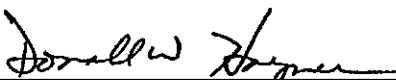


**Emission Test Report**  
for one  
**ABUTEC 11.5 MW**  
**Unit Number 11.5 MW (39 MMBtu/hr) (S/N 2011.204.0004)**  
located at the  
**ABUTEC**  
**Soddy-Daisy Plant**  
Soddy-Daisy, Hamilton County, Tennessee

Prepared for  
**Shell**  
**P.O. Box 576**  
**Houston, TX 77001**

**March 6-7, 2012**  
**Nordon Project No. 12-0067**  
**Report Revision 1.5**

I certify, based on the information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete.

  
Donald W. Haynes  
Nordon Corporation

  
Shell

**NORDON** CORPORATION

LaDEQ LELAP Certification Number 02092

P. O. Box 1415 Round Rock, Texas 78680  
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## **Section 1: INTRODUCTION**

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### **1.1 Summary of Test Program**

Exhaust emission testing was performed on one (1) ABUTEC 11.5 MW (Unit # 11.5 MW (39 MMBtu/hr) (S/N 2011.204.0004)) located at the ABUTEC, Soddy-Daisy Plant. The Soddy-Daisy Plant is located near Soddy-Daisy, Hamilton County, Tennessee. Nordon Corporation of Round Rock, Texas, performed the exhaust emission testing on March 6-7, 2012.

This emission testing was performed to determine the mass emission rates of NO<sub>x</sub>, CO, and THC and to determine THC destruction/reduction efficiency by measuring inlet flow rate and composition. The test methods used followed the principles and procedures set forth in the Code of Federal Regulations, Title 40, Part 60, Appendix A Methods 1, 19 and ASTM D 6348-03.

**1.1.1 Owner/Operator:** Shell  
P.O. Box 576  
Houston, TX 77001

**1.1.2 Test Contractor:** Nordon Corporation  
P.O. Box 1415  
Round Rock, Texas 78680  
Attn: Don Haynes  
Phone: (512) 355-3786  
Fax: (512) 355-3785

**1.1.3 Purpose of Test:** To measure concentrations and mass emission rates of NO<sub>x</sub>, CO, and THC as well as THC destruction efficiency.

**1.1.4 Applicable Regulations:**

**1.1.5 Name of Plant:** Soddy-Daisy Plant

**1.1.6 Location:** near Soddy-Daisy, Hamilton County, Tennessee.

**1.1.7 Unit Tested:** One ABUTEC 11.5 MW used to control THC emissions. The unit is designated as Unit # 11.5 MW (39 MMBtu/hr) (S/N 2011.204.0004).

**1.1.8 Test Dates:** March 6-7, 2012

**1.1.9 List of Analytes:** NO<sub>x</sub> (nitrogen oxides), CO (carbon monoxide), THC (total unburned hydrocarbons), CO<sub>2</sub> (carbon dioxide) and O<sub>2</sub> (oxygen) and inlet gas composition. One inlet sample of propane and one inlet sample of propylene were taken during the test.

**Table 3-3: Summary of Results - Propane Fuel - Full Capacity**



P.O. Box 1415 Round Rock, Texas 78680  
Phone (512) 355-3786 Fax (512) 355-3785

Plant: Soddy-Daisy Plant  
Facility Owner: ABUTEC  
Unit Owner: ABUTEC  
Location: Soddy-Daisy, Hamilton County, Tennessee  
Unit Make/Model: ABUTEC 11.5 MW Combustor  
Unit Number: 11.5 MW, Ser. No. 2011.204.0004  
Test Personnel: DWH / HSJ  
Date: March 6, 2012

