
Boiler 2, Run 3

SAMPLE	net mg	gr/dscf	gr/scf	gr/dscf @ 12% CO2	lbs/hr
Probe & Nozzle:	3.8	0.0010	0.0008	0.0013	0.36
Filter:	6.9	0.0018	0.0014	0.0023	0.65
Total:	10.7	0.0028	0.0022	0.0036	1.01

ADDITIONAL DATA:

TIME						
Start	Finish	%O2	%CO2	%H2O	Vm(std)	DSCFM
1525	2043	10.0	9.2	18.9	59.53	42427

Back Half Condensible Analysis - Boiler #2

	mg, titrametric			mg, gravimetric	weight %	
RUN	H_2SO_4	HCL	Total	Total	H_2SO_4	HCL
1	46.3	1.8	48.1	24.6	188	7
2	32.7	1.8	34.5	42.0	78	4
3	53.5	1.5	55.0	62.4	86	2
Average	44.2	1.7	45.9	43.0	117	4

SO2 AND SULFATE RESULTS

Boiler 2, Run 1

SULFATE RESULTS:	Dilution	Vt	gr/dscf	gr/dscf @ 12% CO2	ppm (H2SO4)	lbs/hr
Probe & Nozzle:	20	0.70	0.0020	0.0027	1.1	0.71
Demister Filter:	5	1.00	0.0007	0.0009	0.4	0.25
IPA Impinger	50	1.20	0.0085	0.0114	4.7	3.02
		Total:	0.0113	0.0150	6.2	3.98

SULFUR DIOXIDE RESULTS: N BaCL	Vs/Va	dilution	Vt	ppm,dry @	ppm,dry @ 12% CO2	ppm,dry @ 7% O2	lbs/hr
0.0097	50	1	21.65	85.3	113.8	110.8	35.05

ADDITIONAL DATA:

TIME start	finish	%O2	%CO2	%H2O	Vm(std)	SDCFM
1341	1510	10.2	9.0	18.4	51.44	41229

SO2 AND SULFATE RESULTS

Boiler 2, Run 2

SULFATE RESULTS:	Vol aliq	Vol samp Vt	gr/dscf	gr/dscf @ 12% CO2	ppm (H2SO4)	lbs/hr
Probe & Nozzle:	20	0.55	0.0012	0.0015	0.7	0.48
Demister Filter:	5	0.60	0.0003	0.0004	0.2	0.13
IPA Impinger	50	10.75	0.0597	0.0746	33.0	23.38
		Total:	0.0612	0.0766	33.9	23.99

SULFUR DIOXIDE RESULTS: N BaCL	Vs/Va	dilution	Vt	ppm,dry @	ppm,dry 12% CO2	ppm,dry @ 7% O2	lbs/hr
0.0097	50	1	12.50	38.4	48.0	49.9	17.48

ADDITIONAL DATA:

TIME start	finish	%O2	%CO2	%H2O	Vm(std)	SDCFM
1845	1008	10.2	9.6	13.6	65.97	45660

SO2 AND SULFATE RESULTS

Boiler 2, Run 3

SULFATE RESULTS:	Vol aliq	Vt	gr/dscf	gr/dscf @ 12% CO2	ppm (H2SO4)	lbs/hr
Probe & Nozzle:	20	0.70	0.0015	0.0019	0.8	0.64
Demister Filter:	5	1.00	0.0005	0.0007	0.3	0.23
IPA Impinger	50	2.60	0.0141	0.0177	7.8	5.95
		Total:	0.0162	0.0202	9.0	6.82

SULFUR DIOXIDE RESULTS: N BaCL	Vs/Va	dilution	Vt	ppm,dry @	ppm,dry @ 12% CO2	ppm,dry @ 7% O2	lbs/hr
0.0097	50	1	21.35	64.2	80.3	84.2	31.42

ADDITIONAL DATA:

TIME start	finish	%O2	%CO2	%H2O	Vm(std)	SDCFM
858	1022	10.3	9.6	14.4	67.38	49087

Fluoride Results

Boiler 2, Run 1

Sample	Vol. Sample	mg/L	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	100	0.22	0.02	0.03	0.03	0.00
Impinger	250	16	3.48	4.64	4.52	0.42
Total			3.50	4.67	4.55	0.42

Additional Data:

Time						
Start	Finish	$\%O_2$	$\%CO_2$	$\% H_2O$	Vm(std)	DSCFM
1341	1510	10.2	9.0	18.4	51.44	41229

Fluoride Results

Boiler 2, Run 2

Sample	Vol. Sample	mg/L	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	100	0.77	0.05	0.06	0.06	0.01
Impinger	350	16.00	3.79	4.74	4.92	0.51
Total			3.84	4.80	4.98	0.52

Additional Data:

Time						
Start	**Finish**	**%O_2**	**%CO_2**	**% H_2O**	**Vm(std)**	**DSCFM**
0845	1008	10.2	9.6	13.6	65.97	45660

EQUIPMENT

Method	Equipment Manufacturer
U.S. EPA Method 5/13A	Andersen Samplers, Inc.
U.S. EPA Modified Method 5	Andersen Samplers, Inc.
U.S. EPA Method 8	Andersen Samplers, Inc.
U.S. EPA Method 6C	Western Research
U.S. EPA Method 7E	Thermo Electron, Inc.
California Air Resources Board Method 100	Horiba Instruments, Inc.
U.S. EPA Method 10	Thermo Electron, Inc.
U.S. EPA Method 12/104	Andersen Samplers, Inc.
U.S. EPA Method 101A	Andersen Samplers, Inc.
Paramagnetic Analyzer	Taylor Sybron
NDIR Analyzer	Infrared Industries, Inc.
U.S. EPA Method 9	--
U.S. EPA Methods 1, 2, 3, 4	Andersen Samplers, Inc.

