

# **Cogeneration Facility 2012 Annual Air Emissions Inventory**

**The University of North Carolina at Chapel Hill  
Chapel Hill, North Carolina**

**Facility ID # 6800043  
Permit # 03069T31**

*Prepared for:*

**The University of North Carolina at Chapel Hill**  
Department of Environment, Health, and Safety  
1120 Estes Drive Extension  
Chapel Hill, North Carolina 27599-1650

*Prepared by:*

**RST Engineering**  
5416 Orchard Oriole Trail  
Wake Forest, North Carolina 27587-6770

**June 2013**

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# The University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

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## 2012 Cogeneration Emissions Inventory

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ES-3.1 - ES-3.5	Silo Conveyors
T-001	Fuel Oil Storage Tank
T-002	Fuel Oil Storage Tank
ES-001	Boiler #6 <ul style="list-style-type: none"><li>- No. 2 Fuel Oil Firing</li><li>- Wood Pellet Firing</li><li>- Coal Firing</li><li>- Natural Gas Firing</li><li>- No. 6 Fuel Oil Firing</li></ul>
ES-002	Boiler #7 <ul style="list-style-type: none"><li>- Wood Pellet Firing</li><li>- No. 2 Fuel Oil Firing</li><li>- Coal Firing</li><li>- Natural Gas Firing</li><li>- No. 6 Fuel Oil Firing</li></ul>
ES-003	Boiler #8 <ul style="list-style-type: none"><li>- Natural Gas Firing</li><li>- No. 2 Fuel Oil Firing</li></ul>
ES-010A	Coal Crusher/Conveyor Building
ES-030	Ash Silo with Loadout
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IS-53	Enclosed Sorbent Railcar Dump Pit

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Cogeneration Boilers

#### Seasonal Fuel Usage Breakdown

Month	Boiler #6				Boiler #7				Boiler #8	
	Coal (tons)	Wood(tons)	Gas (1,000cf)	Oil (gallons)	Coal (tons)	Wood(tons)	Gas (1,000cf)	Oil (gallons)	Gas (1,000cf)	Oil (gallons)
December 2012	4,769	0	28,959	0	1,315	0	17,062	0	9,569	0
January 2012	3,553	0	26,822	0	4,018	0	16,478	0	621	0
February 2012	3,305	0	18,928	0	3,582	0	12,292	0	7,710	0
<i>1st Quarter Total</i>	<i>11,626</i>	<i>0</i>	<i>74,708</i>	<i>0</i>	<i>8,915</i>	<i>0</i>	<i>45,831</i>	<i>0</i>	<i>17,900</i>	<i>0</i>
March 2012	3,533	16	9,060	0	1,720	0	3,380	0	7,530	0
April 2012	3,291	0	16,916	0	0	0	80	0	7,794	0
May 2012	2,642	0	20,542	0	1,941	0	24,872	0	1,947	0
<i>2nd Quarter Total</i>	<i>9,466</i>	<i>16</i>	<i>46,518</i>	<i>0</i>	<i>3,661</i>	<i>0</i>	<i>28,332</i>	<i>0</i>	<i>17,271</i>	<i>0</i>
June 2012	2,967	0	20,762	0	2,136	0	23,888	0	0	0
July 2012	2,350	0	16,118	0	3,738	0	18,975	0	10,047	0
August 2012	2,425	0	12,819	0	2,615	0	27,907	0	5,355	0
<i>3rd Quarter Total</i>	<i>7,741</i>	<i>0</i>	<i>49,699</i>	<i>0</i>	<i>8,489</i>	<i>0</i>	<i>70,770</i>	<i>0</i>	<i>15,402</i>	<i>0</i>
September 2012	3,678	0	16,738	0	2,161	0	11,946	0	1,216	0
October 2012	202	0	1,465	0	5,327	0	10,335	0	2,061	0
November 2012	1,455	0	892	0	4,185	0	12,768	0	41,819	0
<i>4th Quarter Total</i>	<i>5,334</i>	<i>0</i>	<i>19,095</i>	<i>0</i>	<i>11,673</i>	<i>0</i>	<i>35,049</i>	<i>0</i>	<i>45,096</i>	<i>0</i>
<b>2012 TOTAL</b>	<b>34,168</b>	<b>16</b>	<b>190,020</b>	<b>0</b>	<b>32,737</b>	<b>0</b>	<b>179,982</b>	<b>0</b>	<b>95,669</b>	<b>0</b>

#### Seasonal Btu Breakdown

Coal (btu/lb)	13,018	Wood (btu/lb)	8,185	Natural Gas (btu/ft <sup>3</sup> )	1,030	Fuel Oil (btu/gal)	139,043
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Month	Boiler #6				Boiler #7				Boiler #8	
	Coal	Wood	Gas	Oil	Coal	Wood	Gas	Oil	Gas	Oil
December 2012	1.24E+11	0.00E+00	2.98E+10	0.00E+00	3.42E+10	0.00E+00	1.76E+10	0.00E+00	9.86E+09	0.00E+00
January 2012	9.25E+10	0.00E+00	2.76E+10	0.00E+00	1.05E+11	0.00E+00	1.70E+10	0.00E+00	6.40E+08	0.00E+00
February 2012	8.60E+10	0.00E+00	1.95E+10	0.00E+00	9.32E+10	0.00E+00	1.27E+10	0.00E+00	7.94E+09	0.00E+00
<i>1st Quarter Total</i>	<i>3.03E+11</i>	<i>0.00E+00</i>	<i>7.69E+10</i>	<i>0.00E+00</i>	<i>2.32E+11</i>	<i>0.00E+00</i>	<i>4.72E+10</i>	<i>0.00E+00</i>	<i>1.84E+10</i>	<i>0.00E+00</i>
March 2012	9.20E+10	2.62E+08	9.33E+09	0.00E+00	4.48E+10	0.00E+00	3.48E+09	0.00E+00	7.76E+09	0.00E+00
April 2012	8.57E+10	0.00E+00	1.74E+10	0.00E+00	0.00E+00	0.00E+00	8.24E+07	0.00E+00	8.03E+09	0.00E+00
May 2012	6.88E+10	0.00E+00	2.12E+10	0.00E+00	5.05E+10	0.00E+00	2.56E+10	0.00E+00	2.01E+09	0.00E+00
<i>2nd Quarter Total</i>	<i>2.46E+11</i>	<i>2.62E+08</i>	<i>4.79E+10</i>	<i>0.00E+00</i>	<i>9.53E+10</i>	<i>0.00E+00</i>	<i>2.92E+10</i>	<i>0.00E+00</i>	<i>1.78E+10</i>	<i>0.00E+00</i>
June 2012	7.72E+10	0.00E+00	2.14E+10	0.00E+00	5.56E+10	0.00E+00	2.46E+10	0.00E+00	0.00E+00	0.00E+00
July 2012	6.12E+10	0.00E+00	1.66E+10	0.00E+00	9.73E+10	0.00E+00	1.95E+10	0.00E+00	1.03E+10	0.00E+00
August 2012	6.31E+10	0.00E+00	1.32E+10	0.00E+00	6.81E+10	0.00E+00	2.87E+10	0.00E+00	5.52E+09	0.00E+00
<i>3rd Quarter Total</i>	<i>2.02E+11</i>	<i>0.00E+00</i>	<i>5.12E+10</i>	<i>0.00E+00</i>	<i>2.21E+11</i>	<i>0.00E+00</i>	<i>7.29E+10</i>	<i>0.00E+00</i>	<i>1.59E+10</i>	<i>0.00E+00</i>
September 2012	9.57E+10	0.00E+00	1.72E+10	0.00E+00	5.63E+10	0.00E+00	1.23E+10	0.00E+00	1.25E+09	0.00E+00
October 2012	5.25E+09	0.00E+00	1.51E+09	0.00E+00	1.39E+11	0.00E+00	1.06E+10	0.00E+00	2.12E+09	0.00E+00
November 2012	3.79E+10	0.00E+00	9.19E+08	0.00E+00	1.09E+11	0.00E+00	1.32E+10	0.00E+00	4.31E+10	0.00E+00
<i>4th Quarter Total</i>	<i>1.39E+11</i>	<i>0.00E+00</i>	<i>1.97E+10</i>	<i>0.00E+00</i>	<i>3.04E+11</i>	<i>0.00E+00</i>	<i>3.61E+10</i>	<i>0.00E+00</i>	<i>4.64E+10</i>	<i>0.00E+00</i>
<b>2012 TOTAL</b>	<b>8.90E+11</b>	<b>2.62E+08</b>	<b>1.96E+11</b>	<b>0.00E+00</b>	<b>8.52E+11</b>	<b>0.00E+00</b>	<b>1.85E+11</b>	<b>0.00E+00</b>	<b>9.85E+10</b>	<b>0.00E+00</b>

#### Seasonal Total Fuel Usage (%)

	Boiler #6	Boiler #7	Boiler #8
Dec., Jan., Feb.	34.97	26.92	18.71
Mar., Apr., May	27.14	12.00	18
June, July, Aug.	23.28	28.32	16.10
Sept., Oct., Nov.	14.61	32.77	47.14
	100	100	100

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Coal Usage Breakdown

Month	Boiler #6 Coal (tons)	Boiler #7 Coal (tons)
December 2012	4,769	1,315
January 2012	3,553	4,018
February 2012	3,305	3,582
<i>1st Quarter Total</i>	<b><i>11,626</i></b>	<b><i>8,915</i></b>
March 2012	3,533	1,720
April 2012	3,291	0
May 2012	2,642	1,941
<i>2nd Quarter Total</i>	<b><i>9,466</i></b>	<b><i>3,661</i></b>
June 2012	2,967	2,136
July 2012	2,350	3,738
August 2012	2,425	2,615
<i>3rd Quarter Total</i>	<b><i>7,741</i></b>	<b><i>8,489</i></b>
September 2012	3,678	2,161
October 2012	202	5,327
November 2012	1,455	4,185
<i>4th Quarter Total</i>	<b><i>5,334</i></b>	<b><i>11,673</i></b>
<b>2012 TOTAL</b>	<b>34,168</b>	<b>32,737</b>

**Facility-Wide Coal Usage                  66,905                  Tons/year**

### Seasonal Coal Usage (%)

	Boiler #6	Boiler #7	Average (%)
<b>Dec., Jan., Feb.</b>	34.03%	27.23%	30.63%
<b>Mar., Apr., May</b>	27.70%	11.18%	19.44%
<b>June, July, Aug.</b>	22.66%	25.93%	24.29%
<b>Sept., Oct., Nov.</b>	15.61%	35.66%	25.63%
	100%	100%	100%

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Blackstart Generator Fuel Usage Breakdown

Month	DG1 & DG2 #2 Oil (gallons)
December 2012	0
January 2012	211
February 2012	736
<i>1st Quarter Total</i>	<b>946</b>
March 2012	446
April 2012	222
May 2012	272
<i>2nd Quarter Total</i>	<b>941</b>
June 2012	160
July 2012	0
August 2012	172
<i>3rd Quarter Total</i>	<b>332</b>
September 2012	217
October 2012	197
November 2012	223
<i>4th Quarter Total</i>	<b>636</b>
<b>2012 TOTAL</b>	<b>2,855</b>

### Seasonal Oil Usage (%)

	DG1 & DG2
<b>Dec., Jan., Feb.</b>	33.14%
<b>Mar., Apr., May</b>	32.95%
<b>June, July, Aug.</b>	11.62%
<b>Sept., Oct., Nov.</b>	22.29%
	100%

**The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

**2012 Annual Emissions Inventory**

**DG No.1 and No.2 - Two 2,000 kW Generators  
Cogeneration Facility**

**(ES-007 & ES-008)**

<b>Emission Source/Operating Scenario Data</b> Page 1 of 3		Facility ID #: <b>6800043</b>					
<i>Emergency Generators Classified as Insignificant Sources</i>		Permit #: <b>03069T31</b>					
Facility Name: <u>University of North Carolina at Chapel Hill</u>		County: <b>Orange</b>					
		DAQ Region: <b>Raleigh</b>					
<b>North Carolina Department of Environment and Natural Resources</b> <b>Division of Air Quality</b> <b>Air Pollutant Point Source Emissions Inventory - Calendar Year 2012</b>							
1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-007 & ES-008					
2. Emission Source Description		Two Blackstart Generators located at Cogeneration Facility					
3. Operating Scenario Description		Operating Scenario #1 - No. 2 Fuel Oil					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		270 gal/hr - 2 units					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		2,855	gallons/year, Total No. 2 Fuel Oil				
6. Fuel Information (if fuel used)		% Sulfur	0.08%				
		% Ash	N/A				
		Heat Content (Btu/lb or mmCF)	139,043 Btu/gallon				
If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.							
7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)		N/A					
8. Control Device Information, if none, write "none"							
	Control Device ID # (as listed in permit)	Control Device Description					
i. (nearest stack)	None	None					
ii.	None	None					
iii.	None	None					
iv.	None	None					
9. Stack Information (sources vented to more than one stack use additional entry lines)							
Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)	
<b>Common Stack Parameters with 2-generators and Boiler No. 8 operating concurrently</b>							
Stk No.4	208	6	400	70	118,752	Vertical	
--	--	--	--	--	--	--	
10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)							
Hours/Day	N/A	Days/Week	N/A	Weeks/Year	N/A	Hours/Year	N/A
Typical Start & End Times in CY:				Start:	N/A	End:	N/A
11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)							
Jan-Feb, 2007 + Dec, 2007	33.1%	Mar-May	32.9%	June-Aug	11.6%	Sept-Nov	22.3%



Two-2,000 kW No.2 oil-fired generators

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-007 & ES-008

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	0.05	8	N/A
NOx	NOx	0.38	8	N/A
PM Total	PM	0.02	8	N/A
PM-2.5	PM-2.5	0.02	8	N/A
PM-10	PM-10	0.02	8	N/A
SO2	SO2	0.02	8	N/A
VOC	VOC	0.02	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Acetaldehyde	75-07-0	0.010	8	N/A
Acrolein	107-02-8	0.0031	8	N/A
Arsenic	ARSENICCPDS	0.0016	8	N/A
Benzene	71-43-2	0.31	8	N/A
Benzo(a)pyrene	50-32-8	0.00010	8	N/A
Beryllium	BERYLCPDS	0.00119	8	N/A
Cadmium	CADMIUMCPDS	0.00119	8	N/A
Chromium	CROMCPDS	0.0012	8	N/A
Formaldehyde	50-00-0	0.031	8	N/A
Lead	LEADCPDS	0.0036	8	N/A
Manganese	MANGCPDS	0.0024	8	N/A
Mercury	MERCCPDS	0.0012	8	N/A
Naphthalene	91-20-3	0.0516	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	32.36	8	N/A
Methane	CH <sub>4</sub>	1.31E-03	8	N/A
Nitrous Oxide	N <sub>2</sub> O	2.63E-04	8	N/A

Facility ID #: 6800043

Two-2,000 kW No.2 oil-fired generators

Permit #: 03069T31

County: Orange

Facility Name: University of North Carolina at Chapel Hill

DAQ Region: Raleigh

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

Emissions: Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-007 & ES-008

Table with 5 columns: Criteria (NAAQS) Pollutants, Pollutant Code, Emissions Criteria (Tons/Year), Emissions Estimation Method Code (see instructions for code), and Control Efficiency (Net after all controls). Rows include Carbon Monoxide, NOx, PM Total, PM-2.5, PM-10, SO2, VOC, HAP/TAP Pollutants (Nickel, PAH, Selenium, Toluene, Xylene), and Greenhouse Gas Pollutants (Carbon Dioxide, Methane, Nitrous Oxide).