Run Number	DH-30612.01	DH-30612.02	DH-30612.03	
Start Time	17:45	18:56	20:06	
Stop Time	18:45	18:56	21:06	
<b>Combustor Operation</b>				
Rated Capacity (MMBtu/hr)	39.25	39.25	39.25	
Percent of Rated Capacity (%)	106.2	106.0	105.4	
Fuel Gas Pressure (psia)	24.29	24.30	24.30	
Fuel Gas Temperature (°C)	41.4	40.3	41.3	
Fuel Gas Flow Rate, Turbine Meter (acfm)	181.323	180.333	179.921	
Inlet Gas Flow Rate, Turbine Meter (scfm)	279.42	278.92	277.41	
Inlet Gas Flow Rate, Turbine Meter (scfh)	16765	16735	16645	
Inlet Gas Flow Rate, Turbine Meter (Mscfd)	402.4	401.6	399.5	
Mid-Stack Temperature (°C)	873	875	885	
Mid-Stack Temperature (°F)	1604	1608	1625	
Upper-Stack Temperature (°C)	775	778	787	
Upper-Stack Temperature (°F)	1427	1432	1448	
Inlet VOC (propane) Mass Rate (lb/hr)	1848.4	1841.4	1831.4	
<b>Ambient Conditions</b>				
Barometric Pressure (absolute In. Hg)	29.63	29.64	29.64	
Temperature Dry (°F)	63	57	55	
Temperature Wet (°F)	45	42	42	
Humidity (lb H <sub>2</sub> O/lb Air)	0.0022	0.0022	0.0026	
<b>Exhaust Flow Data</b>				
Stoichiometric Exhaust Flow (dscfh)	1.21E+06	1.20E+06	1.16E+06	
O <sub>2</sub> F factor (dscf/MMBtu)	8912	8912	8912	
O <sub>2</sub> F factor (wscf/MMBtu)	10554	10554	10554	
Fuel Heating Value (Gross Btu/scf)	2486	2486	2486	
Heat Input (MMBtu/hr), Turbine Meter	41.68	41.61	41.38	
<b>Exhaust Gas Concentrations</b>				<b>AVERAGES</b>
NO <sub>x</sub> (ppmv, dry)	54.1	54.8	53.7	<b>54</b>
CO (ppmv, dry)	3.4	2.9	2.6	<b>3.0</b>
CO (ppmv, dry @ 3% CO <sub>2</sub> )	2.4	2.1	1.8	<b>2.1</b>
THC (ppmv wet as C <sub>3</sub> )	0.35	0.35	0.35	<b>0.35</b>
THC (ppmv wet as C <sub>3</sub> @ 3% CO <sub>2</sub> )	0.27	0.27	0.26	<b>0.26</b>
THC (ppmv dry as C <sub>3</sub> )	0.38	0.38	0.38	<b>0.38</b>
O <sub>2</sub> (% , dry; F <sub>o</sub> calc.)	14.5	14.4	14.3	<b>14.4</b>
CO <sub>2</sub> (% , dry)	4.2	4.2	4.3	<b>4.3</b>
Stack Moisture (%)	5.5	5.6	5.6	<b>5.6</b>
<b>Mass Emission Rates (Stoichiometric Exhaust flow-based)</b>				
NO <sub>x</sub> (lb/hr)	7.85	7.83	7.46	<b>7.71</b>
CO (lb/hr)	0.30	0.26	0.22	<b>0.26</b>
THC (lb/hr)	0.052	0.051	0.050	<b>0.051</b>
NO <sub>x</sub> (lb/MMBtu)	0.19	0.19	0.18	<b>0.19</b>
CO (lb/MMBtu)	0.0071	0.0061	0.0052	<b>0.0062</b>
THC (lb/MMBtu)	0.0012	0.0012	0.0012	<b>0.0012</b>
Combustor THC DRE (%)	99.997	99.997	99.997	<b>99.997</b>

*Concentrations in italics represent Minimum Detection Limit (MDL)*

**Table 3-4: Summary of Results - Propane Fuel - Multiple Capacities**



P.O. Box 1415 Round Rock, Texas 78680  
Phone (512) 355-3786 Fax (512) 355-3785

Plant: Soddy-Daisy Plant  
Facility Owner: ABUTEC  
Unit Owner: ABUTEC  
Location: Soddy-Daisy, Hamilton County, Tennessee  
Unit Make/Model: ABUTEC 11.5 MW Combustor  
Unit Number: 11.5 MW, Ser. No. 2011.204.0004  
Test Personnel: DWH / HSJ  
Date: March 6, 2012