HCL Results

Boiler 2 Run 1

Sample	Vol. Aliq.	Vol. Sample	VT	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	5	100	0.95	4.21	5.61	5.47	0.99
IPA Impinger	5	250	30.40	336.82	449.09	437.55	78.82
Demister	10	25	1.55	0.86	1.14	1.12	0.20
H_2O_2 Impinger	5	250	1.25	13.85	18.46	17.99	3.24
	Total			355.74	474.30	462.13	83.25

Additional Data:

Time						
Start	Finish	%O_2	%CO_2	%H_2O	Vm(std)	DSCFM
1341	1510	10.2	9.0	18.4	51.44	41229

HCL Results

Boiler 2 Run 2

Sample	Vol. Aliq.	Vol. Sample	VT	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	5	100	0.60	2.07	2.59	2.69	0.54
IPA Impinger	5	350	23.50	284.23	355.29	369.24	73.66
Demister	10	25	0.85	0.37	0.46	0.48	0.10
H_2O_2 Impinger	5	250	6.05	52.27	65.33	67.90	13.55
	Total			338.94	423.67	440.31	87.85

Additional Data:

Time						
Start	Finish	%O_2	%CO_2	%H_2O	Vm(std)	DSCFM
0845	1008	10.2	9.6	13.6	65.97	45660

HCL Results

Boiler 2 Run 3

Sample	Vol. Aliq.	Vol. Sample	VT	ppm,dry	ppm,dry @ 12% CO_2	ppm,dry @ 7% O_2	lbs/hr
Front Half Rinse	5.0	100	2.00	6.77	8.46	8.87	1.89
IPA Impinger	5.0	250	27.05	228.80	286.00	300.03	63.75
Demister	10	25	1.55	0.66	0.82	0.86	0.18
H_2O_2 Impinger	5.0	250	1.25	10.57	13.22	13.86	2.95
	Total			246.80	308.50	323.62	68.77

Additional Data:

Time						
Start	Finish	%O_2	%CO_2	%H_2O	Vm(std)	DSCFM
0858	1022	10.3	9.6	14.4	67.38	49087

C. Common Stack Emission Data

Pb Results

Common Stack, Run 1

SAMPLE	net mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	1.9000	0.3144	0.2622	0.3849	0.102
Rinse and Condensibles:	0.2150	0.0356	0.0297	0.0436	0.011
Total:	2.1150	0.3499	0.2918	0.4285	0.113

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Nm3	Nm3/sec
920	1450	10.1	9.8	16.6	6.04	40.71

Pb Results

Common Stack, Run 2

SAMPLE	net mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	2.2000	0.3673	0.3037	0.4452	0.113
Rinse and Condensibles:	0.2450	0.0409	0.0338	0.0496	0.013
Total:	2.4450	0.4082	0.3376	0.4948	0.125

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Nm3	Nm3/sec
1020	1540	10.1	9.9	17.3	5.99	38.66

Pb Results

Common Stack, Run 3

SAMPLE	net mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	1.3000	0.2200	0.1832	0.2666	0.068
Rinse and Condensibles:	0.2750	0.0465	0.0388	0.0564	0.014
Total:	1.5750	0.2665	0.2220	0.3230	0.082

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Nm3	Nm3/sec
1610	2055	10.3	9.9	16.7	5.91	38.9

Mercury Emissions - Tulsa Resource Recovery Facility

Test No.	Fuel Rate (Tons/hr)	Emissions Boiler 1 and 2 lbs/hr	Emissions Boiler 1 and 2 lbs/ton	Flue Gas Temp. F^{o}
1	29.9	0.106	0.00355	342
2	29.9	0.118	0.00395	363
3	31.8	0.103	0.00324	359
Average	30.5	0.109	0.00358	355

Mercury Results

Common Stack, Run 1

MERCURY RESULTS:	net mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	0.0100	0.0056	0.0047	0.0067	0.0017
Rinse and Condensibles:	0.6010	0.3350	0.2814	0.4020	0.1044
Total:	0.6110	0.3406	0.2861	0.4087	0.106

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Nm3	Nm3/sec
1032	1344	10.2	10.0	16.0	1.79	39.25

Mercury Results

Common Stack, Run 2

MERCURY RESULTS:	net mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	0.0024	0.0014	0.0012	0.0017	0.0004
Rinse and Condensibles:	0.6469	0.3737	0.3109	0.4484	0.1172
Total:	0.6493	0.3751	0.3121	0.4501	0.118

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Nm3	Nm3/sec
1040	1337	10.2	10.0	16.8	1.73	39.53

Mercury Results

Common Stack, Run 3

MERCURY RESULTS:	net mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	0.0024	0.0012	0.0010	0.0015	0.0004
Rinse and Condensibles:	0.6363	0.3228	0.2699	0.3953	0.1021
Total:	0.6387	0.3241	0.2709	0.3968	0.103

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Nm3	Nm3/sec
1550	1750	10.1	9.8	16.4	1.97	39.86

Beryllium Emissions - Tulsa Resource Recovery Facility

Test No.	Mg/Nm^3	Mg^3@	lbs/hr
1	$< 2.48 \times 10^{-6}$	$< 3.04 \times 10^{-6}$	$< 8.02 \times 10^{-7}$
2	$< 2.50 \times 10^{-6}$	$< 3.04 \times 10^{-6}$	$< 7.68 \times 10^{-7}$
3	$< 2.54 \times 10^{-6}$	$< 3.08 \times 10^{-6}$	$< 7.84 \times 10^{-7}$
Average	$< 2 .51 \times 10^{-6}$	$< 3.05 \times 10^{-6}$	$< 7.85 \times 10^{-7}$

Beryllium Results

Incinerator Stack, Run 1

SAMPLE	Part mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	1.00E-05	1.65E-06	1.36E-06	2.03E-06	5.35E-07
Filter + Probe Solids:	1.00E-06	8.27E-07	6.90E-07	1.01E-06	2.67E-07
Part.:	1.10E-05	2.48E-06	2.07E-06	3.04E-06	8.02E-07

Additional Data:

Time	Temp.	Vel.	%CO2	%H2O	Nm3	Nm3/sec
1400	1400	10.7	9.8	16.6	6.04	40.71

Emission Results

Outlet Stack, Run 2

SAMPLE	wet mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
[illegible]	1.09E-05	1.47E-06	1.58E-06	2.02E-06	5.12E-07
[illegible]	5.00E-06	6.75E-07	6.98E-07	1.01E-06	2.56E-07
Total:	1.59E-05	2.15E-06	2.27E-06	3.04E-06	7.68E-07