Emissions and data on this form required to report or verify emissions cannot be held confidential.

To review instructions or get a blank copy, go to web page: http://daq.state.nc.us/Offices/Planning/Attainment/est.html

Copy and Use additional Sheets as needed.

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Blackstart Generators G1 & G2

(ES-007 & ES-008)

<b>Fuel Input Rates</b>	
Hourly Fuel Usage (gallons):	<b>270</b> (2-units)
Annual Fuel Usage (gallons):	<b>2,855</b> (2-units)
Fuel Sulfur Content (%)	<b>0.08</b>
<b>Heat Input Rates</b>	
Fuel Heating Values (Btu/gallon)	<b>139,043</b>
Hourly Fuel Usage (mmBtu):	37.54
Annual Fuel Usage (mmBtu):	396.97

70.00% CO control\*  
\*Cat. Oxydizer

<b>Emissions Output</b>				Emission Factor
<b>Criteria Pollutants</b>				(lb/mmBtu)
Pollutant	lb/hr	lb/yr	tpy	
PM	3.8E+00	4.0E+01	1.98E-02	1.00E-01
PM-10	3.8E+00	4.0E+01	1.98E-02	1.00E-01
PM-2.5	3.8E+00	4.0E+01	1.98E-02	1.00E-01
NOx	7.1E+01	7.5E+02	3.77E-01	1.90E+00
NMTOC, Total	3.1E+00	3.3E+01	1.63E-02	8.19E-02
CO	9.6E+00	1.0E+02	5.06E-02	2.55E-01
SO <sub>x</sub>	3.0E+00	3.2E+01	1.60E-02	8.08E-02
<b>Toxic/Hazardous Air Pollutants</b>				
Pollutant	lb/hr	lb/day	lb/yr	
Acetaldehyde	9.5E-04	2.3E-02	1.00E-02	2.52E-05
Acrolein	3.0E-04	7.1E-03	3.13E-03	7.88E-06
Arsenic	1.5E-04	3.6E-03	1.59E-03	4.00E-06
Benzene	2.9E-02	7.0E-01	3.08E-01	7.76E-04
Benzo(a)pyrene	9.6E-06	2.3E-04	1.02E-04	2.57E-07
Beryllium	1.1E-04	2.7E-03	1.19E-03	3.00E-06
Cadmium	1.1E-04	2.7E-03	1.19E-03	3.00E-06
Chromium	1.1E-04	2.7E-03	1.19E-03	3.00E-06
Formaldehyde	3.0E-03	7.1E-02	3.13E-02	7.89E-05
Lead	3.4E-04	8.1E-03	3.57E-03	9.00E-06
Manganese	2.3E-04	5.4E-03	2.38E-03	6.00E-06
Mercury	1.1E-04	2.7E-03	1.19E-03	3.00E-06
Naphthalene	4.9E-03	1.2E-01	5.16E-02	1.30E-04
Nickel	1.1E-04	2.7E-03	1.19E-03	3.00E-06
PAH	8.0E-03	1.9E-01	8.42E-02	2.12E-04
Selenium	5.6E-04	1.4E-02	5.95E-03	1.50E-05
Toluene	1.1E-02	2.5E-01	1.12E-01	2.81E-04
Xylene	7.2E-03	1.7E-01	7.66E-02	1.93E-04
<b>Greenhouse Gas Pollutants</b>				Em. Factor
Pollutant	lb/hr	lb/yr	tpy	(lb/mmBtu)
Carbon dioxide	6,121	64,726	32.36	163
Methane	2.5E-01	2.6E+00	1.31E-03	6.61E-03
Nitrous Oxide	5.0E-02	5.3E-01	2.63E-04	1.32E-03

Most emission factors are from DAQ spreadsheet for Large Stationary Diesel Engines >600 Hp.  
Greenhouse gas emission factors are from the Greenhouse Gas Reporting regulations.

**The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

**2012 Annual Emissions Inventory**

**Three Enclosed Railcar Dump Pits  
(ES-010)**

<b>Emission Source/Operating Scenario Data</b> Page 1 of 2	<b>Facility ID #:</b> 6800043
<b>Railcar Dump Pits</b>	<b>Permit #:</b> 03069T31
If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)	<b>County:</b> Orange
<b>Facility Name:</b> University of North Carolina at Chapel Hill	<b>DAQ Region:</b> Raleigh

**North Carolina Department of Environment and Natural Resources**  
**Division of Air Quality**  
**Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

<b>1. Emission Source ID No.</b> (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		<b>ES-010</b>
<b>2. Emission Source Description</b>	<b>Three Enclosed Railcar Dump Pits</b>	
<b>3. Operating Scenario Description</b>	N/A	
<b>4. Maximum Permitted Operating Rate</b> With Units (Ex. gal/hr, mmBtu/hr)	<b>350 tons/hr</b>	
<b>5. Throughput in CY</b> (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)	<b>67,329</b>	<b>tons/yr</b>
<b>6. Fuel Information</b> (if fuel used)	% Sulfur	N/A
	% Ash	N/A
	Heat Content (Btu/lb or mmCF)	N/A

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

<b>7. Capture Efficiency</b> (% Emissions from Emission Source Vented to Control Device or Stack)	<b>N/A</b>
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**8. Control Device Information**, if none, write "none"

	Control Device ID # <small>(as listed in permit)</small>	Control Device Description
<i>i. (nearest stack)</i>	N/A	<b>Enclosed Dump Pits</b>
<i>ii.</i>	<b>CD-018</b>	<b>Wet Spray Dust Suppression System</b>
<i>iii.</i>	N/A	N/A
<i>iv.</i>	N/A	N/A

**9. Stack Information** (sources vented to more than one stack use additional entry lines)

Stack ID #	Height <small>(in whole feet)</small>	Diameter (feet) <small>Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)</small>	Temperature <small>(F)</small>	Velocity <small>(feet/sec)</small>	Volume Flow Rate <small>(acfm)</small>	Release Point Description <small>(Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)</small>
<b>Fugitive</b>						
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**10. Operating Schedule** (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	<b>1.5</b>	Days/Week	<b>5</b>	Weeks/Year	<b>52</b>	Hours/Year	<b>390</b>
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

**11. Seasonal Periods Percent Annual Throughput** (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	<b>30.63%</b>	Mar-May	<b>19.44%</b>	June-Aug	<b>24.29%</b>	Sept-Nov	<b>25.63%</b>
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**Railcar Dump Pits**

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

**Facility ID #:** 6800043

**Permit #:** 03069T31

**County:** Orange

**DAQ Region:** Raleigh

**Facility Name:** University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

**Emission Source ID No.** (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-010

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	N/A	N/A	N/A
NOx	NOx	N/A	N/A	N/A
PM Total	PM	4.45E-03	2	67%
PM-2.5	PM-2.5	6.61E-04	2	40%
PM-10	PM-10	2.10E-03	2	63%
SO2	SO2	N/A	N/A	N/A
VOC	VOC	N/A	N/A	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Fugitive Losses from the unloading of coal from railcars into a dump pit.

(ES-010)

Boiler #6	-	Tons/yr
Boiler #7	-	Tons/yr
Total	67,329	Tons/yr

From section 13.2.4 of the AP-42, coal handling is well approximated by aggregate handling operations. The following equation represents the particulate emissions generated by the dropping of coal into the dump pit.

$$E = k (0.0032) \frac{(u/5)^{1.3}}{(m/2)^{1.4}}$$

E = Emission Factor (lb/ton)

k = Particle Size Multiplier

u = Mean Wind Speed (mph)

m = Material Moisture Content (%)

k Value	Particulate Size	Emission Factor (lb/ton)
0.74	PM	1.32E-04
0.35	PM-10	6.25E-05
0.11	PM-2.5	1.96E-05

Average moisture content of coal is 4.5%

The dump area is fully enclosed, therefore the minimum wind speed of 1.3 mph was used.

**Total Coal            67,329 tons/yr**

*Emissions from the unloading of coal:*

	Emission Factor (lb/ton)	Emissions (lb/yr)	Emissions (ton/yr)
PM	1.32E-04	8.89	4.45E-03
PM-10	6.25E-05	4.21	2.10E-03
PM-2.5	1.96E-05	1.32	6.61E-04

# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

**Coal Silos  
(ES-1, ES-2)**



<b>Emission Source/Operating Scenario Data</b> Page 1 of 2	<b>Facility ID #:</b> 6800043
<i>Coal Silos</i>	<b>Permit #:</b> 03069T31
If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)	<b>County:</b> Orange
<b>Facility Name:</b> University of North Carolina at Chapel Hill	<b>DAQ Region:</b> Raleigh

**North Carolina Department of Environment and Natural Resources**  
**Division of Air Quality**  
**Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

<b>1. Emission Source ID No.</b> (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)	<b>ES-1 and ES-2</b>						
<b>2. Emission Source Description</b>	<b>Two Coal Storage Silos</b>						
<b>3. Operating Scenario Description</b>	N/A						
<b>4. Maximum Permitted Operating Rate</b> With Units (Ex. gal/hr, mmBtu/hr)	<b>350 tons/hr</b>						
<b>5. Throughput in CY</b> (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)	<b>67,329 tons/yr</b>						
<b>6. Fuel Information</b> (if fuel used)	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">% Sulfur</td> <td style="width:15%;">N/A</td> <td style="width:15%;">% Ash</td> <td style="width:15%;">N/A</td> <td style="width:40%;">Heat Content (Btu/lb or mmCF)</td> <td style="width:10%;">N/A</td> </tr> </table>	% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A
% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A		

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

<b>7. Capture Efficiency</b> (% Emissions from Emission Source Vented to Control Device or Stack)	<b>100%</b>
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**8. Control Device Information**, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	<b>CD-011</b>	<b>Bagfilter Installed on Silo ES-1</b>
ii.	<b>CD-012</b>	<b>Bagfilter Installed on Silo ES-2</b>
iii.	N/A	N/A
iv.	N/A	N/A

**9. Stack Information** (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
EP-12-028	140	0.9	Ambient	61	2,500	Horizontal
EP-12-036	140	0.9	Ambient	61	2,500	Horizontal
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**10. Operating Schedule** (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	1.5	Days/Week	5	Weeks/Year	52	Hours/Year	390
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

**11. Seasonal Periods Percent Annual Throughput** (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	<b>30.63%</b>	Mar-May	<b>19.44%</b>	June-Aug	<b>24.29%</b>	Sept-Nov	<b>25.63%</b>
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Coal Silos

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant) ES-1 and ES-2

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	N/A	N/A	N/A
NOx	NOx	N/A	N/A	N/A
PM Total	PM	3.07E-03	2	99.80%
PM-2.5	PM-2.5	2.92E-03	2	97.90%
PM-10	PM-10	3.07E-03	2	99.60%
SO2	SO2	N/A	N/A	N/A
VOC	VOC	N/A	N/A	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)

**Emissions and data on this form required to report or verify emissions cannot be held confidential.**  
To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>  
Copy and Use additional Sheets as needed.

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Emissions from the loading of 2 coal storage silos.

(ES-1, ES-2)

Boiler #6	-	Tons/yr
Boiler #7	-	Tons/yr
Total	67,329	Tons/yr

The bulk density of coal is 47 lb/ft<sup>3</sup>

Total volume of coal combusted is = 2,865,064 ft<sup>3</sup>/yr  
(Volume of coal combusted = volume of displaced air through bin filter)

These emissions are routed through bin filters (baghouses). Emissions from the bin filters are conservatively estimated at 0.015 gr/acfm (displaced air through bin filters).

$$\text{lb/yr} = (\text{volume of coal, ft}^3/\text{yr}) (0.015 \text{ gr/acf}) (1/7000 \text{ lb/gr})$$

<b>Total Emissions from the silos</b>	<b>42,976</b>	<b>gr/yr</b>
	<b>6.139</b>	<b>lb/yr</b>
	<b>0.0031</b>	<b>ton/yr</b>

100% of these emissions are PM-10

95% of these emissions are PM-2.5

# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

**Silo Feed Conveyors  
(ES-3)**

<b>Emission Source/Operating Scenario Data</b> Page 1 of 2		<b>Facility ID #:</b> 6800043							
<i>Silo Feed Conveyors</i>		<b>Permit #:</b> 03069T31							
<small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>		<b>County:</b> Orange							
<b>Facility Name:</b>	University of North Carolina at Chapel Hill	<b>DAQ Region:</b> Raleigh							
<b>North Carolina Department of Environment and Natural Resources</b>									
<b>Division of Air Quality</b>									
<b>Air Pollutant Point Source Emissions Inventory - Calendar Year 2012</b>									
<b>1. Emission Source ID No.</b> (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)			<b>ES-3</b>						
<b>2. Emission Source Description</b>		<b>Silo Feed Conveyors</b>							
<b>3. Operating Scenario Description</b>		N/A							
<b>4. Maximum Permitted Operating Rate</b> <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		<b>700 tons/hr</b>							
<b>5. Throughput in CY</b> (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		<b>67,329 tons/yr</b>							
<b>6. Fuel Information</b> (if fuel used)		<b>% Sulfur</b> N/A	<b>% Ash</b> N/A						
		<b>Heat Content</b> (Btu/lb or mmCF)	N/A						
<small>If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.</small>									
<b>7. Capture Efficiency</b> (% Emissions from Emission Source Vented to Control Device or Stack)			<b>100%</b>						
<b>8. Control Device Information</b> , if none, write "none"									
	<b>Control Device ID #</b> <small>(as listed in permit)</small>	<b>Control Device Description</b>							
<i>i. (nearest stack)</i>	<b>CD-019</b>	<b>Bagfilter</b>							
<i>ii.</i>	N/A	N/A							
<i>iii.</i>	N/A	N/A							
<i>iv.</i>	N/A	N/A							
<b>9. Stack Information</b> (sources vented to more than one stack use additional entry lines)									
<b>Stack ID #</b>	<b>Height</b> <small>(in whole feet)</small>	<b>Diameter (feet)</b> <small>Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)</small>	<b>Temperature</b>  (F)	<b>Velocity</b>  (feet/sec)	<b>Volume Flow Rate</b>  (acfm)	<b>Release Point Description</b> <small>(Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)</small>			
EP-12-6901	200	2	Ambient	45	8,500	Vertical			
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--	--	--	--	--	--	--			
<b>10. Operating Schedule</b> (Source/Operating Scenario that best characterizes calendar year)									
Hours/Day	N/A		Days/Week	N/A		Weeks/Year	N/A		
Typical Start & End Times in CY:				Start:	N/A		End:	N/A	
<b>11. Seasonal Periods Percent Annual Throughput</b> (for Emission Source in CY, MUST total 100%)									
Jan-Feb, 2002 + Dec, 2002		<b>30.63%</b>	Mar-May	<b>19.44%</b>	June-Aug	<b>24.29%</b>	Sept-Nov	<b>25.63%</b>	

Silo Feed Conveyors

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

Emissions: Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-03

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	N/A	N/A	N/A
NOx	NOx	N/A	N/A	N/A
PM Total	PM	3.07E-03	2	99.80%
PM-2.5	PM-2.5	2.92E-03	2	97.90%
PM-10	PM-10	3.07E-03	2	99.60%
SO2	SO2	N/A	N/A	N/A
VOC	VOC	N/A	N/A	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Emissions from silo feed conveyors.