Run Number	DH-030612.04	DH-030612.05	DH-030612.06	DH-030612.07	DH-030612.08	DH-030612.09	DH-030612.10
Start Time	21:25	21:42	22:13	22:42	23:06	23:24	23:45
Stop Time	21:35	21:52	22:23	22:52	23:16	23:34	23:55
<b>Combustor Operation</b>							
Rated Capacity (MMBtu/hr)	39.25	39.25	39.25	39.25	39.25	39.25	39.25
Percent of Rated Capacity (%)	93.7	84.2	73.7	63.2	52.6	42.4	32.5
Fuel Gas Pressure (psia)	24.45	24.59	24.73	24.87	25.02	25.14	25.27
Fuel Gas Temperature (°C)	42.9	42.9	44.0	43.6	39.9	44.2	42.1
Fuel Gas Flow Rate, Turbine Meter (acfm)	159.750	142.754	124.632	106.163	86.718	70.536	53.470
Inlet Gas Flow Rate, Turbine Meter (scfm)	246.64	221.63	193.87	166.34	138.28	111.50	85.54
Inlet Gas Flow Rate, Turbine Meter (scfh)	14798	13298	11632	9980	8297	6690	5133
Inlet Gas Flow Rate, Turbine Meter (Mscfd)	355.2	319.1	279.2	239.5	199.1	160.6	123.2
Mid-Stack Temperature (°C)	831	800	754	735	697	677	578
Mid-Stack Temperature (°F)	1527	1472	1390	1355	1287	1251	1073
Upper-Stack Temperature (°C)	738	716	676	661	627	619	529
Upper-Stack Temperature (°F)	1360	1320	1249	1221	1161	1147	985
Inlet VOC (propane) Mass Rate (lb/hr)	1628.3	1463.1	1279.9	1098.1	912.9	736.1	564.7
<b>Ambient Conditions</b>							
Barometric Pressure (absolute In. Hg)	29.66	29.66	29.66	29.90	29.67	29.67	29.67
Temperature Dry (°F)	55	55	54	53	51	50	48
Temperature Wet (°F)	42	42	42	41	40	40	38
Humidity (lb H <sub>2</sub> O/lb Air)	0.0026	0.0026	0.0029	0.0026	0.0027	0.0029	0.0025
<b>Exhaust Flow Data</b>							
Stoichiometric Exhaust Flow (dscfh)	1.06E+06	9.97E+05	9.70E+05	9.08E+05	8.31E+05	6.50E+05	5.54E+05
O <sub>2</sub> F factor (dscf/MMBtu)	8912	8912	8912	8912	8912	8912	8912
O <sub>2</sub> F factor (wscf/MMBtu)	10554	10554	10554	10554	10554	10554	10554
Fuel Heating Value (Gross Btu/scf)	2486	2486	2486	2486	2486	2486	2486
Heat Input (MMBtu/hr), Turbine Meter	36.79	33.06	28.92	24.81	20.63	16.63	12.76
<b>Exhaust Gas Concentrations</b>							
NO <sub>x</sub> (ppmv, dry)	52.6	48.8	42.0	37.3	32.2	31.1	26.0
CO (ppmv, dry)	4.6	8.6	19.3	31.9	37.4	34.5	32.2
CO (ppmv, dry @ 3% CO <sub>2</sub> )	3.3	6.4	15.9	28.7	37.1	33.2	34.4
THC (ppmv wet as C <sub>3</sub> )	0.35	0.35	0.35	0.75	2.48	1.21	3.87
THC (ppmv wet as C <sub>3</sub> @ 3% CO <sub>2</sub> )	0.27	0.28	0.31	0.70	2.56	1.21	4.30
THC (ppmv dry as C <sub>3</sub> )	0.38	0.37	0.37	0.78	2.59	1.26	4.03
O <sub>2</sub> (% , dry; F <sub>o</sub> calc.)	14.4	14.7	15.3	15.8	16.3	16.1	16.6
CO <sub>2</sub> (% , dry)	4.2	4.0	3.6	3.3	3.0	3.1	2.8
Stack Moisture (%)	5.6	5.4	4.9	4.5	4.2	4.3	3.9
<b>Mass Emission Rates (Stoichiometric Exhaust flow-based)</b>							
NO <sub>x</sub> (lb/hr)	6.65	5.80	4.87	4.04	3.19	2.42	1.72
CO (lb/hr)	0.35	0.62	1.36	2.11	2.26	1.63	1.30
THC (lb/hr)	0.045	0.043	0.041	0.081	0.25	0.09	0.25
NO <sub>x</sub> (lb/MMBtu)	0.18	0.18	0.17	0.16	0.15	0.15	0.13
CO (lb/MMBtu)	0.010	0.019	0.047	0.085	0.110	0.098	0.102
THC (lb/MMBtu)	0.0012	0.0013	0.0014	0.0033	0.0119	0.0056	0.0200
Combustor THC DRE (%)	99.997	99.997	99.997	99.993	99.973	99.987	99.955

Concentrations in italics represent Minimum Detection Limit (MDL)