[illegible]:

[illegible]	[illegible]	%O2	%CO2	%H2O	Nm3	Nm3/sec
[illegible]	[illegible]	10.1	9.9	17.1	5.99	38.66

Beryllium Results

Common Stack, Run 3

SAMPLE	net mg	mg/Nm3	mg/m3 wet	mg/Nm3@ 12% CO2	lbs/hr
Filter:	< 1.00E-05	1.69E-06	1.41E-06	2.05E-06	5.22E-07
Rinse and Condensibles:	< 5.00E-06	8.46E-07	7.05E-07	1.03E-06	2.61E-07
Total:	< 1.50E-05	2.54E-06	2.11E-06	3.08E-06	7.84E-07

ADDITIONAL DATA:

TIME start	TIME finish	%O2	%CO2	%H2O	Nm3	Nm3/sec
1610	2055	10.3	9.9	16.7	5.91	38.9

OPACITY RESULTS

DATE	TIME		Common Stack Visible Emissions
	From	To	%
6-23-86	1010	1110	0
6-24-86	1425	1525	0
7-1-86	1003	1036	0
7-2-86	0956	1055	0
	Average		0

D. Source Test Method Calculations

The testing methods and analytical calculations used for determination of pollutant emissions are as per source test plan. The calculations for determining HCl and HF emission levels are as follows.

HCL Calculations

$$ppmdv = \frac{Vt * N * 35450 * \text{Liters of sample} * \text{Aliquot factor} * 24.054 \frac{\text{liters}}{\text{mole}} @ 68^{\circ}F * 10^{6}ppm}{MW * 1000\frac{mg}{g} * 28.32 \frac{\text{liters}}{ft^3} * VMSTD @ 68^{\circ}F}$$

where MW = 36,453

$$\text{ppm dv @ 12\% } CO_2 = \frac{\text{ppm dv} * 12}{\% CO_2}$$

$$\text{ppm dv @ 7\% } O_2 = \text{ppm dv} * \frac{13.9}{20.9 - \% O_2}$$

$$\frac{\text{lbs}}{\text{hr}} \text{ HCL} = \text{ppm dv} * MW * DSCFM * 1.557 \times 10^{-7}$$

Total Fluoride Calculations

$$\text{ppm dv} = \frac{\text{mg/L} * \text{L} * 24.054 \frac{\text{liters}}{\text{mole}} @ 68^{\circ} * 10^{6}\text{ppm}}{\text{MW} * 1000\frac{\text{mg}}{\text{g}} * 28.32 \frac{\text{liters}}{\text{ft}^3} * \text{Vm std} @ 68^{\circ}\text{F}}$$

where MW = 19.0
L = Liters of sample

$$\text{ppm, dry @ 12\% } CO_2 = \text{ppm dv} * \frac{12}{\%CO_2}$$

$$\text{ppm, dry @ 7\% } O_2 = \text{ppm dv} * \frac{20.9 - 7\%}{20.9 - \% O_2}$$

$$\frac{\text{lbs}}{\text{hr}} = \text{ppm dv} * \text{MW} * \text{DSCFM} * 1.557 \times 10^{-7}$$

IV. Continuous Emission Monitoring Data Summary

A. Stoker/Boiler 1 Results - NO_x, CO, VOC

IV.A Stoker/Boiler 1 Results - NO_x, CO, VOC

	DATE	TIME	RUN	ppmdv	@ 68°F	lbs/hr
NO_x						
	6-27-86	0920-1020	1	314	41505[1/]	93.3
	6-27-86	1025-1125	2	297	41505[1/]	88.3
	6-27-86	1135-1235	3	297	40680[3/]	86.5
	6-27-86	1240-1340	4	299	39853[2/]	85.3
	6-27-86	1345-1445	5	324	39853[2/]	92.5
	Average			306		89.2
CO						
	6-27-86	0920-1020	1	13	41505[1/]	2.4
	6-27-86	1025-1235	2	20	41505[1/]	3.6
	6-27-86	1135-1235	3	21	40680[3/]	3.7
	6-27-86	1240-1340	4	16	39853[2/]	2.8
	6-27-86	1345-1445	5	16	39853[2/]	2.8
	Average			17		3.1
VOC (as THC)						
	6-27-86	0920-1020	1	<1	41505[1/]	<0.1
	6-27-86	1025-1125	2	<1	41505[1/]	<0.1
	6-27-86	1135-1235	3	<1	40680[1/]	<0.1
	6-27-86	1240-1340	4	<1	39853[3/]	<0.1
	6-27-86	1345-1445	5	<1	39853[2/]	<0.1
	Average			<1		<0.1

1/ DSCFM @ 68°F is calculated from the EPA Method 8, test run #5.

2/ DSCFM @ 68°F is calculated from the EPA Method 8, test run #6.

3/ Average of EPA Method 8, test runs #5 and 6.

B. Stoker/Boiler 2 Results - NO_x, CO, VOC

IV.B Stoker/Boiler 2 Results - NO_x, CO, VOC

DATE	Time	Run	ppmdv	DSCFM @68°F	lbs/hr
NO_x					
6-24-86	1200-1300	1	325	40413[1/]	94.1
6-24-86	1315-1415	2	340	40413[1/]	98.4
6-24-86	1435-1535	3	337	40413[1/]	97.5
6-24-86	1545-1645	4	327	41229[2/]	96.6
6-24-86	1655-1755	5	312	42055[3/]	94.0
Average			328		96.1
CO					
6-24-86	1200-1300	1	22	40413[1/]	3.9
6-24-86	1315-1415	2	21	40413[1/]	3.7
6-24-86	1435-1535	3	18	40413[1/]	3.2
6-24-86	1545-1645	4	21	41229[2/]	3.8
6-24-86	1655-1755	5	22	42055[3/]	4.0
			21		3.7
VOC (as THC)					
6-24-86	1200-1300	1	<1	40413[1/]	<0.1
6-24-86	1315-1415	2	<1	40413[1/]	<0.1
6-24-86	1435-1535	3	<1	40413[1/]	<0.1
6-24-86	1545-1645	4	<1	41239[1/]	<0.1
6-24-86	1655-1755	5	<1	42055[3/]	<0.1
Average			<1		<0.1

1/ DSCFM @ 68°F is calculated from EPA Method 5, Run #2.