(ES-3)

Boiler #6	-	Tons/yr
Boiler #7	-	Tons/yr
Total	67,329	Tons/yr

The bulk density of coal is 47 lb/ft<sup>3</sup>

Total volume of coal combusted is = 2,865,064 ft<sup>3</sup>/yr  
(Volume of coal combusted = volume of displaced air through bin filter)

These emissions are routed through bin filters (baghouses). Emissions from the bin filters are conservatively estimated at 0.015 gr/acfm (displaced air through bin filters).

$$\text{lb/yr} = (\text{volume of coal, ft}^3/\text{yr}) (0.015 \text{ gr/acf}) (1/7000 \text{ lb/gr})$$

<b>Total Emissions from the conveyors</b>	<b>42,976</b>	<b>gr/yr</b>
	<b>6.139</b>	<b>lb/yr</b>
	<b>0.0031</b>	<b>ton/yr</b>

100% of these emissions are PM-10

95% of these emissions are PM-2.5

# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

**Fuel Oil Storage Tanks**

**(T-001 and T-002)**



# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## *2012 Cogeneration Emissions Inventory*

### **Summary of Emissions from Tanks T-001 & T-002** **(ES-T-001 and ES-T-002)**

VOC Emissions calculated with EPA TANKS 4.0 Program

T-001	214.43	lb/yr	0.107	Tons/yr
T-002	214.43	lb/yr	0.107	Tons/yr
Total	428.86	lb/yr	0.214	Tons/yr

# The University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## 2012 Annual Emissions Inventory

### **Boiler #6 (ES-001-Boiler #6)**

#### Operating Scenarios

#1 - Coal Firing

#2 - Natural Gas Firing

#4 - No.2 Fuel Oil Firing

#5 - Wood Pellet Firing

(#3 - No.6 Fuel Oil Firing is no longer permitted)

Boilers #6 and #7 are equipped with Continuous Emission Monitoring (CEMs) devices to measure SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> emissions from each of the boilers. The monthly averages presented in the attached spreadsheets are for the total emissions from firing all types of fuel. The Annual Emission Inventory forms require that the emissions be divided among the three possible operating scenarios.

NO<sub>x</sub> and CO<sub>2</sub> emissions have been divided between the four operating scenarios based on the percentage of total heat input by each fuel. These calculations are detailed in the attached spreadsheets.

SO<sub>2</sub> emissions from natural gas and wood pellet combustion are insignificant, therefore, SO<sub>2</sub> emissions have been divided between the fuel oil and coal operating scenarios based on the percentage of total heat input by each fuel. These calculations are detailed in the attached spreadsheets.

#### *Emissions Calculations*

SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> Emissions are taken from CEMs data  
Other emission factors are from stack test or DAQ spreadsheets

**Boiler #6 - Operating Scenario #4 - No. 2 Fuel Oil**

If Emission Source has multiple Operating Scenarios, complete one form for each.

(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources**  
**Division of Air Quality**  
**Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "T" for insignificant)		ES-001-Boiler #6					
2. Emission Source Description		Coal / Natural Gas / No. 2 Fuel Oil/Wood Fired Circulating Fluidized Bed Combustion - Steam Generating Unit					
3. Operating Scenario Description		Operating Scenario #4 - No. 2 Fuel Oil					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		323.17 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		0 gallons/yr					
6. Fuel Information (if fuel used)		% Sulfur	0.08%	% Ash		Heat Content (Btu/lb or mmCF)	139,043 Btu/gal

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	100%
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## 8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	CD-004	Bagfilter with Calcium Carbonate (CaCO <sub>3</sub> ) Sorbent Injection
ii.	N/A	N/A
iii.	N/A	N/A
iv.	N/A	N/A

## 9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
EP-14-136	220	9	305	56.1	214,000	Vertical
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--	--	--	--	--	--	--

## 10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	24	Days/Week	7	Weeks/Year	50	Hours/Year	8,057 Total
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

## 11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	#DIV/0!	Mar-May	#DIV/0!	June-Aug	#DIV/0!	Sept-Nov	#DIV/0!
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## Boiler #6 - Operating Scenario #4 - No. 2 Fuel Oil

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-001-Boiler #6

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	0.00E+00	8	N/A
NOx	NOx	0.00E+00	1	N/A
PM Total	PM	0.00E+00	8	99.0%
PM-2.5	PM-2.5	0.00E+00	8	99.0%
PM-10	PM-10	0.00E+00	8	99.0%
SO2	SO2	0.00E+00	1	90.0%
VOC	VOC	0.00E+00	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Antimony	ANTIMONYPDS	0.00E+00	8	99.0%
Arsenic	ARSENICPDS	0.00E+00	8	99.0%
Benzene	71-43-2	0.00E+00	8	N/A
Beryllium	BERYLCPDS	0.00E+00	8	99.0%
Cadmium	CADMIUMCPDS	0.00E+00	8	99.0%
Chromium	CROMCPDS	0.00E+00	8	99.0%
Chromium VI	CHROM6CPDS	0.00E+00	8	99.0%
Cobalt	COBALTCPDS	0.00E+00	8	99.0%
Ethylbenzene	100-41-4	0.00E+00	8	N/A
Fluoride	16984-48-8	0.00	8	N/A
Formaldehyde	50-00-0	0.00	8	N/A
Lead	LEADCPDS	0.00E+00	8	99.0%
Manganese	MANGCPDS	0.00E+00	8	99.0%
Mercury	MERCPDS	0.00E+00	8	99.0%
Methyl chloroform	71-55-6	0.00E+00	8	N/A
Napthalene	91-20-3	0.00E+00	8	N/A
Nickel	NICKCPDS	0.00E+00	8	99.0%
POM	POM	0.00E+00	8	99.0%
Selenium	SEC	0.00E+00	8	99.0%
Toluene	108-88-3	0.00	8	N/A
Xylene	1330-20-7	0.00E+00	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	0.00	8	N/A
Methane	CH <sub>4</sub>	0.00E+00	8	N/A
Nitrous oxide	N <sub>2</sub> O	0.00E+00	8	N/A

Emissions and data on this form required to report or verify emissions cannot be held confidential.

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed.

**Boiler #6 - Operating Scenario #1 - Coal**

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name: University of North Carolina at Chapel Hill

Facility ID #:	6800043
Permit #:	03069T31
County:	Orange
DAQ Region:	Raleigh

**North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-001-Boiler #6					
2. Emission Source Description		Coal / Natural Gas / No. 2 Fuel Oil/Wood Fired Circulating Fluidized Bed Combustion - Steam Generating Unit					
3. Operating Scenario Description		Operating Scenario #1 - Coal					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		323.17 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		34,168				tons/yr	
6. Fuel Information (if fuel used)		% Sulfur	1.24%	% Ash	7.96%	Heat Content (Btu/lb or mmCF)	13,026 Btu/lb

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	100%
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8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	CD-004	Bagfilter with Calcium Carbonate (CaCO <sub>3</sub> ) Sorbent Injection
ii.	N/A	N/A
iii.	N/A	N/A
iv.	N/A	N/A

9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
EP-14-136	220	9	305	56.1	214,000	Vertical
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10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	24	Days/Week	7	Weeks/Year	50	Hours/Year	8057 Total
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	34.03%	Mar-May	27.70%	June-Aug	22.66%	Sept-Nov	15.61%
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## Boiler #6 - Operating Scenario #1 - Coal

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-001-Boiler #6

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	15.18	8	N/A
NOx	NOx	156.52	1	N/A
PM Total	PM	3.76	8	99.80%
PM-2.5	PM-2.5	2.17	8	97.90%
PM-10	PM-10	3.76	8	99.60%
SO2	SO2	81.01	1	90.00%
VOC	VOC	0.20	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Acetaldehyde	750-07-0	19.48	8	N/A
Acetophenone	98-86-2	0.51	8	N/A
Acrolein	107-02-8	9.91	8	N/A
Arsenic*	ARSENICPDS	0.27	8	99.60%
Benzene	71-43-2	44.42	8	N/A
Benzo(a)pyrene	50-32-8	1.30E-03	8	N/A
Benzyl chloride	100-44-7	23.92	8	N/A
Beryllium*	BERYLCPDS	0.05	8	N/A
Biphenyl	92-52-4	5.81E-02	8	N/A
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	2.49	8	N/A
Bromine	7726-95-6	7.30	8	99.60%
Bromoform	75-25-2	1.33	8	N/A
Cadmium*	CADMIUMCPDS	1.24E-01	8	99.60%
Carbon disulfide	75-10-0	4.44	8	N/A
2-Chloroacetophenone	532-27-4	0.24	8	N/A
Chlorobenzene	108-90-7	0.75	8	N/A
Chloroform	67-66-3	2.02	8	N/A
Chromium*	CROMCPDS	4.27	8	99.60%
Chromium (VI)	CHROM6CPDS	0.01	8	99.60%
Cumene	98-82-8	0.18	8	N/A
Cyanide	CNC	85.42	8	N/A
Dibenzofurans	132-64-9	6.87E-03	8	N/A
Dimethyl sulfate	77-78-1	1.64	8	N/A
2,4-Dinitrotoluene	121-14-2	9.57E-03	8	N/A
Ethyl benzene	100-41-4	3.21	8	N/A
Ethyl chloride	75-00-3	1.44	8	N/A
Ethylene dibromide	106-93-4	4.10E-02	8	N/A
Ethylene dichloride	107-06-2	1.37	8	N/A

Emissions and data on this form required to report or verify emissions cannot be held confidential.

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed.

**Boiler #6 - Operating Scenario #1 - Coal**If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name:

University of North Carolina at Chapel Hill

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

## North Carolina Department of Environment and Natural Resources

## Division of Air Quality

## Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-001-Boiler #6

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	N/A	N/A	N/A
NOx	NOx	N/A	N/A	N/A
PM Total	PM	N/A	N/A	N/A
PM-2.5	PM-2.5	N/A	N/A	N/A
PM-10	PM-10	N/A	N/A	N/A
SO2	SO2	N/A	N/A	N/A
VOC	VOC	N/A	N/A	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Formaldehyde*	50-0-00	58.57	8	N/A
Hexane	HEXANEISO	2.29	8	N/A
Hydrogen Chloride *	7647-01-0	11393.72	8	N/A
Hydrogen Fluoride *	7664-39-3	204.73	8	90% Control with CaCO <sub>3</sub>
Isophorone	78-59-1	19.82	8	N/A
Lead*	LEADCPDS	1.57	8	99.60%
Manganese*	MANGCPDS	10.68	8	99.60%
Mercury*	MERCCPDS	0.75	8	N/A
Methyl bromide	74-83-9	5.47	8	N/A
Methyl chloride	74-87-3	18.11	8	N/A
Methyl ethyl ketone	78-93-3	13.33	8	N/A
Methyl hydrazine	60-34-4	5.81	8	N/A
Methyl methacrylate	80-62-6	0.68	8	N/A
Methyl tert butyl ether	1634-04-4	1.20	8	N/A
Methylene chloride	75-09-2	9.91	8	N/A
Naphthalene	91-20-3	0.44	8	N/A
Nickel	NICKCPDS	8.70	8	99.60%
Phenol	108-95-2	0.55	8	N/A
POM	POM	1.99	8	N/A
Propionaldehyde	123-38-6	12.98	8	N/A
Styrene	100-42-5	0.85	8	N/A
2,3,7,8-TCDD	1746-01-6	4.89E-07	8	N/A
Tetrachloroethylene	79-34-5	1.47	8	N/A
Toluene	108-88-3	8.20	8	N/A
1,1,1-Trichloroethane	79-00-5	0.68	8	N/A
Vinyl acetate	108-05-4	0.26	8	N/A
Xylenes	1330-20-7	1.26	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	102,355.58	8	N/A
Methane	CH <sub>4</sub>	0.17	8	N/A
Nitrous oxide	N <sub>2</sub> O	1.57	8	N/A

**Boiler #6 - Operating Scenario #3 - Natural Gas**

If Emission Source has multiple Operating Scenarios, complete one form for each.

(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "T" for insignificant)		ES-001-Boiler #6					
2. Emission Source Description		Coal / Natural Gas / No. 2 Fuel Oil/Wood Fired Circulating Fluidized Bed Combustion - Steam Generating Unit					
3. Operating Scenario Description		Operating Scenario #2 - Natural Gas					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		323.17 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		190,020			1,000 ft <sup>3</sup> /yr		
6. Fuel Information (if fuel used)		% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	1,030 Btu/ft <sup>3</sup>

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	100%
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## 8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	CD-004	Bagfilter with Calcium Carbonate (CaCO <sub>3</sub> ) Sorbent Injection
ii.	N/A	N/A
iii.	N/A	N/A
iv.	N/A	N/A

## 9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
EP-14-136	220	9	305	56.1	214,000	Vertical
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## 10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	24	Days/Week	7	Weeks/Year	50	Hours/Year	8059 Total
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

## 11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	39.32%	Mar-May	24.48%	June-Aug	26.15%	Sept-Nov	10.05%
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**Boiler #6 - Operating Scenario #3 - Natural Gas**  
 If Emission Source has multiple Operating Scenarios, complete one form for each.  
 (All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043  
 Permit #: 03069T31  
 County: Orange  
 DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-001-Boiler #6

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	7.98	8	N/A
NOx	NOx	34.41	1	N/A
PM Total	PM	0.72	8	N/A
PM-2.5	PM-2.5	0.72	8	N/A
PM-10	PM-10	0.72	8	N/A
SO2	SO2	0.00	1	N/A
VOC	VOC	0.52	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Arsenic	ARSENICCPDS	3.80E-02	8	N/A
Benzene	71-43-2	0.40	8	N/A
Cadmium	CADMIUMCPDS	2.09E-01	8	N/A
Chromium	CROMCPDS	2.66E-01	8	N/A
Chromium VI	CHROM6CPDS	2.66E-01	8	N/A
Dichlorobenzene	106-46-7	2.28E-01	8	N/A
Formaldehyde	50-00-0	14.25	8	N/A
Hexane	HEXANEISO	342.04	8	N/A
Lead	LEADCPDS	9.50E-02	8	N/A
Manganese	MANGCPDS	7.22E-02	8	N/A
Mercury	MERCPDS	4.94E-02	8	N/A
Napthalene	91-20-3	1.16E-01	8	N/A
Nickel	NICKCPDS	0.40	8	N/A
POM	POM	1.26E-01	8	N/A
Toluene	108-88-3	0.65	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	12,775.75	8	N/A
Methane	CH <sub>4</sub>	2.157E-01	8	N/A
Nitrous oxide	N <sub>2</sub> O	2.157E-02	8	N/A

**Boiler #6 - Operating Scenario #5 - Wood Pellets**  
 If Emission Source has multiple Operating Scenarios, complete one form for each.  
 (All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: **6800043**  
 Permit #: **03069T31**  
 County: **Orange**  
 DAQ Region: **Raleigh**

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		<b>ES-001-Boiler #6</b>					
2. Emission Source Description		<b>Coal / Natural Gas / No. 2 Fuel Oil/Wood Fired Circulating Fluidized Bed Combustion - Steam Generating Unit</b>					
3. Operating Scenario Description		<b>Operating Scenario #5 - Wood Pellets</b>					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		<b>64.63 MMBtu/hr (20% HI from wood pellets)</b>					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>			<b>16.0</b>			<b>tons/yr</b>	
6. Fuel Information (if fuel used)		% Sulfur	<b>NA</b>	% Ash	<b>NA</b>	Heat Content (Btu/lb or mmCF)	<b>8,125 Btu/lb</b>

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	<b>100%</b>
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8. Control Device Information, if none, write "none"