2/ DSCFM @ 68°F is calculated from EPA Method 8, Run #2.

3/ DSCFM @ 68°F is calculated from EPA Method 5, Run #3.

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #1

TIME INTERVAL BEGIN	- END	NOx	CO	THC
09:20 AM	- 09:30 AM	308	16	0
09:30 AM	- 09:40 AM	305	18	0
09:40 AM	- 09:50 AM	308	13	0
09:50 AM	- 10:00 AM	317	13	0
10:00 AM	- 10:10 AM	322	10	0
10:10 AM	- 10:20 AM	322	10	0
Averages;		314	13	0

	NOx	CO	THC
ZERO DRIFT	0	0	-2
CALIB. DRIFT	0	0	-1
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #1

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
09:20 AM	- 09:30 AM	8.5	10.2
09:30 AM	- 09:40 AM	9.1	10.3
09:40 AM	- 09:50 AM	8.7	10.3
09:50 AM	- 10:00 AM	8.6	10.5
10:00 AM	- 10:10 AM	8	10.4
10:10 AM	- 10:20 AM	8.7	10.5
Averages;		8.6	10.4

	O2;%	CO2;%
ZERO DRIFT	-0.2	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #2

TIME INTERVAL BEGIN	- END	NOx	CO	THC
10:25 AM	- 10:35 AM	298	19	0
10:35 AM	- 10:45 AM	312	17	0
10:45 AM	- 10:55 AM	317	23	0
10:55 AM	- 11:05 AM	293	20	0
11:05 AM	- 11:15 AM	279	28	0
11:15 AM	- 11:25 AM	284	12	0
Averages;		297	20	0

	NOx	CO	THC
ZERO DRIFT	0	0	-2
CALIB. DRIFT	0	0	-1
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #2

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
09:20 AM	- 09:30 AM	10.1	10
09:30 AM	- 09:40 AM	9.8	10.2
09:40 AM	- 09:50 AM	9.6	9.9
09:50 AM	- 10:00 AM	9.8	9.7
10:00 AM	- 10:10 AM	9.6	10
10:10 AM	- 10:20 AM	9.3	9.9
Averages;		9.7	10

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #3

TIME INTERVAL BEGIN	- END	NOx	CO	THC
11:35 AM	- 11:45 AM	279	26	0
11:45 AM	- 11:55 AM	267	30	0
11:55 AM	- 12:05 PM	317	21	0
12:05 PM	- 12:15 PM	308	17	0
12:15 PM	- 12:25 PM	320	16	0
12:25 PM	- 12:35 PM	293	14	0
Averages;		297	21	0

	NOx	CO	THC
ZERO DRIFT	0	0	-2
CALIB. DRIFT	0	0	-1
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #3

TIME INTERVAL BEGIN	- END	NOx	CO	THC
11:35 AM	- 11:45 AM	279	26	0
11:45 AM	- 11:55 AM	267	30	0
11:55 AM	- 12:05 PM	317	21	0
12:05 PM	- 12:15 PM	308	17	0
12:15 PM	- 12:25 PM	320	16	0
12:25 PM	- 12:35 PM	293	14	0
Averages;		297	21	0

	NOx	CO	THC
ZERO DRIFT	0	0	-2
CALIB. DRIFT	0	0	-1
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #4

TIME INTERVAL BEGIN	- END	NOx	CO	THC
12:40 PM	- 12:50 PM	293	23	0
12:50 PM	- 01:00 PM	289	22	0
01:00 PM	- 01:10 PM	305	11	0
01:10 PM	- 01:20 PM	289	13	0
01:20 PM	- 01:30 PM	308	14	0
01:30 PM	- 01:40 PM	312	13	0
Averages;		299	16	0

	NOx	CO	THC
ZERO DRIFT	0	0	-2
CALIB. DRIFT	0	0	-1
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #4

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
12:40 PM	- 12:50 PM	9.4	10.3
12:50 PM	- 01:00 PM	9.3	10.3
01:00 PM	- 01:10 PM	8.4	10.5
01:10 PM	- 01:20 PM	9.2	10.6
01:20 PM	- 01:30 PM	9.2	10.3
01:30 PM	- 01:40 PM	9.2	10.2
Averages;		9.1	10.4

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #5

TIME INTERVAL BEGIN	- END	NOx	CO	THC
01:45 PM	- 01:55 PM	327	19	0
01:55 PM	- 02:05 PM	341	12	0
02:05 PM	- 02:15 PM	360	11	0
02:15 PM	- 02:25 PM	312	13	0
02:25 PM	- 02:35 PM	317	22	0
02:35 PM	- 02:45 PM	289	21	0
Averages;		324	16	0

	NOx	CO	THC
ZERO DRIFT	0	0	-2
CALIB. DRIFT	0	0	0
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/27/86
UNIT: ESP BOILER #1
REPORT #: 50-146

INSTRUMENT DATA

RUN #5

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
01:45 PM	- 01:55 PM	8.9	10.2
01:55 PM	- 02:05 PM	8.7	10.6
02:05 PM	- 02:15 PM	8.8	10.5
02:15 PM	- 02:25 PM	9.2	10.3
02:25 PM	- 02:35 PM	9.3	10.2
02:35 PM	- 02:45 PM	9.9	9.9
Averages;		9.1	10.3

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	-0.1	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #1

TIME INTERVAL BEGIN	- END	NOx	CO	THC
12:00 PM	- 12:10 PM	321	22	0
12:10 PM	- 12:20 PM	332	26	0
12:20 PM	- 12:30 PM	354	21	0
12:30 PM	- 12:40 PM	308	19	0
12:40 PM	- 12:50 PM	325	21	0
12:50 PM	- 01:00 PM	310	24	0
Averages;		325	22	0

	NOx	CO	THC
ZERO DRIFT	0	0	-2
CALIB. DRIFT	-1.5	0	0
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #1

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
12:00 PM	- 12:10 PM	8.7	10.6
12:10 PM	- 12:20 PM	8.6	10.5
12:20 PM	- 12:30 PM	8.3	10.6
12:30 PM	- 12:40 PM	8.7	10.6
12:40 PM	- 12:50 PM	9	10.6
12:50 PM	- 01:00 PM	9	10.3
Averages;		8.7	10.5

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #2

TIME INTERVAL BEGIN	- END	NOx	CO	THC
01:15 PM	- 01:25 PM	337	25	0
01:25 PM	- 01:35 PM	331	20	0
01:35 PM	- 01:45 PM	352	23	0
01:45 PM	- 01:55 PM	339	21	0
01:55 PM	- 02:05 PM	337	20	0
02:05 PM	- 02:15 PM	345	19	0
Averages;		340	21	0

	NOx	CO	THC
ZERO DRIFT	0	0	0
CALIB. DRIFT	0	0	0
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #2

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
01:15 PM	- 01:25 PM	8.6	10.5
01:25 PM	- 01:35 PM	8.5	10.6
01:35 PM	- 01:45 PM	8.7	10.7
01:45 PM	- 01:55 PM	8.7	10.3
01:55 PM	- 02:05 PM	8.7	10.3
02:05 PM	- 02:15 PM	8.6	10.5
Averages;		8.6	10.5

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #3

TIME INTERVAL BEGIN	- END	NOx	CO	THC
02:35 PM	- 02:45 PM	331	17	0
02:45 PM	- 02:55 PM	350	16	0
02:55 PM	- 03:05 PM	352	19	0
03:05 PM	- 03:15 PM	326	20	0
03:15 PM	- 03:25 PM	342	15	0
03:25 PM	- 03:35 PM	323	19	0
Averages;		337	18	0

	NOx	CO	THC
ZERO DRIFT	0	0	0
CALIB. DRIFT	0	0	0
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #3

TIME INTERVAL			O2;%	CO2;%
BEGIN	-	END		
02:35 PM	-	02:45 PM	9.5	10.3
02:45 PM	-	02:55 PM	8.6	10.6
02:55 PM	-	03:05 PM	9	10.4
03:05 PM	-	03:15 PM	9.1	10.5
03:15 PM	-	03:25 PM	8.2	10.5
03:25 PM	-	03:35 PM	8.8	10.3
Averages;			8.9	10.4

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #4

TIME INTERVAL BEGIN	- END	NOx	CO	THC
03:45 PM	- 03:55 PM	347	23	0
03:55 PM	- 04:05 PM	326	21	0
04:05 PM	- 04:15 PM	350	19	0
04:15 PM	- 04:25 PM	318	18	0
04:25 PM	- 04:35 PM	315	18	0
04:35 PM	- 04:45 PM	307	24	0
Averages;		327	21	0

	NOx	CO	THC
ZERO DRIFT	0	0	0
CALIB. DRIFT	0	0	0
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #4

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
03:45 PM	- 03:55 PM	8.5	10.6
03:55 PM	- 04:05 PM	8.5	10.3
04:05 PM	- 04:15 PM	8.2	10.6
04:15 PM	- 04:25 PM	8.2	10.6
04:25 PM	- 04:35 PM	8.2	10.6
04:35 PM	- 04:45 PM	8.8	10.3
Averages;		8.4	10.5

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #5

TIME INTERVAL BEGIN	- END	NOx	CO	THC
04:55 PM	- 05:05 PM	305	23	0
05:05 PM	- 05:15 PM	321	22	0
05:15 PM	- 05:25 PM	310	21	0
05:25 PM	- 05:35 PM	302	24	0
05:35 PM	- 05:45 PM	305	22	0
05:45 PM	- 05:55 PM	331	20	0
Averages;		312	22	0

	NOx	CO	THC
ZERO DRIFT	0	0	0
CALIB. DRIFT	0	0	0
CAL GAS value	47.7	48.5	39.6
FULL SCALE RANGE	500	100	100

COMPANY: OGDEN PROJECTS
DATE: 6/24/86
UNIT: ESP BOILER #2
REPORT #: 50-146

INSTRUMENT DATA

RUN #5

TIME INTERVAL BEGIN	- END	O2;%	CO2;%
04:55 PM	- 05:05 PM	8.3	10.6
05:05 PM	- 05:15 PM	9	10.5
05:15 PM	- 05:25 PM	9.1	10.3
05:25 PM	- 05:35 PM	8.7	10.3
05:35 PM	- 05:45 PM	8.5	10.5
05:45 PM	- 05:55 PM	8	10.6
Averages;		8.6	10.5

	O2;%	CO2;%
ZERO DRIFT	0	0
CALIB. DRIFT	0	0
CAL GAS value	20.9	9.87
FULL SCALE RANGE	25	20

V. Stoker/Boiler Operational Data

V. Stoker/Boiler Operational Data

DATE	TIME	Boiler 1 Steam Rate lbs/hr(*1000)	Boiler 1 Capacity[2/] %	Boiler 2 Steam Rate lbs/hr(*1000)	Boiler 2 Capacity[2/] %	Boiler 1 and 2 Steam Rate lbs/hr(*1000)	Boiler 1 and 2 Capacity[3/] %
6-23-86	0800-2100	87	98	1/	---		
6-24-86	0700-2100	89	101	85	96		
6-25-86	1100-1900	90	102	89	101		
6-26-86	1100-1700	90	102	90	102		
6-27-86	0800-1800	85	96	1/	---		
6-30-86	0800-1800					181.2	102
7-1-86	0800-1600					183.6	104
7-2-86	0800-1600					193.1	109

1/ No Air emissions tests were performed

2/ 88,500 lbs/hr steam is equal to 100% heat input Capacity

3/ 177,000 lbs/hr steam is equal to 100% heat input Capacity

VI. Methodology

A. References

REFERENCES:

CONTINUOUS EMISSION MONITORING SYSTEM (CEMS)

Reference: BAAQMD, Manual of Procedures; ST-13A, ST-19A, January 1982 State of California, Air Resources Board, Test Methods 1-100, June 1979.

Reference: EPA Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 10, 1984.

MODIFIED METHOD 5

Reference: SW-846, "Proposed Sampling and Analytical Methodologies for Addition to Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, U.S. EPA.