	Control Device ID # <small>(as listed in permit)</small>	Control Device Description
i. (nearest stack)	<b>CD-004</b>	<b>Bagfilter with Calcium Carbonate (CaCO<sub>3</sub>) Sorbent Injection</b>
ii.	<b>N/A</b>	<b>N/A</b>
iii.	<b>N/A</b>	<b>N/A</b>
iv.	<b>N/A</b>	<b>N/A</b>

9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height <small>(in whole feet)</small>	Diameter (feet) <small>Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)</small>	Temperature <small>(F)</small>	Velocity <small>(feet/sec)</small>	Volume Flow Rate <small>(acfm)</small>	Release Point Description <small>(Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)</small>
<b>EP-14-136</b>	<b>220</b>	<b>9</b>	<b>305</b>	<b>56.1</b>	<b>214,000</b>	<b>Vertical</b>
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10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	<b>24</b>	Days/Week	<b>7</b>	Weeks/Year	<b>50</b>	Hours/Year	<b>8057 Total</b>
Typical Start & End Times in CY:				Start:	<b>N/A</b>	End:	<b>N/A</b>

11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	<b>0.00%</b>	Mar-May	<b>100.00%</b>	June-Aug	<b>0.00%</b>	Sept-Nov	<b>0.00%</b>
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Boiler #6 - Operating Scenario #5 - Wood Pellets  
 If Emission Source has multiple Operating Scenarios, complete one form for each.  
 (All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-001-Boiler #6

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	0.022	8	N/A
NOx	NOx	0.046	1	N/A
PM Total	PM	0.00011	8	99.80%
PM-2.5	PM-2.5	0.00009	8	97.90%
PM-10	PM-10	0.00010	8	99.60%
SO2	SO2	CEM w/coal	1	90.00%
VOC	VOC	0.0022	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Acetaldehyde	750-07-0	2.17E-01	8	N/A
Acetophenone	98-86-2	8.38E-07	8	N/A
Acrolein	107-02-8	1.05E+00	8	N/A
Antimony	7440-36-0	8.28E-06	8	99.60%
Arsenic	ARSENICPDS	2.30E-05	8	99.60%
Benzene	71-43-2	1.10E+00	8	N/A
Benzo(a)pyrene	50-32-8	6.81E-04	8	N/A
Beryllium	BERYLCPDS	1.15E-06	8	99.60%
Cadmium	CADMIUMCPDS	4.30E-06	8	99.60%
Carbon tetrachloride	56-23-5	1.18E-02	8	N/A
Chlorine	7782-50-5	2.07E-01	8	N/A
Chlorobenzene	108-90-7	8.64E-03	8	N/A
Chloroform	67-66-3	7.33E-03	8	N/A
Chromium	CROMCPDS	1.83E-05	8	99.60%
Cobalt	7440-48-4	6.81E-06	8	99.60%
Di(2-ethylhexyl)phthalate	117-81-7	1.23E-05	8	N/A
Dinitrophenol, 2,4-	51-28-5	4.71E-05	8	N/A
Ethyl benzene	100-41-4	8.12E-03	8	N/A
Ethylene dichloride	107-06-2	7.60E-03	8	N/A
Formaldehyde*	50-0-00	1.15E+00	8	N/A
Hexachlorodib-dioxin	57653-85-7	4.19E-04	8	N/A
Hydrogen Chloride *	7647-01-0	1.60E+00	8	68% Control with CaCO <sub>3</sub>
Lead*	LEADCPDS	5.03E-05	8	99.60%
Manganese*	MANGCPDS	1.68E-03	8	99.60%
Mercury*	MERCCPDS	7.06E-05	8	92%
Methyl bromide	74-83-9	3.93E-03	8	N/A
Methyl chloride	74-87-3	6.02E-03	8	N/A

Emissions and data on this form required to report or verify emissions cannot be held confidential.

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed.

## Boiler #6 - Operating Scenario #1 - Coal

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

Emissions: Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-001-Boiler #6

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	N/A	N/A	N/A
NOx	NOx	N/A	N/A	N/A
PM Total	PM	N/A	N/A	N/A
PM-2.5	PM-2.5	N/A	N/A	N/A
PM-10	PM-10	N/A	N/A	N/A
SO2	SO2	N/A	N/A	N/A
VOC	VOC	N/A	N/A	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Methyl chloroform	71-55-6	8.12E-03	8	N/A
Methyl ethyl ketone	78-93-3	1.41E-03	8	N/A
Methylene chloride	75-09-2	7.60E-02	8	N/A
Naphthalene	91-20-3	2.54E-02	8	N/A
Nickel	NICKCPDS	3.46E-05	8	99.60%
Nitrophenol, 4-	100-02-07	2.88E-05	8	N/A
Pentachlorophenol	87-86-5	1.34E-05	8	N/A
Perchloroethylene	127-18-4	9.95E-03	8	N/A
Phenol	108-95-2	1.34E-02	8	N/A
Phosphorus	7723-14-0	2.83E-05	8	99.60%
Polychlorinated biphenyls	1336-36-3	2.13E-06	8	N/A
POM	POM	3.27E-02	8	N/A
Propionaldehyde	123-38-6	1.60E-02	8	N/A
Propylene dichloride	78-87-5	8.64E-03	8	N/A
Selenium	7782-49-2	2.93E-06	8	99.60%
Styrene	100-42-5	4.98E-01	8	N/A
2,3,7,8-TCDD	1746-01-6	2.25E-09	8	N/A
Toluene	108-88-3	2.41E-01	8	N/A
Trichloroethylene	79-01-6	7.86E-03	8	N/A
Trichlorofluoromethane	75-69-4	1.07E-02	8	N/A
Trichlorophenol	95-95-4	5.76E-06	8	N/A
Vinyl chloride	75-01-4	4.71E-03	8	N/A
Xylenes	1330-20-7	6.55E-03	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	30.25	8	N/A
Methane	CH <sub>4</sub>	0.0092	8	N/A
Nitrous oxide	N <sub>2</sub> O	0.0012	8	N/A

# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

**Boiler #6**

**(ES-001-Boiler #6)**

*Emissions Calculations*

SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> Emissions are Taken from CEMs Data  
Other emission factors are from stack test or DAQ spreadsheets

**Fuel Oil Combustion Emissions Calculator FO2000 Revision A  
2012 Cogeneration Emissions Inventory**

**Boiler #6  
(ES-001-Boiler #6)  
Facility ID # 6800043  
Permit # 03069T31**

Operating Scenario #4 - No.2 Fuel Oil

<b>User Input</b>	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T31
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.000
Maximum fuel sulfur content (%):	0.08
Latest Construction/Modification Date:	N/A
<b>Enter the boiler type below ↘</b>	
	15

<b>Boilers =&gt;100 mmBtu/hr</b> 1 = No. 6 oil fired, normal firing (U) 2 = No. 6 oil fired, normal firing (I) 3 = No. 6 oil fired, normal firing (C) 4 = No. 6 oil fired, normal firing, low NOx burner (U) 5 = No. 6 oil fired, normal firing, low NOx burner (I) 6 = No. 6 oil fired, normal firing, low NOx burner (C) 7 = No. 6 oil fired, tangential firing (U) 8 = No. 6 oil fired, tangential firing, low NOx burner (U) 9 = No. 5 oil fired, normal firing (U) 10 = No. 5 oil fired, normal firing (I) 11 = No. 5 oil fired, tangential firing (U) 12 = No. 4 oil fired, normal firing (U) 13 = No. 4 oil fired, normal firing (I) 14 = No. 4 oil fired, tangential firing (U) 15 = No. 2 oil fired (U,I)	<b>Boilers =&gt;100 mmBtu/hr (cont'd)</b> 16 = No. 2 oil fired (C) 17 = No. 2 oil fired, LNB/FGR (U,I) 18 = No. 2 oil fired, LNB/FGR (C)
	19 = Vertical fired utility boiler
	<b>Small Boilers (&lt;100 mmBtu/hr)</b> 20 = No. 6 oil fired (I) 21 = No. 6 oil fired (C) 22 = No. 5 oil fired (C) 23 = No. 4 oil fired (C) 24 = No. 2 oil fired (I) 25 = No. 2 oil fired (C)
	26 = Residential Furnace

**Fuel Oil Combustion Emissions Calculator FO2000 Revision A**

**2012 Cogeneration Emissions Inventory**

**Boiler #6**

**(ES-001-Boiler #6)**

**Facility ID # 6800043**

**Permit # 03069T31**

Operating Scenario #4 - No.2 Fuel Oil

<b>User Input</b>	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T31
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.000
Maximum fuel sulfur content (%):	0.08
Latest Construction/Modification Date:	N/A

**Emission Controls**

Particulate controls

<b>Enter the control type below</b> ▾	Message Area	Or enter a PM control efficiency below to override built in values.
3		
<u>Control Device</u>	<u>Avg. Cont. Effic.</u>	<u>User Input PM Cont. Effic.</u>
0 = None/other		
1 = ESP		
2 = Scrubber		
3 = Bagfilter	99.0	
4 = Multiple cyclone		
		Message Area

Postcombustion SO<sub>2</sub> controls

<b>Enter the control type below</b> ▾	Message Area	Or enter an SO <sub>2</sub> control efficiency below to override built in values.
0		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input SO<sub>2</sub> Cont. Effic.</u>
0 = None/other		90.0
1 = Wet scrubber, Lime/limestone		
2 = Wet scrubber, Sodium carbonate	0.0	
3 = Wet scrubber, Magnesium oxide/hydroxide		
4 = Wet scrubber, Dual alkali		
5 = Spray drying, calcium hydroxide slurry, vap. in spray vessel		
6 = Furnace injection, Dry calcium carbonate/hydrate inj. in upper furn. cavity		
7 = Duct injection, Dry sorbent injection into duct, sometimes combined with water spray		
	<u>Remarks</u>	<b>User entered control efficiency may be overestimated and should be documented.</b>
	NA	

NO<sub>x</sub> controls

<b>Enter the control type below</b> ▾	Message Area	Or enter a NO <sub>x</sub> control efficiency below to override built in values.
5		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input NO<sub>x</sub> Cont. Effic.</u>
0 = None/other		0.0
1 = Low excess air (LEA)		
2 = Staged combustion (SC)		
3 = Burners out of service (BOOS)	39.0	
4 = Flue gas recirculation (FGR)		
5 = Flue gas recirculation plus staged combustion		
6 = Low NO <sub>x</sub> burners (LNB)		
7 = Reduced air preheat (RAP)		
8 = Selective noncatalytic reduction (SNCR)		
9 = Conventional selective catalytic reduction (SCR)		
	<u>Remarks</u>	Message Area
	Available for boilers with sufficient operational flexibility	

**Fuel Oil Combustion Emissions Calculator FO2000 Revision A**  
**2012 Cogeneration Emissions Inventory**

**Boiler #6**  
**(ES-001-Boiler #6)**  
**Facility ID # 6800043**  
**Permit # 03069T31**

Operating Scenario #4 - No.2 Fuel Oil

<b>User Input</b>	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T31
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.000
Maximum fuel sulfur content (%):	0.08
Latest Construction/Modification Date:	N/A

<b>Emissions Output (for operation 3.42 hr/yr)</b>				Emission Factor <sup>1</sup>
<b>Criteria Pollutants</b>				(lb/10 <sup>3</sup> gal)
Pollutant	lb/hr <sup>2</sup>	tpy	lb/yr <sup>3</sup>	
Total PM (FPM + CPM)	3.0	0.000	0	3.30E+00
Filterable PM (FPM) rates @ 99% control	0.0	0.000	0	2.00E+00
Condensable PM (CPM) <sup>4</sup>	3.0	0.000	0	1.30E+00
Filterable PM-10 <sup>5</sup>	0.0	0.000	0	1.00E+00
Filterable PM-2.5 <sup>5</sup>	0.0	0.000	0	2.50E-01
NOx rates @ 39% control	see attached CEMs-based calculations			2.40E+01
NMTOC	0	0.000	0	2.00E-01
CO	12	0.000	0	5.00E+00
SO2 rates @ 90% control	see attached CEMs-based calculations			2.98E+02
Total HAP <sup>6</sup>	4.17E-01	0.000	0	1.81E-01
Largest HAP <sup>6</sup>	1.84E-01	0.000	0	7.97E-02

<b>Toxic/Hazardous Air Pollutants</b>				Emission Factor <sup>1</sup>
Pollutant	lb/hr <sup>2</sup>	lb/day <sup>7</sup>	lb/yr <sup>3</sup>	(lb/10 <sup>3</sup> gal)
Antimony rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Arsenic rates @ 99% control	1.29E-05	NA	0.00E+00	5.60E-04
Benzene	6.35E-03	NA	0.00E+00	2.75E-03
Beryllium rates @ 99% control	9.70E-06	NA	0.00E+00	4.20E-04
Cadmium rates @ 99% control	9.70E-06	NA	0.00E+00	4.20E-04
Chromium rates @ 99% control	9.70E-06	NA	0.00E+00	4.20E-04
Chromium VI rates @ 99% control	2.85E-06	NA	0.00E+00	1.23E-04
Cobalt rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Ethylbenzene	1.89E-03	NA	0.00E+00	8.17E-04
Fluoride	8.61E-02	2.07E+00	0.00E+00	3.73E-02
Formaldehyde	1.11E-01	2.66E+00	0.00E+00	4.80E-02
Lead rates @ 99% control	2.91E-05	NA	0.00E+00	1.26E-03
Manganese rates @ 99% control	1.94E-05	4.65E-04	0.00E+00	8.40E-04
Mercury	9.70E-04	2.33E-02	0.00E+00	4.20E-04
Methyl chloroform (1,1,1-Trichloroethane)	5.45E-04	1.31E-02	0.00E+00	2.36E-04
Naphthalene	7.69E-04	NA	0.00E+00	3.33E-04
Nickel rates @ 99% control	9.70E-06	2.33E-04	0.00E+00	4.20E-04
POM rates @ 99% control	7.62E-05	NA	0.00E+00	3.30E-03
Selenium rates @ 99% control	4.85E-05	NA	0.00E+00	2.10E-03
Toluene	1.84E-01	4.41E+00	0.00E+00	7.97E-02
Xylene	3.23E-03	7.76E-02	0.00E+00	1.40E-03

<b>Greenhouse Gases</b>				Emission Factor
Pollutant	lb/hr <sup>2</sup>	tpy	lb/yr <sup>3</sup>	(lb/10 <sup>3</sup> gal)
Carbon dioxide	see attached CEMs-based calculations			22671.27
Methane	2.12E+00	0.00E+00	0.00E+00	0.920
Nitrous Oxide	4.25E-01	0.00E+00	0.00E+00	0.18

<sup>1</sup>Emission factors represent AP-42 uncontrolled values. Emission rates are reflective of controls where applicable.

<sup>2</sup>Hourly emission rates for all pollutants are based on hourly rated capacity.

<sup>3</sup>Annual emission rates for all pollutants are based on maximum annual fuel throughput.

<sup>4</sup>Wet scrubbers are assumed to control CPM whereas other PM control devices are assumed to only control FPM.

<sup>5</sup>AP-42 assumes PM-10 and PM-2.5 assumes these pollutants are controlled with the same efficiency as total PM.

<sup>6</sup>Total and largest HAP factors and emission rates do not reflect control of metals. Individual metal emission rates are reflective of particulate matter controls where applicable.



Fuel Oil Combustion Emissions Calculator **FO2000 Revision A**  
2012 Cogeneration Emissions Inventory

Boiler #6  
(ES-001-Boiler #6)  
Facility ID # 6800043  
Permit # 03069T31

Operating Scenario #4 - No.2 Fuel Oil

<b>User Input</b>	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T31
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.000
Maximum fuel sulfur content (%):	0.08
Latest Construction/Modification Date:	N/A

<sup>7</sup>Daily emission rates are based on operation 24 hours per day at rated capacity.