Reference: EPA Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 5, 1984.

METHOD 12

Reference: EPA, Code of Federal Regulations, Title 40, Part 60, Appendix A, Method 12, 1984.

METHOD 101A

Reference: EPA, Code of Federal Regulations, Title 40, Part 61, Appendix B, Method 101A, 1984.

METHOD 104

Reference: EPA, Code of Federal Regulations, Title 40, Part 61, Appendix B, Method 104, 1984.

METHOD 5

Reference: EPA, Code of Federal Regulations, Title 40, Part 61, Appendix A, Method 5, 1984.

METHOD 13B

Reference: EPA, Code of Federal Regulations, Title 40, Part 61, Appendix A, Method 13B, 1984.

B. Equipment

EQUIPMENT

Method	Equipment Manufacturer
U.S. EPA Method 5/13A	Andersen Samplers, Inc.
U.S. EPA Modified Method 5	Andersen Samplers, Inc.
U.S. EPA Method 8	Andersen Samplers, Inc.
U.S. EPA Method 6C	Western Research
U.S. EPA Method 7E	Thermo Electron, Inc.
California Air Resources Board Method 100	Horiba Instruments, Inc.
U.S. EPA Method 10	Thermo Electron, Inc.
U.S. EPA Method 12/104	Andersen Samplers, Inc.
U.S. EPA Method 101A	Andersen Samplers, Inc.
Paramagnetic Analyzer	Taylor Sybron
NDIR Analyzer	Infrared Industries, Inc.
U.S. EPA Method 9	--
U.S. EPA Methods 1, 2, 3, 4	Andersen Samplers, Inc.

C. Variations From Source Test Plan

VI.C. Variations From Source Test Plan

HF, HCL

The proposed source test plan collected HF and HCL in an U.S. EPA Method 5/13A. The glass filter used in the U.S. EPA Method 5 could react with HF in the sample gas. To eliminate this potential, HF and HCL were collected in a U.S. EPA Method 8/13A without the use of a glass filter.

Be

The proposed source test plan collected Be using the U.S. EPA Method 104 with the analysis performed on the filter, probe rinse and impinger liquid. The variation to this method involved combining the probe rinse and impinger liquid, and evaporating the water to effectively concentrate the Be twenty-fold. The sample was then analyzed as per U.S. EPA Method 104. A pre-analysis test run to determine the percent recovery of this concentration procedure was performed by Brown and Caldwell Laboratories. Results of 90 and 100 percent recovery of Be in the spiked samples were obtained from this procedure.

H_2SO_2

The proposed source test plan involved triplicate determination of H_2SO_4 and SO_2 using the U.S. EPA Method 8. The triplicate runs were performed on both boiler outlets and, upon analysis, the second U.S. EPA Method 8 on Boiler 2 was found to have hydrogen peroxide contamination in the IPA impinger. The relative levels of H_2SO_4 in each impinger were also indicative of a bad test, therefore, the second U.S. EPA Method 8 run on Boiler #2 is not included in the H_2SO_4 and SO_2 averages. The analysis of this test is included in Section III B for comparison.

Opacity

Opacity readings at the common stack were performed by Mr. James Van Sandt of the TCCHD.

VII. Quality Assurance/Quality Control

CALIBRATION OF PUMP METERS

Correction Factor 0926

Pump Type Method 5 Number 1 Date 5/22/86

Ambient Temperature, °F 68

Barometric Pressure 29.98 in Hg

Initial Dry Meter Reading = 509.420

Final Dry Meter Reading = 529.575 Difference = 20.155

Initial Wet Test Meter Reading = Ø

Final Wet Test Meter Reading = 18.06 Difference = 18.06

Dry Meter Temperatures, °F

Min	In	Out
0	69	69
10	95	72
20	109	78
30	108	83
	Average	85

Wet Meter Temperatures, °F

Min	Temp
0	66
10	66
20	66
30	66
	Average 66

Pressure Dry Meter ΔH 1.2

Pressure Wet Test Meter ΔH 0.1

$$\frac{V_w \cdot (P_b + P_B)}{t_w + 460} = C \cdot \frac{V_m \cdot (P_b + P_A)}{T_m + 460}$$

CALIBRATION OF PUMP METERS

Correction Factor 0.970

Pump Type Method 5 Number 2 Date 5/22/86

Ambient Temperature, °F 68

Barometric Pressure 29.98 in Hg

Initial Dry Meter Reading = 653.830

Final Dry Meter Reading = 673.805 Difference = 19.975

Initial Wet Test Meter Reading = Ø

Final Wet Test Meter Reading = 18.67 Difference = 18.67

Dry Meter Temperatures, °F

Min	In	Out
0	85	72
10	87	73
20	98	78
30	104	83

Average 85

Wet Meter Temperatures, °F

Min	Temp
0	69
10	69
20	69
30	69

Average 69

Pressure Dry Meter ΔH 1.2

Pressure Wet Test Meter ΔH .1

$$\frac{V_w \cdot (P_b + P_B)}{t_w + 460} = C \cdot \frac{V_m \cdot (P_b + P_A)}{T_m + 460}$$

NOZZLE CALIBRATION DATA FORM

Date June 5, 1986 Calibrated by MTT

Nozzle identification number	Nozzle Diameter[a]			ΔD,[b] mm (in.)	D_{avg}[c]
	D_1, mm (in.)	D_2, mm (in.)	D_3, mm (in.)		
(A) 6.4 mm S.S.	6.10	6.08	6.12	0.04	6.10
(B) 6.4 mm S.S.	6.08	6.12	6.08	0.04	6.09
(C) 6.4 mm S.S.	6.28	6.36	6.30	0.08	6.31
(D) 9.5 mm S.S.	9.26	9.26	9.28	0.02	9.27
(E) 9.5 mm S.S.	9.40	9.46	9.44	0.06	9.43
(F) 9.5 mm S.S.	9.38	9.44	9.42	0.06	9.41
(G) 13 mm S.S.	12.42	12.48	12.50	0.08	12.47
(H) 13 mm S.S.	12.28	12.30	12.36	0.08	12.31
(I) 13 mm S.S.	12.62	12.58	12.56	0.06	12.59

where:

[a] $D_{1,2,3}$ = three different nozzles diameters, mm (in.); each diameter must be within (0.025 mm) 0.001 in.

[b] ΔD = maximum difference between any two diameters, mm (in.), $\Delta D \leq$ (0.10 mm) 0.004 in.

[c] D_{avg} = average of D_1, D_2, and D_3.

ANALYTICAL BALANCE CALIBRATION FORM

Balance name Mettler Number Ae 163

Classification of standard weights class P

Date	0.500 g	1.0000 g	10.0000 g	50.0000 g	100.0000 g	Analyst
7/21/86	0.5000	1.0000	10.0002	50.0003	100.0002	MTT

Quality Assurance Handbook M5-5.2

Date August 19 1986 Thermocouple number Meter 5 - 2

Ambient temperature 63 °C Barometric pressure 30.09 in. Hg

Calibrator MTT Reference: mercury-in-glass ASTM 56F

other ASTM 69F

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
212 °F	Boiling H_2O	212°F	STACK = 212 Probe = 212	-0.2 -0.2
—	Boiling oil	431°F	Probe = 434 STACK = 434	-0.3 -0.3

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

Figure 2.10 Stack temperature sensor calibration data form.

Date August 19 1986 Thermocouple number METHOD 5-2

Ambient temperature 68 °C Barometric pressure 30.04 in. Hg

Calibrator MTT Reference: mercury-in-glass ASTM 66F
ASTM 69F

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
212°F	Boiling H2O	208.0°F	209 °F	-0.1
			208°F	-0.1
	Boiling O2	431 °F	433	-0.2
			433	-0.2

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right] 100 \leq 1.5\%$.

Figure 2.10 Stack temperature sensor calibration data form.

Date August 19 1986 Thermocouple number WAHL

Ambient temperature 68 °C Barometric pressure 30.0= in. Hg

Calibrator MTT Reference: mercury-in-glass ASTM 66°F
ASTM 69F

other

Reference point number[a]	Source[b] (specify)	Reference thermometer temperature, °C	Thermocouple potentiometer temperature, °C	Temperature difference,[c] %
212°=	Boiling H2O	210.9 °F	208 °F	0.3
—	300 °C	429 °F	426 °F	0.3

[a] Every 30°C (50°F) for each reference point.

[b] Type of calibration system used.

[c] $\left[\frac{(\text{ref temp, °C} + 273) - (\text{test thermom temp, °C} + 273)}{\text{ref temp, °C} + 273}\right]$ 100 ≤ 1.5%.

Figure 2.10 Stack temperature sensor calibration data form.

PETRO-CHEM ENVIRONMENTAL SERVICES

INSTRUMENT LINEARITY TEST

DATE: 8-6-86

OPERATOR: LAJ

MANUFACTURER: Thermo Electron

ANALYZER: NO/NOx

MODEL: 10

SERIAL #: 10AR-1515-153

CALIBRATION GASES: BAL 3270
AAL13665
AAL14186
JJ8391

INSTRUMENT RANGE: 0-1000

INSTRUMENT MODE SETTING: NOx

GAS VALUE (Calibration)	INSTRUMENT VALUE	% ACCURACY
782.4	782.4	100.0
289.4	287	99.2
99.94	99.6	99.7
47.7	47.0	98.5
	AVG.	99.4

PETRO-CHEM ENVIRONMENTAL SERVICES

INSTRUMENT LINEARITY TEST

DATE: 8-6-86

OPERATOR: LAJ

MANUFACTURER: THERMO ELECTRON

ANALYZER: CO

MODEL: #48

SERIAL #: 48-17394-169

CALIBRATION GASES: AAL13665
1C50189
JJ8391
AAL14186

INSTRUMENT RANGE: 0-100

INSTRUMENT MODE SETTING: CO (5-5)

GAS VALUE (Calibration)	INSTRUMENT VALUE	% ACCURACY
75.0	75.0	100.0
62.7	62.0	98.9
48.5	47.9	98.8
25.0	25.2	100.8
	AVG.	99.6

PETRO-CHEM ENVIRONMENTAL SERVICES

INSTRUMENT LINEARITY TEST

DATE: 8-6-86

OPERATOR: LAJ

MANUFACTURER: THERMO ELECTRON

ANALYZER: #10

MODEL: 10A/R-1515-153

SERIAL #:

CALIBRATION GASES: AAL14186
JJ8391

INSTRUMENT RANGE: 0-250

INSTRUMENT MODE SETTING: NOx

GAS VALUE (Calibration)	INSTRUMENT VALUE	% ACCURACY
99.94	99.9	100.0
47.7	47.2	99.0
	Avg.	99.5

PETRO-CHEM ENVIRONMENTAL SERVICES

INSTRUMENT LINEARITY TEST

DATE: 8-6-86

OPERATOR: LAJ

MANUFACTURER: Teledyne

ANALYZER: O_2

MODEL: 320AX

SERIAL #: 50840

CALIBRATION GASES: Ambient Air
Hopper 7.09%

INSTRUMENT RANGE: 0-25%

INSTRUMENT MODE SETTING: O_2

GAS VALUE (Calibration)	INSTRUMENT VALUE	% ACCURACY
20.9	20.9	100.0
7.09	7.20	101.6
	Avg.	100.8

PETRO-CHEM ENVIRONMENTAL SERVICES

INSTRUMENT LINEARITY TEST

DATE: 4/24/86

OPERATOR: A. Winkler

MANUFACTURER: TECO

ANALYZER: NO/NOx

MODEL: 10

SERIAL #:

CALIBRATION GASES: Tank #FF17479

HIGH CONCENTRATION: 3014

LOW CONCENTRATION:

DILUTION GAS: Zero Grade Nz

INSTRUMENT RANGE: 0-2500

INSTRUMENT MODE SETTING: NOx

GAS BLENDER SETTINGS:		INSTRUMENT RESULTS		
Blend Gas (L/Min)	Dilution Gas (L/Min)	Blended Value	Instrument Value	% Deviation
0.0	2.0	0.0	0.0	
2.0	0.0	3014	3014	
1.6	0.4	2411	2386	99.0
1.2	0.8	1808	1808	100.0
0.8	1.2	1205	1225	101.7
0.4	1.6	603	617	102.3
0.0	2.0	0.0	0.0	
2.0	0.0	3014	3014	

AVERAGE 100.7

PETRO-CHEM ENVIRONMENTAL SERVICES

INSTRUMENT LINEARITY TEST

DATE: 4/2/86

OPERATOR: Andy Winkler

MANUFACTURER: Thermo Electron

ANALYZER: NO/NOx

MODEL: IC

SERIAL #: 10A/R-17380-169

CALIBRATION GASES: EPA Protocol 1

HIGH CONCENTRATION: 723 ppm NOx

LOW CONCENTRATION:

DILUTION GAS: N_2 (zero grade)

INSTRUMENT RANGE: 0-1000 ppm

INSTRUMENT MODE SETTING: Converter Temp. @ 700° C.