# Bituminous Coal Combustion

2012 Cogeneration Emissions Inventory

Facility **University of North Carolina at Chapel Hill**  
 City **Chapel Hill**  
 County **Orange County**

APP #/Fac ID **6800043**  
 Input By **RST Engineering**  
 Source ID **Boiler #6**  
 (ES-001-Boiler #6)

Operating Scenario #1

## Data Input

Maximum Heat Input	<input type="text" value="323.17"/>	mmBtu/hr	<b>Boiler Type:</b>	<input type="text" value="7"/>
Boiler Size/Type	Large Industrial		1) Pulverized/Dry Bottom	6) Underfeed Stoker
Actual Fuel Usage	<input type="text" value="34,168"/>	ton/yr	2) Pulverized/Wet Bottom	7) Fluidized Bed Cir.
or	or		3) Cyclone Furnace	8) Fluidized Bed Bub.
Hours of Operation	<input type="text"/>	hr/yr	4) Spreader Stoker	9) Hand Fed
and	and		5) Overfeed Stoker	
Heating Value	<input type="text" value="13,026"/>	Btu/lb	<b>Control Device Efficiencies:</b>	
		ton/yr	PM	<input type="text" value="99.80"/> %
Sulfur Content	<input type="text" value="1.24"/>	%	PM-10	<input type="text" value="98.00"/> %
Ash Content :	<input type="text" value="7.96"/>	%	PM-2.5	<input type="text" value="97.90"/> %
(B)ituminous or (S)ubbituminous?	<input type="text" value="B"/>	(B/S)	SOx*	<input type="text" value="90.00"/> %
Calcium to Sulfur Ratio	<input type="text" value="2.22"/>		NOx*	<input type="text" value="0.00"/> %

*\*SOx and NOx emission estimates were calculated using CEMS data. Please refer to the SOx and NOx emissions data presented in the following CEMs spreadsheets.  
 HCl, HF, and Hg emissions based on stack test data.*

# Bituminous Coal Combustion

## 2012 Cogeneration Emissions Inventory

Facility **University of North Carolina at Chapel Hill**  
 City **Chapel Hill**  
 County **Orange County**

APP #/Fac ID **6800043**  
 Input By **RST Engineering**  
 Source ID **Boiler #6**  
**(ES-001-Boiler #6)**

### Operating Scenario #1

#### ACTUAL CRITERIA EMISSIONS

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
PM*	0.22	2.73	7,526	3.76
PM-10*	0.22	2.73	7,526	3.76
PM-2.5*	0.13	1.58	4,339	2.17
SO2	10.79	**	**	**
SO3	0.08	**	**	**
NOx	3.90	**	**	**
VOC*	0.01	0.15	409	0.20
CO*	0.89	11.02	30,354	15.18

#### ACTUAL TOXIC EMISSIONS

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Acetaldehyde	5.70E-04	7.07E-03	1.95E+01	9.74E-03
Acetophenone	1.50E-05	1.86E-04	5.13E-01	2.56E-04
Acrolein	2.90E-04	3.60E-03	9.91E+00	4.95E-03
Antimony*	8.41E-06	1.04E-04	2.88E-01	1.44E-04
Arsenic*	7.84E-06	9.73E-05	2.68E-01	1.34E-04
Benzene	1.30E-03	1.61E-02	4.44E+01	2.22E-02
Benzo(a)pyrene	3.80E-08	4.71E-07	1.30E-03	6.49E-07
Benzyl chloride	7.00E-04	8.68E-03	2.39E+01	1.20E-02
Beryllium*	1.38E-06	1.71E-05	4.70E-02	2.35E-05
Biphenyl	1.70E-06	2.11E-05	5.81E-02	2.90E-05
Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05	9.06E-04	2.49E+00	1.25E-03
Bromine	1.07E-01	2.65E-03	7.30E+00	3.65E-03
Bromoform	3.90E-05	4.84E-04	1.33E+00	6.66E-04
Cadmium*	3.62E-06	4.49E-05	1.24E-01	6.19E-05
Carbon disulfide	1.30E-04	1.61E-03	4.44E+00	2.22E-03
2-Chloroacetophenone	7.00E-06	8.68E-05	2.39E-01	1.20E-04
Chlorobenzene	2.20E-05	2.73E-04	7.52E-01	3.76E-04
Chlorine*	2.81E-03	3.49E-02	9.61E+01	4.81E-02
Chloroform	5.90E-05	7.32E-04	2.02E+00	1.01E-03
Chromium*	1.25E-04	1.55E-03	4.27E+00	2.14E-03
Chromium (VI)	1.25E-04	3.10E-06	8.55E-03	4.27E-06
Cobalt*	7.19E-06	8.92E-05	2.46E-01	1.23E-04
Cumene	5.30E-06	6.57E-05	1.81E-01	9.05E-05
Cyanide	2.50E-03	3.10E-02	8.54E+01	4.27E-02
Dibenzofurans	2.01E-07	2.49E-06	6.87E-03	3.43E-06
Dimethyl sulfate	4.80E-05	5.95E-04	1.64E+00	8.20E-04
2,4-Dinitrotoluene	2.80E-07	3.47E-06	9.57E-03	4.78E-06
Ethyl benzene	9.40E-05	1.17E-03	3.21E+00	1.61E-03
Ethyl chloride	4.20E-05	5.21E-04	1.44E+00	7.18E-04
Ethylene dibromide	1.20E-06	1.49E-05	4.10E-02	2.05E-05
Ethylene dichloride	4.00E-05	4.96E-04	1.37E+00	6.83E-04
Formaldehyde*	1.71E-03	2.13E-02	5.86E+01	2.93E-02
Hexane	6.70E-05	8.31E-04	2.29E+00	1.14E-03
Hydrogen Chloride *	3.33E-01	4.14E+00	1.14E+04	5.70E+00
Hydrogen Fluoride *	5.99E-03	7.43E-02	2.05E+02	1.02E-01
Isophorone	5.80E-04	7.19E-03	1.98E+01	9.91E-03
Lead*	4.59E-05	5.69E-04	1.57E+00	7.83E-04

\*\*SO<sub>2</sub> and NOx emissions were estimated using CEMS data, please refer to the attached data sheets entitled "Sulfur Dioxide Emissions from Boiler #6" and Nitrogen Dioxide Emissions from Boiler #6".

# Bituminous Coal Combustion

## 2012 Cogeneration Emissions Inventory

Facility **University of North Carolina at Chapel Hill**  
 City **Chapel Hill**  
 County **Orange County**

APP #/Fac ID **6800043**  
 Input By **RST Engineering**  
 Source ID **Boiler #6**  
**(ES-001-Boiler #6)**

### Operating Scenario #1

### ACTUAL TOXIC EMISSIONS (continued)

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
<i>Manganese*</i>	3.13E-04	3.88E-03	1.07E+01	5.34E-03
<i>Mercury*</i>	2.18E-05	2.70E-04	7.45E-01	3.73E-04
Methyl bromide	1.60E-04	1.98E-03	5.47E+00	2.73E-03
Methyl chloride	5.30E-04	6.57E-03	1.81E+01	9.05E-03
Methyl ethyl ketone	3.90E-04	4.84E-03	1.33E+01	6.66E-03
Methyl hydrazine	1.70E-04	2.11E-03	5.81E+00	2.90E-03
Methyl methacrylate	2.00E-05	2.48E-04	6.83E-01	3.42E-04
Methyl tert butyl ether	3.50E-05	4.34E-04	1.20E+00	5.98E-04
Methylene chloride	2.90E-04	3.60E-03	9.91E+00	4.95E-03
Naphthalene	1.30E-05	1.61E-04	4.44E-01	2.22E-04
<i>Nickel*</i>	2.55E-04	3.16E-03	8.70E+00	4.35E-03
Phenol	1.60E-05	1.98E-04	5.47E-01	2.73E-04
<i>Phosphorus*</i>	3.80E-05	4.72E-04	1.30E+00	6.50E-04
POM	5.84E-05	7.24E-04	1.99E+00	9.97E-04
Propionaldehyde	3.80E-04	4.71E-03	1.30E+01	6.49E-03
<i>Selenium*</i>	5.60E-06	6.95E-05	1.91E-01	9.57E-05
Styrene	2.50E-05	3.10E-04	8.54E-01	4.27E-04
2,3,7,8-TCDD	1.43E-11	1.77E-10	4.89E-07	2.44E-10
Tetrachloroethylene	4.30E-05	5.33E-04	1.47E+00	7.35E-04
Toluene	2.40E-04	2.98E-03	8.20E+00	4.10E-03
1,1,1-Trichloroethane	2.00E-05	2.48E-04	6.83E-01	3.42E-04
Vinyl acetate	7.60E-06	9.43E-05	2.60E-01	1.30E-04
Xylenes	3.70E-05	4.59E-04	1.26E+00	6.32E-04
Total HAPs		4.39	12,089.76	6.04

### Greenhouse Gases

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Carbon dioxide			see attached CEMs-based calculations	
<i>Methane*</i>	0.010	0.12	338.25	0.17
Nitrous Oxide	0.09	1.14	3,140	1.57

**\*Emission rates for pollutants in italics from August 2009 Section 114 test of Boiler #6.**

#### Notes :

- 1) Emission factors are from Supplement B to the 5th edition of AP-42, unless otherwise noted
- 2) Emission calculations will be based on the hours of operation only when actual fuel usage is not supplied
- 3) Particulate controls affect PM, PM-10, PM-2.5, and all toxics that are regulated as particulates except Mercury
- 4) VOC = NMTOC = TOC \* (1-%METHANE)
- 5) PM-2.5 and SO3 do not currently need to be reported
- 6) Dibenzofurans = Polychlorinated dibenzo-p-furans
- 7) The Br emission factor is based on a mass balance generated from a 3 year coal analysis for Duke Power (1990-1992, 7 samples per year). The average concentration of bromine was 55.33 ppm (wet basis) and a heating value of 13,500 Btu/lb was assumed
- 8) For fluidized bed combustion the emission factor for underfeed stokers is utilized whenever the calcium-to-sulfur ratio is outside of the acceptable range of 1.5 to 7

**Natural Gas Combustion Emissions Calculator NG2000 Revision C**  
**2012 Cogeneration Emissions Inventory**

**Boiler #6**

(ES-001-Boiler #6)

Facility ID # 6800043  
 Permit # 03069T31

**Operating Scenario #2**

<b>User Input</b>	<b>Emissions Output</b>																																																																																							
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# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Boiler # 6 Wood Pellet Combustion

16.0 ton/yr, wood pellets burned                      2.62E+02 MMBtu/yr  
 64.63 MMBtu/hr, HI from wood                      99.8% PM control                      99.6% Metals control  
 8,000 Btu/lb, wood heating value                      67.8% HCl efficiency\*  
 4.04 ton/hr, max. wood firing rate                      92.3% Hg efficiency\*  
 8,760 hr/yr                      \*Calculated from August 2009 EPA Tests

Pollutant	Emission Factor (lb/MMBtu) <sup>1</sup>	Emissions (lb/hr)	Emissions (lb/yr)	Emissions (ton/yr)
<b>NOx</b>	see attached CEMs-based calculations			
<b>CO</b>	0.17	10.99	44.5	0.02
<b>SO<sub>2</sub></b>	see attached CEMs-based calculations			
PM	0.417	0.054	0.22	0.00011
PM <sub>10</sub>	0.377	0.049	0.20	0.00010
PM <sub>2.5</sub>	0.327	0.042	0.17	0.00009
VOC	0.017	1.10	4.5	0.002
	<b>lb/MMBtu</b>			
Acetaldehyde	8.30E-04	5.36E-02	2.17E-01	1.09E-04
Acetophenone	3.20E-09	2.07E-07	8.38E-07	4.19E-10
Acrolein	4.00E-03	2.59E-01	1.05E+00	5.24E-04
Antimony	7.90E-06	2.04E-06	8.28E-06	4.14E-09
Arsenic	2.20E-05	5.69E-06	2.30E-05	1.15E-08
Benzene	4.20E-03	2.71E-01	1.10E+00	5.50E-04
Benzo(a)pyrene	2.60E-06	1.68E-04	6.81E-04	3.40E-07
Beryllium	1.10E-06	2.84E-07	1.15E-06	5.76E-10
Cadmium	4.10E-06	1.06E-06	4.30E-06	2.15E-09
Carbon tetrachloride	4.50E-05	2.91E-03	1.18E-02	5.89E-06
Chlorine	7.90E-04	5.11E-02	2.07E-01	1.03E-04
Chlorobenzene	3.30E-05	2.13E-03	8.64E-03	4.32E-06
Chloroform	2.80E-05	1.81E-03	7.33E-03	3.67E-06
Chromium	1.75E-05	4.52E-06	1.83E-05	9.17E-09
Cobalt	6.50E-06	1.68E-06	6.81E-06	3.40E-09
Di(2-ethylhexyl)phthalate	4.70E-08	3.04E-06	1.23E-05	6.16E-09
Dinitrophenol, 2,4-	1.80E-07	1.16E-05	4.71E-05	2.36E-08
Ethyl Benzene	3.10E-05	2.00E-03	8.12E-03	4.06E-06
Ethylene dichloride	2.90E-05	1.87E-03	7.60E-03	3.80E-06
Formaldehyde	4.40E-03	2.84E-01	1.15E+00	5.76E-04
Hexachlorodibenzo-p-dioxin	1.60E-06	1.03E-04	4.19E-04	2.10E-07
Hydrogen Chloride	1.90E-02	3.95E-01	1.60E+00	8.01E-04
Lead	4.80E-05	1.24E-05	5.03E-05	2.51E-08
Manganese	1.60E-03	4.14E-04	1.68E-03	8.38E-07
Mercury	3.50E-06	1.74E-05	7.06E-05	3.53E-08
Methyl bromide	1.50E-05	9.70E-04	3.93E-03	1.96E-06
Methyl chloride	2.30E-05	1.49E-03	6.02E-03	3.01E-06
Methyl chloroform	3.10E-05	2.00E-03	8.12E-03	4.06E-06
Methyl ethyl ketone	5.40E-06	3.49E-04	1.41E-03	7.07E-07
Methylene chloride	2.90E-04	1.87E-02	7.60E-02	3.80E-05
Naphthalene	9.70E-05	6.27E-03	2.54E-02	1.27E-05
Nickel	3.30E-05	8.53E-06	3.46E-05	1.73E-08
Nitrophenol, 4-	1.10E-07	7.11E-06	2.88E-05	1.44E-08
Pentachlorophenol	5.10E-08	3.30E-06	1.34E-05	6.68E-09
Perchloroethylene	3.80E-05	2.46E-03	9.95E-03	4.98E-06
Phenol	5.10E-05	3.30E-03	1.34E-02	6.68E-06
Phosphorus	2.70E-05	6.98E-06	2.83E-05	1.41E-08
Polychlorinated biphenyls	8.15E-09	5.27E-07	2.13E-06	1.07E-09
POM	1.25E-04	8.08E-03	3.27E-02	1.64E-05
Propionaldehyde	6.10E-05	3.94E-03	1.60E-02	7.99E-06
Propylene dichloride	3.30E-05	2.13E-03	8.64E-03	4.32E-06
Selenium	2.80E-06	7.24E-07	2.93E-06	1.47E-09
Styrene	1.90E-03	1.23E-01	4.98E-01	2.49E-04
2,3,7,8-TCDD	8.60E-12	5.56E-10	2.25E-09	1.13E-12
Toluene	9.20E-04	5.95E-02	2.41E-01	1.20E-04
Trichloroethylene	3.00E-05	1.94E-03	7.86E-03	3.93E-06
Trichlorofluoromethane	4.10E-05	2.65E-03	1.07E-02	5.37E-06
Trichlorophenol	2.20E-08	1.42E-06	5.76E-06	2.88E-09
Vinyl chloride	1.80E-05	1.16E-03	4.71E-03	2.36E-06
Xylenes	2.50E-05	1.62E-03	6.55E-03	3.27E-06
Carbon Dioxide	see attached CEMs-based calculations			
Methane	0.0705	4.557	18.5	0.0092
N <sub>2</sub> O	0.00926	0.60	2.4	0.0012

1-Emission factors based on DAQ wood combustion spreadsheet

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Sulfur Dioxide Emissions from Boiler #6

#### (ES-001-Boiler #6)

The exhaust duct at Boiler #6 is equipped with a continuous emissions monitor (CEMs) for SO<sub>2</sub> emissions.

For the 2012 calendar year, 30 day facility averages for the SO<sub>2</sub> emission rate measured by the CEM are as follows:

Month	30 day average CEM reading (lb/MMBtu)
January 2012	0.16
February 2012	0.16
March 2012	0.14
April 2012	0.15
May 2012	0.14
June 2012	0.15
July 2012	0.16
August 2012	0.15
September 2012	0.15
October 2012	0.15
November 2012	0.15
December 2012	0.13
<b>Annual Average</b>	<b>0.149</b>

This average includes SO<sub>2</sub> emissions from coal, wood, fuel oil, and natural gas from Boiler #6 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #6 for 2012

Boiler #6			
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr	Wood Pellets, Tons/yr
<b>34,168</b>	<b>190,020</b>	<b>0</b>	<b>16.0</b>
Coal (13,026 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)	Wood (8,185 btu/lb)
MMBtu/yr			
8.90E+05	1.96E+05	0.00E+00	261.92

Total for Boiler #6 (MMBtu/yr)	1.09E+06
--------------------------------	----------

Total SO <sub>2</sub> Emissions from Boiler #6 (lb/yr)	162,012
<b>Total SO<sub>2</sub> Emissions from Boiler #6 (ton/yr)</b>	<b>81.01</b>

SO <sub>2</sub> Emissions Associated with Coal Combustion (ton/yr)	<b>81.01</b>
SO <sub>2</sub> Emissions Associated with No. 2 Fuel Oil Combustion (ton/yr)	<b>0.00000</b>
SO <sub>2</sub> Emissions Associated with Natural Gas Combustion (ton/yr)	<b>0*</b>
SO <sub>2</sub> Emissions Associated with Wood Pellet Combustion (ton/yr)	<b>0*</b>

\*All SO<sub>2</sub> measured by CEMS allocated to coal and No.2 fuel oil.

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Nitrogen Dioxide Emissions from Boiler #6 (ES-001-Boiler #6)

The exhaust duct at Boiler #6 is equipped with a continuous emissions monitor (CEMs) for NOx emissions. For the 2012 calendar year, 30 day facility averages for the NOx emission rate measured by the CEM are as follows:

Month	30 day average CEM reading (lb/MMBtu)
January 2012	0.38
February 2012	0.38
March 2012	0.31
April 2012	0.36
May 2012	0.35
June 2012	0.35
July 2012	0.33
August 2012	0.29
September 2012	0.33
October 2012	0.34
November 2012	0.35
December 2012	0.45
<b>Annual Average</b>	<b>0.35</b>

This average includes NOx emissions from coal, fuel oil, and natural gas from Boiler #6 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #6 for 2012

Boiler #6			
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr	Wood Pellets, Tons/yr
<b>34,168</b>	<b>190,020</b>	<b>0</b>	<b>16.0</b>
Coal (13,026 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)	Wood (8,185 btu/lb)
MMBtu/yr			
8.90E+05	1.96E+05	0.00E+00	261.92

Total for Boiler #6 (MMBtu/yr)	1.09E+06
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Total NOx Emissions from Boiler #6 (lb/yr)	381,951
<b>Total NOx Emissions from Boiler #6 (ton/yr)</b>	<b>190.98</b>

<b>NOx Emissions Associated with Coal Combustion (ton/yr)</b>	<b>156.52</b>
<b>NOx Emissions Associated with Fuel Oil No. 2 Combustion (ton/yr)</b>	<b>0.0000</b>
<b>NOx Emissions Associated with Natural Gas Combustion (ton/yr)</b>	<b>34.41</b>
<b>NOx Emissions Associated with Wood Pellet Combustion (ton/yr)</b>	<b>0.046</b>



# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### CO<sub>2</sub> Emissions from Boiler No.6 (ES-3)

The exhaust system on Boiler #6 is equipped with a continuous emissions monitor (CEMs) for CO<sub>2</sub> concentrations. The exhaust also includes a flow monitor. Mass CO<sub>2</sub> emissions are calculated by the DAHS for GHG reporting. For the 2012 calendar year, the monthly CO<sub>2</sub> emissions measured by the CEM/DAHS System are as follows:

Month	Metric Tons	Tons
January 2012	10,744	11,843
February 2012	9,756	10,754
March 2012	10,153	11,191
April 2012	9,907	10,920
May 2012	8,605	9,486
June 2012	9,405	10,367
July 2012	7,509	8,277
August 2012	7,494	8,261
September 2012	11,211	12,358
October 2012	640	705
November 2012	4,093	4,512
December 2012	14,958	16,488
<b>Annual Total</b>	<b>104,474</b>	<b>115,162</b>

This total includes CO<sub>2</sub> emissions from coal, fuel oil, wood pellets, and natural gas from Boiler #6 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #6 for 2012

Boiler #6			
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr	Wood Pellets, Tons/yr
<b>34,168</b>	<b>190,020</b>	<b>0</b>	<b>16.0</b>
Coal (13,026 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)	Wood (8,185 btu/lb)
MMBtu/yr			
8.90E+05	1.96E+05	0.00E+00	261.92

Total for Boiler #6 (MMBtu/yr)	1.09E+06
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#### CO<sub>2</sub> Emission Rate Ratios

	kg/MMBtu	Ratio
coal	93.40	1
n.gas	53.02	0.56767
No.2 oil	73.96	0.79186
wood	93.80	1.00428

<b>CO<sub>2</sub> Emissions Associated with Coal Combustion (ton/yr)</b>	<b>102,355.6</b>
<b>CO<sub>2</sub> Emissions Associated with Fuel Oil No. 2 Combustion (ton/yr)</b>	<b>0.00</b>
<b>CO<sub>2</sub> Emissions Associated with Natural Gas Combustion (ton/yr)</b>	<b>12775.8</b>
<b>CO<sub>2</sub> Emissions Associated with Wood Pellet Combustion (ton/yr)</b>	<b>30.25</b>

1.00E+06 Dist. Factor

115,162

# The University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

### **Boiler #7 (ES-002-Boiler #7)**

#### Operating Scenarios

#1 - Coal Firing

#2 - Natural Gas Firing

#4 - No.2 Fuel Oil Firing

#5 - Wood Pellet Firing

(#3 - No.6 Fuel Oil Firing is no longer permitted)

Boilers #6 and #7 are equipped with Continuous Emission Monitoring (CEMs) devices to measure SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> emissions from each of the boilers. The monthly averages presented in the attached spreadsheets are for the total emissions from firing all types of fuel. The Annual Emission Inventory forms require that the emissions be divided among the three possible operating scenarios.

NO<sub>x</sub> and CO<sub>2</sub> emissions have been divided between the four operating scenarios based on the percentage of total heat input by each fuel. These calculations are detailed in the attached spreadsheets.

SO<sub>2</sub> emissions from natural gas and wood pellet combustion are insignificant, therefore, SO<sub>2</sub> emissions have been divided between the fuel oil and coal operating scenarios based on the percentage of total heat input by each fuel. These calculations are detailed in the attached spreadsheets.

#### *Emissions Calculations*

SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> Emissions are taken from CEMs data

Other emission factors are from stack test or DAQ spreadsheets

<b>Emission Source/Operating Scenario Data</b> Page 1 of 2		<b>Facility ID #:</b> 6800043					
<i>Boiler #7 - Operating Scenario #4 - No. 2 Fuel Oil</i>		<b>Permit #:</b> 03069T31					
If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)		<b>County:</b> Orange					
<b>Facility Name:</b> University of North Carolina at Chapel Hill		<b>DAQ Region:</b> Raleigh					
<b>North Carolina Department of Environment and Natural Resources</b> <b>Division of Air Quality</b> <b>Air Pollutant Point Source Emissions Inventory - Calendar Year 2012</b>							
<b>1. Emission Source ID No.</b> (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)			<b>ES-002-Boiler #7</b>				
<b>2. Emission Source Description</b>		<b>Coal / Natural Gas / No. 6 Fuel Oil Fired Circulating Fluidized Bed Combustion - Steam Generating Unit</b>					
<b>3. Operating Scenario Description</b>		<b>Operating Scenario #4 - No. 2 Fuel Oil</b>					
<b>4. Maximum Permitted Operating Rate</b> With Units (Ex. gal/hr, mmBtu/hr)		<b>323.17 MMBtu/hr</b>					
<b>5. Throughput in CY</b> (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		<b>0</b> gallons/yr					
<b>6. Fuel Information</b> (if fuel used)		% Sulfur	<b>0.08%</b>				
		% Ash					
		Heat Content (Btu/lb or mmCF)	<b>139,043 Btu/gal</b>				
If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.							
<b>7. Capture Efficiency</b> (% Emissions from Emission Source Vented to Control Device or Stack)			<b>100%</b>				
<b>8. Control Device Information</b> , if none, write "none"							
	<b>Control Device ID #</b> (as listed in permit)	<b>Control Device Description</b>					
<i>i. (nearest stack)</i>	<b>CD-004</b>	<b>Bagfilter with Calcium Carbonate (CaCO<sub>3</sub>) Sorbent Injection</b>					
<i>ii.</i>	<b>N/A</b>	<b>N/A</b>					
<i>iii.</i>	<b>N/A</b>	<b>N/A</b>					
<i>iv.</i>	<b>N/A</b>	<b>N/A</b>					
<b>9. Stack Information</b> (sources vented to more than one stack use additional entry lines)							
<b>Stack ID #</b>	<b>Height</b> (in whole feet)	<b>Diameter (feet)</b> Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	<b>Temperature</b> (F)	<b>Velocity</b> (feet/sec)	<b>Volume Flow Rate</b> (acfm)	<b>Release Point Description</b> (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions )	
<b>EP-14-136</b>	<b>220</b>	<b>9</b>	<b>305</b>	<b>56.1</b>	<b>214,000</b>	<b>Vertical</b>	
--	--	--	--	--	--	--	
--	--	--	--	--	--	--	
<b>10. Operating Schedule</b> (Source/Operating Scenario that best characterizes calendar year)							
Hours/Day	<b>24</b>	Days/Week	<b>7</b>	Weeks/Year	<b>50</b>	Hours/Year	<b>7,848 Total</b>
Typical Start & End Times in CY:				Start:	<b>N/A</b>	End:	<b>N/A</b>
<b>11. Seasonal Periods Percent Annual Throughput</b> (for Emission Source in CY, MUST total 100%)							
Jan-Feb, 2002 + Dec, 2002	<b>#DIV/0!</b>	Mar-May	<b>#DIV/0!</b>	June-Aug	<b>#DIV/0!</b>	Sept-Nov	<b>#DIV/0!</b>

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed

**Boiler #7 - Operating Scenario #4 - No. 2 Fuel Oil**

If Emission Source has multiple Operating Scenarios, complete one form for each.

(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: **6800043**Permit #: **03069T31**County: **Orange**DAQ Region: **Raleigh**Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-002-Boiler #7

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	0.00	8	N/A
NOx	NOx	0.00	1	N/A
PM Total	PM	0.00	8	99.0%
PM-2.5	PM-2.5	0.00	8	99.0%
PM-10	PM-10	0.00	8	99.0%
SO2	SO2	0.00	1	90.00%
VOC	VOC	0.00	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Antimony	ANTIMONYPDS	0.00E+00	8	99.0%
Arsenic	ARSENICPDS	0.00E+00	8	99.0%
Benzene	71-43-2	0.00E+00	8	N/A
Beryllium	BERYLCPDS	0.00E+00	8	99.0%
Cadmium	CADMIUMCPDS	0.00E+00	8	99.0%
Chromium	CROMCPDS	0.00E+00	8	99.0%
Chromium VI	CHROM6CPDS	0.00E+00	8	99.0%
Cobalt	COBALTCPDS	0.00E+00	8	99.0%
Ethylbenzene	100-41-4	0.00E+00	8	N/A
Fluoride	16984-48-8	0.00	8	N/A
Formaldehyde	50-00-0	0.00	8	N/A
Lead	LEADCPDS	0.00E+00	8	99.0%
Manganese	MANGCPDS	0.00E+00	8	99.0%
Mercury	MERCPDS	0.00E+00	8	99.0%
Methyl chloroform	71-55-6	0.00E+00	8	N/A
Napthalene	91-20-3	0.000	8	N/A
Nickel	NICKCPDS	0.00E+00	8	99.0%
POM	POM	0.00E+00	8	99.0%
Selenium	SEC	0.00E+00	8	99.0%
Toluene	108-88-3	0.00	8	N/A
Xylene	1330-20-7	0.00E+00	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	0.00	8	N/A
Methane	CH <sub>4</sub>	0.00E+00	8	N/A
Nitrous oxide	N <sub>2</sub> O	0.00E+00	8	N/A

Emissions and data on this form required to report or verify emissions cannot be held confidential.

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed.

**Boiler #7 - Operating Scenario #1 - Coal**

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name: University of North Carolina at Chapel Hill

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

**North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-002-Boiler #7					
2. Emission Source Description		Coal / Natural Gas / No. 2 Fuel Oil Fired Circulating Fluidized Bed Combustion - Steam Generating Unit					
3. Operating Scenario Description		Operating Scenario #1 - Coal					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		323.17 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		32,737				tons/yr	
6. Fuel Information (if fuel used)		% Sulfur	1.20%	% Ash	7.75%	Heat Content (Btu/lb or mmCF)	13,001 Btu/lb

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	100%
--	------

8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	CD-004	Bagfilter with Calcium Carbonate (CaCO <sub>3</sub> ) Sorbent Injection
ii.	N/A	N/A
iii.	N/A	N/A
iv.	N/A	N/A

9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
EP-14-136	220	9	305	56.1	214,000	Vertical
--	--	--	--	--	--	--
--	--	--	--	--	--	--

10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	24	Days/Week	7	Weeks/Year	50	Hours/Year	8,154 Total
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	27.23%	Mar-May	11.18%	June-Aug	25.93%	Sept-Nov	35.66%
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## Boiler #7 - Operating Scenario #1 - Coal

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name:

University of North Carolina at Chapel Hill

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-002-Boiler #7

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	14.51	8	N/A
NOx	NOx	158.90	1	N/A
PM Total	PM	3.61	8	99.80%
PM-2.5	PM-2.5	2.08	8	97.90%
PM-10	PM-10	3.61	8	99.60%
SO2	SO2	78.18	1	90.00%
VOC	VOC	0.20	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Acetaldehyde	750-07-0	18.66	8	N/A
Acetophenone	98-86-2	0.49	8	N/A
Acrolein	107-02-8	9.49	8	N/A
Arsenic*	ARSENICPDS	0.26	8	99.60%
Benzene	71-43-2	42.56	8	N/A
Benzo(a)pyrene	50-32-8	1.24E-03	8	N/A
Benzyl chloride	100-44-7	22.92	8	N/A
Beryllium*	BERYLCPDS	0.04	8	N/A
Biphenyl	92-52-4	5.57E-02	8	N/A
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	2.39	8	N/A
Bromine	7726-95-6	6.98	8	99.60%
Bromoform	75-25-2	1.28	8	N/A
Cadmium*	CADMIUMCPDS	1.18E-01	8	99.60%
Carbon disulfide	75-10-0	4.26	8	N/A
2-Chloroacetophenone	532-27-4	0.23	8	N/A
Chlorobenzene	108-90-7	0.72	8	N/A
Chloroform	67-66-3	1.93	8	N/A
Chromium*	CROMCPDS	4.09	8	99.60%
Chromium (VI)	CHROM6CPDS	0.01	8	99.60%
Cumene	98-82-8	0.17	8	N/A
Cyanide	CNC	81.84	8	N/A
Dibenzofurans	132-64-9	6.58E-03	8	N/A
Dimethyl sulfate	77-78-1	1.57	8	N/A
2,4-Dinitrotoluene	121-14-2	9.17E-03	8	N/A
Ethyl benzene	100-41-4	3.08	8	N/A
Ethyl chloride	75-00-3	1.37	8	N/A
Ethylene dibromide	106-93-4	3.93E-02	8	N/A
Ethylene dichloride	107-06-2	1.31	8	N/A

Emissions and data on this form required to report or verify emissions cannot be held confidential.