GAS BLENDER SETTINGS:

INSTRUMENT RESULTS

Blend Gas (L/Min)	Dilution Gas (L/Min)	Blended Value	Instrument Value	% Deviation
0.0	2.0	723	720	
2.0	0.0	0		
0.4	1.6	578	577	99.8
0.8	1.2	434	435	100.2
1.0	1.0	361	365	101.1
1.2	0.8	289	290	100.3
1.6	0.4	145	147	101.4
2.0	0.0		0	
0.0	2.0		720	
			AVERAGE	100.6

SCOTT-MARRIN, INC.
2001 THIRD ST. • UNIT H • RIVERSIDE, CA 92507
TELEPHONE (714) 784-1240

REPORT OF ANALYSIS

TO: Ron Zurlinden
Ogden Projects, Inc.
1301 Canal Blvd.
Richmond, CA 94804

DATE: 27 May 1986

CUSTOMER ORDER NUMBER: SF-11-486 5002 Partial

CYLINDER NUMBER JJ8391

COMPONENT	CONCENTRATION(v/v)
Nitric Oxide	47.7 ± 0.5 ppm
Sulfur Dioxide	47.2 ± 0.9 ppm
Carbon Monoxide	48.5 ± 0.5 ppm
Carbon Dioxide	9.87 ± 0.10 mole %
Nitrogen	Balance

(The Nitric Oxide analysis is traceable to the National Bureau of Standards SRM 1683a,)
(Cylinder Number CAL2574.)

(The Sulfur Dioxide analysis is traceable to the National Bureau of Standards SRM 1693,)
(Cylinder Number CAL6740.)

(The Carbon Monoxide analysis is traceable to the National Bureau of Standards SRM 2614a)
(Cylinder Number CAL3308.)

(The Carbon Dioxide analysis is traceable to the National Bureau of Standards SRM 1674b.)
(Cylinder Number CAL2806.

ANALYST J.W. Gay

APPROVED J.T. Marrin

SCOTT-MARRIN, INC.
2001 THIRD ST. • UNIT H • RIVERSIDE, CA 92507
TELEPHONE (714) 784-1240

REPORT OF ANALYSIS

TO: Ron Zurlinden
Ogden Products, Inc.
1301 Canal Blvd
Richmond, CA 94804

DATE: 10 June 1986

CUSTOMER ORDER NUMBER: 5002

CYLINDER NUMBER JJ597

COMPONENT	CONCENTRATION(v/v)
Methane	39.6 ± 0.4 ppm
Oxygen*	10%
Carbon Dioxide*	10%
Nitrogen	Balance

*Unanalyzed

CYLINDER NUMBER _____

COMPONENT	CONCENTRATION(v/v)

CYLINDER NUMBER _____

COMPONENT	CONCENTRATION(v/v)

(The Methane analysis is traceable to the National Bureau of Standards analyzed)
(Cylinder Number L2293 under Report Number 3100630.)

ANALYST J. W. Gay

APPROVED J. T. Marrin

VIII. Conclusions

VII. Conclusions

The results from the Walter B. Hall Resource Recovery Facility Compliance test program are summarized in Section II. For comparison, the permitted levels of emissions, as per condition 1 in the Authority to Construct, are also presented in Section II.

The boiler capacities were calculated in terms of percent of design steam flow rate and all testing occurred with Boiler Capacities at, or near, capacity load as shown in Section V.

Seasonal increases of plant material in the fuel could have resulted in elevated MSW fuel nitrogen content. Higher fuel nitrogen levels would raise NO_x levels in the combustion gas and, compared with recent testing of similar facilities of the Martin GmbH stoker/boiler design, the average NO_x levels were higher at the Tulsa Resource Recovery Facility.

A bi-annual air emissions test for SO_2 will be performed in January 1987 to meet condition 6 of the TCCHD permit to Construct No. T84-23. During this time NO_x emissions should be more representative of normal operating conditions. Along with the SO_2 emission testing, continuous emission monitoring equipment will be operated at this time for determining NO_x levels in the flue gas.

Total Suspended Particulate (TSP) was derived by analyzing both the front- and back-half (condensible) sections of the U.S. EPA Method 5 train. After dessication, the back-half impinger liquid was reconstituted to determine the proportion of non-sulfate particulate, sulfates and chlorides. As shown in Section III, the residue consisted primarily of sulfates. A direct comparison of sulfate results with the condensible particulate results in Section II indicates that from 80% to 100% of the condensible particulate is sulfate. Thus, only very minor amounts of either sub-micron particles or condensible hydrocarbons could be passing through the U.S. EPA Method 5 filter and reporting out as condensible particulate, especially since the THC readings were normally less than or equal to 1 ppm.

The emissions of PCDDs and PCDFs are the lowest reporting for a major, mass-fired, waterwall stoker/boiler in the United States and would meet the new, 1986 Swedish guidelines for existing stationary sources of dioxin.

The emission of Hg, although slightly higher than the permit limit, is close to the Hg emission factor based on worldwide testing of many MSW-fired boilers.

As for HCl emissions, the average level for this testing is below the worldwide average from the same database. In addition, the SO_3 + H_2SO_4 emissions, while higher than the permit limit, are typical of the $SO_2/SO_3+H_2SO_4$ ratios measured at other MSW-fired boilers.