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed.

## Boiler #7 - Operating Scenario #1 - Coal

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name:

University of North Carolina at Chapel Hill

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

## North Carolina Department of Environment and Natural Resources

## Division of Air Quality

## Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-002-Boiler #7

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	N/A	N/A	N/A
NOx	NOx	N/A	N/A	N/A
PM Total	PM	N/A	N/A	N/A
PM-2.5	PM-2.5	N/A	N/A	N/A
PM-10	PM-10	N/A	N/A	N/A
SO2	SO2	N/A	N/A	N/A
VOC	VOC	N/A	N/A	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Formaldehyde*	50-0-00	56.01	8	N/A
Hexane	HEXANEISO	2.19	8	N/A
Hydrogen Chloride *	7647-01-0	10895.68	8	N/A
Hydrogen Fluoride *	7664-39-3	195.78	8	90% Control with CaCO <sub>3</sub>
Isophorone	78-59-1	18.99	8	N/A
Lead*	LEADCPDS	1.50	8	99.60%
Manganese*	MANGCPDS	10.21	8	99.60%
Mercury*	MERCCPDS	0.71	8	N/A
Methyl bromide	74-83-9	5.24	8	N/A
Methyl chloride	74-87-3	17.35	8	N/A
Methyl ethyl ketone	78-93-3	12.77	8	N/A
Methyl hydrazine	60-34-4	5.57	8	N/A
Methyl methacrylate	80-62-6	0.65	8	N/A
Methyl tert butyl ether	1634-04-4	1.15	8	N/A
Methylene chloride	75-09-2	9.49	8	N/A
Naphthalene	91-20-3	0.43	8	N/A
Nickel	NICKCPDS	8.32	8	99.60%
Phenol	108-95-2	0.52	8	N/A
POM	POM	1.91	8	N/A
Propionaldehyde	123-38-6	12.44	8	N/A
Styrene	100-42-5	0.82	8	N/A
2,3,7,8-TCDD	1746-01-6	4.68E-07	8	N/A
Tetrachloroethylene	79-34-5	1.41	8	N/A
Toluene	108-88-3	7.86	8	N/A
1,1,1-Trichloroethane	79-00-5	0.65	8	N/A
Vinyl acetate	108-05-4	0.25	8	N/A
Xylenes	1330-20-7	1.21	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	96,290.53	8	N/A
Methane	CH <sub>4</sub>	0.16	8	N/A
Nitrous oxide	N <sub>2</sub> O	1.50	8	N/A

<b>Emission Source/Operating Scenario Data</b> Page 1 of 2		<b>Facility ID #:</b> 6800043					
<b>Boiler #7 - Operating Scenario #2 - Natural Gas</b> <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>		<b>Permit #:</b> 03069T31					
<b>Facility Name:</b> University of North Carolina at Chapel Hill		<b>County:</b> Orange					
		<b>DAQ Region:</b> Raleigh					
<b>North Carolina Department of Environment and Natural Resources</b> <b>Division of Air Quality</b> <b>Air Pollutant Point Source Emissions Inventory - Calendar Year 2012</b>							
<b>1. Emission Source ID No.</b> (same as in permit - Use "U" prefix for non-permitted and "T" for insignificant)			<b>ES-002-Boiler #7</b>				
<b>2. Emission Source Description</b>		<b>Coal / Natural Gas / No. 2 Fuel Oil Fired Circulating Fluidized Bed Combustion - Steam Generating Unit</b>					
<b>3. Operating Scenario Description</b>		<b>Operating Scenario #2 - Natural Gas</b>					
<b>4. Maximum Permitted Operating Rate</b> <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		<b>323.17 MMBtu/hr</b>					
<b>5. Throughput in CY</b> (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		<b>179,982</b>	<b>1,000 ft<sup>3</sup>/yr</b>				
<b>6. Fuel Information</b> (if fuel used)		<b>% Sulfur</b> N/A	<b>% Ash</b> N/A				
		<b>Heat Content</b> (Btu/lb or mmCF)	<b>1,030 Btu/ft<sup>3</sup></b>				
<small>If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.</small>							
<b>7. Capture Efficiency</b> (% Emissions from Emission Source Vented to Control Device or Stack)			<b>100%</b>				
<b>8. Control Device Information</b> , if none, write "none"							
	<b>Control Device ID #</b> <small>(as listed in permit)</small>	<b>Control Device Description</b>					
<i>i. (nearest stack)</i>	<b>CD-004</b>	<b>Bagfilter with Calcium Carbonate (CaCO<sub>3</sub>) Sorbent Injection</b>					
<i>ii.</i>	N/A	N/A					
<i>iii.</i>	N/A	N/A					
<i>iv.</i>	N/A	N/A					
<b>9. Stack Information</b> (sources vented to more than one stack use additional entry lines)							
<b>Stack ID #</b>	<b>Height</b> <small>(in whole feet)</small>	<b>Diameter (feet)</b> <small>Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)</small>	<b>Temperature</b> <small>(F)</small>	<b>Velocity</b> <small>(feet/sec)</small>	<b>Volume Flow Rate</b> <small>(acfm)</small>	<b>Release Point Description</b> <small>(Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)</small>	
EP-14-136	220	9	305	56.1	214,000	Vertical	
--	--	--	--	--	--	--	
--	--	--	--	--	--	--	
<b>10. Operating Schedule</b> (Source/Operating Scenario that best characterizes calendar year)							
Hours/Day	24	Days/Week	7	Weeks/Year	50	Hours/Year	7,848 Total
Typical Start & End Times in CY:				Start:	N/A	End:	N/A
<b>11. Seasonal Periods Percent Annual Throughput</b> (for Emission Source in CY, MUST total 100%)							
Jan-Feb, 2002 + Dec, 2002	25.46%	Mar-May	15.74%	June-Aug	39.32%	Sept-Nov	19.47%



<b>Emission Source/Operating Scenario Data</b> Page 2 of 2 <i>Boiler #7 - Operating Scenario #2 - Natural Gas</i> <small>If Emission Source has multiple Operating Scenarios, complete one form for each.          (All permitted, Insignificant and/or Non-permitted Sources)</small>	Facility ID #: <u>6800043</u> Permit #: <u>03069T31</u> County: <u>Orange</u> DAQ Region: <u>Raleigh</u>
Facility Name: <u>University of North Carolina at Chapel Hill</u>	

**North Carolina Department of Environment and Natural Resources**  
**Division of Air Quality**  
**Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant) ES-002-Boiler #7

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	7.56	8	N/A
NOx	NOx	34.60	1	N/A
PM Total	PM	0.68	8	N/A
PM-2.5	PM-2.5	0.68	8	N/A
PM-10	PM-10	0.68	8	N/A
SO2	SO2	0.00	1	N/A
VOC	VOC	0.49	8	N/A

HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Arsenic	ARSENICPDS	3.60E-02	8	N/A
Benzene	71-43-2	0.38	8	N/A
Cadmium	CADMIUMCPDS	1.98E-01	8	N/A
Chromium	CROMCPDS	2.52E-01	8	N/A
Chromium VI	CHROM6CPDS	2.52E-01	8	N/A
Dichlorobenzene	106-46-7	2.16E-01	8	N/A
Formaldehyde	50-00-0	13.50	8	N/A
Hexane	HEXANEISO	3.24E+02	8	N/A
Lead	LEADCPDS	9.00E-02	8	N/A
Manganese	MANGCPDS	6.84E-02	8	N/A
Mercury	MERCPDS	4.68E-02	8	N/A
Napthalene	91-20-3	1.10E-01	8	N/A
Nickel	NICKCPDS	0.38	8	N/A
POM	POM	1.19E-01	8	N/A
Toluene	108-88-3	0.61	8	N/A

Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	11,904.18	8	N/A
Methane	CH <sub>4</sub>	2.04E-01	8	N/A
Nitrous oxide	N <sub>2</sub> O	2.04E-02	8	N/A

**Boiler #7 - Operating Scenario #5 - Wood Pellets**  
 If Emission Source has multiple Operating Scenarios, complete one form for each.  
 (All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: **6800043**  
 Permit #: **03069T31**  
 County: **Orange**  
 DAQ Region: **Raleigh**

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		<b>ES-002-Boiler #7</b>					
2. Emission Source Description		<b>Coal / Natural Gas / No. 2 Fuel Oil/Wood Fired Circulating Fluidized Bed Combustion - Steam Generating Unit</b>					
3. Operating Scenario Description		<b>Operating Scenario #5 - Wood Pellets</b>					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		<b>64.63 MMBtu/hr (20% HI from wood pellets)</b>					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>			<b>0.0</b>			<b>tons/yr</b>	
6. Fuel Information (if fuel used)		% Sulfur	<b>NA</b>	% Ash	<b>NA</b>	Heat Content (Btu/lb or mmCF)	<b>8,185 Btu/lb</b>

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	<b>100%</b>
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8. Control Device Information, if none, write "none"

	Control Device ID # <small>(as listed in permit)</small>	Control Device Description
<i>i. (nearest stack)</i>	<b>CD-004</b>	<b>Bagfilter with Calcium Carbonate (CaCO<sub>3</sub>) Sorbent Injection</b>
<i>ii.</i>	<b>N/A</b>	<b>N/A</b>
<i>iii.</i>	<b>N/A</b>	<b>N/A</b>
<i>iv.</i>	<b>N/A</b>	<b>N/A</b>

9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height <small>(in whole feet)</small>	Diameter (feet) <small>Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)</small>	Temperature <small>(F)</small>	Velocity <small>(feet/sec)</small>	Volume Flow Rate <small>(acfm)</small>	Release Point Description <small>(Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)</small>
<b>EP-14-136</b>	<b>220</b>	<b>9</b>	<b>305</b>	<b>56.1</b>	<b>214,000</b>	<b>Vertical</b>
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10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	<b>24</b>	Days/Week	<b>7</b>	Weeks/Year	<b>50</b>	Hours/Year	<b>8057 Total</b>
Typical Start & End Times in CY:				Start:	<b>N/A</b>	End:	<b>N/A</b>

11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	<b>#DIV/0!</b>	Mar-May	<b>#DIV/0!</b>	June-Aug	<b>#DIV/0!</b>	Sept-Nov	<b>#DIV/0!</b>
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Boiler #7 - Operating Scenario #5 - Wood Pellets  
 If Emission Source has multiple Operating Scenarios, complete one form for each.  
 (All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-002-Boiler #7

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	0.000	8	N/A
NOx	NOx	0.000	1	N/A
PM Total	PM	0.00000	8	99.80%
PM-2.5	PM-2.5	0.00000	8	97.90%
PM-10	PM-10	0.00000	8	99.60%
SO2	SO2	CEM w/coal	1	90.00%
VOC	VOC	0.0000	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Acetaldehyde	750-07-0	0.00E+00	8	N/A
Acetophenone	98-86-2	0.00E+00	8	N/A
Acrolein	107-02-8	0.00E+00	8	N/A
Antimony	7440-36-0	0.00E+00	8	99.60%
Arsenic	ARSENICPDS	0.00E+00	8	99.60%
Benzene	71-43-2	0.00E+00	8	N/A
Benzo(a)pyrene	50-32-8	0.00E+00	8	N/A
Beryllium	BERYLCPDS	0.00E+00	8	99.60%
Cadmium	CADMIUMCPDS	0.00E+00	8	99.60%
Carbon tetrachloride	56-23-5	0.00E+00	8	N/A
Chlorine	7782-50-5	0.00E+00	8	N/A
Chlorobenzene	108-90-7	0.00E+00	8	N/A
Chloroform	67-66-3	0.00E+00	8	N/A
Chromium	CROMCPDS	0.00E+00	8	99.60%
Cobalt	7440-48-4	0.00E+00	8	99.60%
Di(2-ethylhexy)phthalate		0.00E+00	8	N/A
Dinitrophenol, 2,4-	51-28-5	0.00E+00	8	N/A
Ethyl benzene	100-41-4	0.00E+00	8	N/A
Ethylene dichloride	107-06-2	0.00E+00	8	N/A
Formaldehyde*	50-0-00	0.00E+00	8	N/A
Hexachlorodib-dioxin	57653-85-7	0.00E+00	8	N/A
Hydrogen Chloride *	7647-01-0	0.00E+00	8	68% Control with CaCO <sub>3</sub>
Lead*	LEADCPDS	0.00E+00	8	99.60%
Manganese*	MANGCPDS	0.00E+00	8	99.60%
Mercury*	MERCCPDS	0.00E+00	8	92%
Methyl bromide	74-83-9	0.00E+00	8	N/A
Methyl chloride	74-87-3	0.00E+00	8	N/A

Emissions and data on this form required to report or verify emissions cannot be held confidential.

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed.

## Boiler #7 - Operating Scenario #5 - Wood Pellets

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

Emissions: Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-002-Boiler #7

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	N/A	N/A	N/A
NOx	NOx	N/A	N/A	N/A
PM Total	PM	N/A	N/A	N/A
PM-2.5	PM-2.5	N/A	N/A	N/A
PM-10	PM-10	N/A	N/A	N/A
SO2	SO2	N/A	N/A	N/A
VOC	VOC	N/A	N/A	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Methyl chloroform	71-55-6	0.00E+00	8	N/A
Methyl ethyl ketone	78-93-3	0.00E+00	8	N/A
Methylene chloride	75-09-2	0.00E+00	8	N/A
Naphthalene	91-20-3	0.00E+00	8	N/A
Nickel	NICKCPDS	0.00E+00	8	99.60%
Nitrophenol, 4-	100-02-07	0.00E+00	8	N/A
Pentachlorophenol	87-86-5	0.00E+00	8	N/A
Perchloroethylene	127-18-4	0.00E+00	8	N/A
Phenol	108-95-2	0.00E+00	8	N/A
Phosphorus	7723-14-0	0.00E+00	8	99.60%
Polychlorinated biphenyls	1336-36-3	0.00E+00	8	N/A
POM	POM	0.00E+00	8	N/A
Propionaldehyde	123-38-6	0.00E+00	8	N/A
Propylene dichloride	78-87-5	0.00E+00	8	N/A
Selenium	7782-49-2	0.00E+00	8	99.60%
Styrene	100-42-5	0.00E+00	8	N/A
2,3,7,8-TCDD	1746-01-6	0.00E+00	8	N/A
Toluene	108-88-3	0.00E+00	8	N/A
Trichloroethylene	79-01-6	0.00E+00	8	N/A
Trichlorofluoromethane	75-69-4	0.00E+00	8	N/A
Trichlorophenol		0.00E+00	8	N/A
Vinyl chloride	75-01-4	0.00E+00	8	N/A
Xylenes	1330-20-7	0.00E+00	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	0.00	8	N/A
Methane	CH <sub>4</sub>	0.0000	8	N/A
Nitrous oxide	N <sub>2</sub> O	0.0000	8	N/A

# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

**Boiler #7**

**(ES-002-Boiler #7)**

***Emissions Calculations***

SO<sub>2</sub>, NO<sub>x</sub>, and CO<sub>2</sub> Emissions are Taken from CEMs Data  
Other emission factors are from stack test or DAQ spreadsheets

**Fuel Oil Combustion Emissions Calculator FO2000 Revision A  
2012 Cogeneration Emissions Inventory**

**Boiler #7  
(ES-002-Boiler #7)  
Facility ID # 6800043  
Permit # 03069T31**

Operating Scenario #4 - No.2 Fuel Oil

<b>User Input</b>	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T31
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.000
Maximum fuel sulfur content (%):	0.08
Latest Construction/Modification Date:	N/A
<b>Enter the boiler type below</b> ▾	
	15

<b>Boilers =&gt;100 mmBtu/hr</b> 1 = No. 6 oil fired, normal firing (U) 2 = No. 6 oil fired, normal firing (I) 3 = No. 6 oil fired, normal firing (C) 4 = No. 6 oil fired, normal firing, low NOx burner (U) 5 = No. 6 oil fired, normal firing, low NOx burner (I) 6 = No. 6 oil fired, normal firing, low NOx burner (C) 7 = No. 6 oil fired, tangential firing (U) 8 = No. 6 oil fired, tangential firing, low NOx burner (U) 9 = No. 5 oil fired, normal firing (U) 10 = No. 5 oil fired, normal firing (I) 11 = No. 5 oil fired, tangential firing (U) 12 = No. 4 oil fired, normal firing (U) 13 = No. 4 oil fired, normal firing (I) 14 = No. 4 oil fired, tangential firing (U) 15 = No. 2 oil fired (U,I)	<b>Boilers =&gt;100 mmBtu/hr (cont'd)</b> 16 = No. 2 oil fired (C) 17 = No. 2 oil fired, LNB/FGR (U,I) 18 = No. 2 oil fired, LNB/FGR (C)
	19 = Vertical fired utility boiler
	<b>Small Boilers (&lt;100 mmBtu/hr)</b> 20 = No. 6 oil fired (I) 21 = No. 6 oil fired (C) 22 = No. 5 oil fired (C) 23 = No. 4 oil fired (C) 24 = No. 2 oil fired (I) 25 = No. 2 oil fired (C)
	26 = Residential Furnace

**Emission Controls**

Particulate controls

<b>Enter the control type below</b> ▾	Message Area	Or enter a PM control efficiency below to override built in values.
	3	
Control Device 0 = None/other 1 = ESP 2 = Scrubber 3 = Bagfilter 4 = Multiple cyclone	Avg. Cont. Effic.    99.0	User Input PM Cont. Effic.  Message Area

Postcombustion SO<sub>2</sub> controls

<b>Enter the control type below</b> ▾	Message Area	Or enter an SO <sub>2</sub> control efficiency
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0	below to override built in values.
<b>Control Technology/Process</b>	<b>User Input SO<sub>2</sub> Cont. Effic.</b>
0 = None/other	90.0
1 = Wet scrubber, Lime/limestone	<b>User entered control efficiency may be overestimated and should be documented.</b>
2 = Wet scrubber, Sodium carbonate	<b>Avg. Cont. Effic.</b>
3 = Wet scrubber, Magnesium oxide/hydroxide	0.0
4 = Wet scrubber, Dual alkali	<b>Remarks</b>
5 = Spray drying, calcium hydroxide slurry, vap. in spray vessel	NA
6 = Furnace injection, Dry calcium carbonate/hydrate inj. in upper furn. cavity	
7 = Duct injection, Dry sorbent injection into duct, sometimes combined with water spray	

NO<sub>x</sub> controls

<b>Enter the control type below</b> ▾	Message Area	Or enter a NO <sub>x</sub> control efficiency below to override built in values.
0		
<b>Control Technology/Process</b>	<b>User Input NO<sub>x</sub> Cont. Effic.</b>	
0 = None/other	0.0	
1 = Low excess air (LEA)	<b>Avg. Cont. Effic.</b>	Message Area
2 = Staged combustion (SC)	0.0	
3 = Burners out of service (BOOS)	<b>Remarks</b>	
4 = Flue gas recirculation (FGR)	NA	
5 = Flue gas recirculation plus staged combustion		
6 = Low NO <sub>x</sub> burners (LNB)		
7 = Reduced air preheat (RAP)		
8 = Selective noncatalytic reduction (SNCR)		
9 = Conventional selective catalytic reduction (SCR)		

**Emissions Output (for operation 6.79 hr/yr)**

<b>Criteria Pollutants</b>				<b>Emission Factor<sup>1</sup></b>
Pollutant	lb/hr <sup>2</sup>	tpy	lb/yr <sup>3</sup>	(lb/10 <sup>3</sup> gal)
Total PM (FPM + CPM)	3.0	0.0000	0	3.30E+00
Filterable PM (FPM) rates @ 99% control	0.0	0.0000	0	2.00E+00
Condensable PM (CPM) <sup>4</sup>	3.0	0.0000	0	1.30E+00
Filterable PM-10 <sup>5</sup>	0.0	0.0000	0	1.00E+00
Filterable PM-2.5 <sup>5</sup>	0.0	0.0000	0	2.50E-01
NO <sub>x</sub> rates uncontrolled	see attached CEMs-based calculations			2.40E+01
NMTOC	0	0.0000	0	2.00E-01
CO	12	0.0000	0	5.00E+00
SO <sub>2</sub> rates @ 90% control	see attached CEMs-based calculations			2.98E+02
Total HAP <sup>6</sup>	4.17E-01	0.0000	0	1.81E-01
Largest HAP <sup>6</sup>	1.84E-01	0.0000	0	7.97E-02

<b>Toxic/Hazardous Air Pollutants.</b>				<b>Emission Factor<sup>1</sup></b>
Pollutant	lb/hr <sup>2</sup>	lb/day <sup>7</sup>	lb/yr <sup>3</sup>	(lb/10 <sup>3</sup> gal)
Antimony rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Arsenic rates @ 99% control	1.29E-05	NA	0.00E+00	5.60E-04
Benzene	6.35E-03	NA	0.00E+00	2.75E-03
Beryllium rates @ 99% control	9.70E-06	NA	0.00E+00	4.20E-04
Cadmium rates @ 99% control	9.70E-06	NA	0.00E+00	4.20E-04
Chromium rates @ 99% control	9.70E-06	NA	0.00E+00	4.20E-04
Chromium VI rates @ 99% control	2.85E-06	NA	0.00E+00	1.23E-04
Cobalt rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Ethylbenzene	1.89E-03	NA	0.00E+00	8.17E-04
Fluoride	8.61E-02	2.07E+00	0.00E+00	3.73E-02
Formaldehyde	1.11E-01	2.66E+00	0.00E+00	4.80E-02
Lead rates @ 99% control	2.91E-05	NA	0.00E+00	1.26E-03
Manganese rates @ 99% control	1.94E-05	4.65E-04	0.00E+00	8.40E-04
Mercury	9.70E-04	2.33E-02	0.00E+00	4.20E-04
Methyl chloroform (1,1,1-Trichloroethane)	5.45E-04	1.31E-02	0.00E+00	2.36E-04
Napthalene	7.69E-04	NA	0.00E+00	3.33E-04
Nickel rates @ 99% control	9.70E-06	2.33E-04	0.00E+00	4.20E-04
POM rates @ 99% control	7.62E-05	NA	0.00E+00	3.30E-03
Selenium rates @ 99% control	4.85E-05	NA	0.00E+00	2.10E-03

Toluene	1.84E-01	4.41E+00	0.00E+00	7.97E-02
Xylene	3.23E-03	7.76E-02	0.00E+00	1.40E-03

Greenhouse Gases				Emission Factor (lb/10 <sup>3</sup> gal)
Pollutant	lb/hr <sup>2</sup>	tpy	lb/yr <sup>3</sup>	
Carbon dioxide	see attached CEMs-based calculations			22671.27
Methane	2.12E+00	0.00E+00	0.00E+00	0.920
Nitrous Oxide	4.25E-01	0.00E+00	0.00E+00	0.18

<sup>1</sup>Emission factors represent AP-42 uncontrolled values. Emission rates are reflective of controls where applicable.

<sup>2</sup>Hourly emission rates for all pollutants are based on hourly rated capacity.

<sup>3</sup>Annual emission rates for all pollutants are based on maximum annual fuel throughput.

<sup>4</sup>Wet scrubbers are assumed to control CPM whereas other PM control devices are assumed to only control FPM.

<sup>5</sup>AP-42 assumes PM-10 and PM-2.5 assumes these pollutants are controlled with the same efficiency as total PM.

<sup>6</sup>Total and largest HAP factors and emission rates do not reflect control of metals. Individual metal emission rates are reflective of particulate matter controls where applicable.

<sup>7</sup>Daily emission rates are based on operation 24 hours per day at rated capacity.



# Bituminous Coal Combustion

2012 Cogeneration Emissions Inventory

Facility **University of North Carolina at Chapel Hill**  
 City **Chapel Hill**  
 County **Orange County**

APP #/Fac ID **6800043**  
 Input By **RST Engineering**  
 Source ID **Boiler #7**

Operating Scenario #1

(ES-002-Boiler #7)

## Data Input

Maximum Heat Input	<input type="text" value="323.17"/>	mmBtu/hr	<b>Boiler Type:</b>	<input type="text" value="7"/>
Boiler Size/Type	Large Industrial		1) Pulverized/Dry Bottom	6) Underfeed Stoker
Actual Fuel Usage or	<input type="text" value="32,737"/>	ton/yr	2) Pulverized/Wet Bottom	7) Fluidized Bed Cir.
Hours of Operation and	<input type="text"/>	hr/yr	3) Cyclone Furnace	8) Fluidized Bed Bub.
Heating Value	<input type="text" value="13,001"/>	Btu/lb	4) Spreader Stoker	9) Hand Fed
		ton/yr	5) Overfeed Stoker	
Sulfur Content	<input type="text" value="1.20"/>	%	<b>Control Device Efficiencies:</b>	
Ash Content :	<input type="text" value="7.8"/>	%	PM	<input type="text" value="99.80"/> %
(B)ituminous or (S)ubbituminous?	<input type="text" value="B"/>	(B/S)	PM-10	<input type="text" value="98.00"/> %
Calcium to Sulfur Ratio	<input type="text" value="2.22"/>		PM-2.5	<input type="text" value="97.90"/> %
			SOx*	<input type="text" value="90.00"/> %
			NOx*	<input type="text" value="0.00"/> %

**\*SOx and NOx emission estimates were calculated using CEMS data. Please refer to the SOx and NOX emissions data presented in the following CEMs spreadsheets.  
 HCl, HF, and Hg emissions based on stack test data.**

# Bituminous Coal Combustion

## 2012 Cogeneration Emissions Inventory

Facility **University of North Carolina at Chapel Hill**  
 City **Chapel Hill**  
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APP #/Fac ID **6800043**  
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 Source ID **Boiler #7**

Operating Scenario #1

(ES-002-Boiler #7)

### ACTUAL CRITERIA EMISSIONS

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
PM*	0.22	2.73	7,211	3.61
PM-10*	0.22	2.73	7,211	3.61
PM-2.5*	0.13	1.58	4,158	2.08
SO2	10.44	**	**	**
SO3	0.07	**	**	**
NOx	3.90	**	**	**
VOC*	0.01	0.15	392	0.20
CO*	0.89	11.02	29,027	14.51

### ACTUAL TOXIC EMISSIONS

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Acetaldehyde	5.70E-04	7.08E-03	1.87E+01	9.33E-03
Acetophenone	1.50E-05	1.86E-04	4.91E-01	2.46E-04
Acrolein	2.90E-04	3.60E-03	9.49E+00	4.75E-03
Antimony*	8.40E-06	1.04E-04	2.75E-01	1.37E-04
Arsenic*	7.83E-06	9.73E-05	2.56E-01	1.28E-04
Benzene	1.30E-03	1.62E-02	4.26E+01	2.13E-02
Benzo(a)pyrene	3.80E-08	4.72E-07	1.24E-03	6.22E-07
Benzyl chloride	7.00E-04	8.70E-03	2.29E+01	1.15E-02
Beryllium*	1.37E-06	1.71E-05	4.49E-02	2.25E-05
Biphenyl	1.70E-06	2.11E-05	5.57E-02	2.78E-05
Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05	9.07E-04	2.39E+00	1.19E-03
Bromine	1.07E-01	2.65E-03	6.98E+00	3.49E-03
Bromoform	3.90E-05	4.85E-04	1.28E+00	6.38E-04
Cadmium*	3.61E-06	4.49E-05	1.18E-01	5.92E-05
Carbon disulfide	1.30E-04	1.62E-03	4.26E+00	2.13E-03
2-Chloroacetophenone	7.00E-06	8.70E-05	2.29E-01	1.15E-04
Chlorobenzene	2.20E-05	2.73E-04	7.20E-01	3.60E-04
Chlorine*	2.81E-03	3.49E-02	9.19E+01	4.60E-02
Chloroform	5.90E-05	7.33E-04	1.93E+00	9.66E-04
Chromium*	1.25E-04	1.55E-03	4.09E+00	2.04E-03
Chromium (VI)	1.25E-04	3.10E-06	8.17E-03	4.09E-06
Cobalt*	7.18E-06	8.92E-05	2.35E-01	1.17E-04
Cumene	5.30E-06	6.59E-05	1.74E-01	8.68E-05
Cyanide	2.50E-03	3.11E-02	8.18E+01	4.09E-02
Dibenzofurans	2.01E-07	2.50E-06	6.58E-03	3.29E-06
Dimethyl sulfate	4.80E-05	5.97E-04	1.57E+00	7.86E-04
2,4-Dinitrotoluene	2.80E-07	3.48E-06	9.17E-03	4.58E-06
Ethyl benzene	9.40E-05	1.17E-03	3.08E+00	1.54E-03
Ethyl chloride	4.20E-05	5.22E-04	1.37E+00	6.87E-04
Ethylene dibromide	1.20E-06	1.49E-05	3.93E-02	1.96E-05
Ethylene dichloride	4.00E-05	4.97E-04	1.31E+00	6.55E-04
Formaldehyde*	1.71E-03	2.13E-02	5.60E+01	2.80E-02
Hexane	6.70E-05	8.33E-04	2.19E+00	1.10E-03
Hydrogen Chloride *	3.33E-01	4.14E+00	1.09E+04	5.45E+00
Hydrogen Fluoride *	5.98E-03	7.43E-02	1.96E+02	9.79E-02
Isophorone	5.80E-04	7.21E-03	1.90E+01	9.49E-03
Lead*	4.58E-05	5.69E-04	1.50E+00	7.49E-04

\*\*SO<sub>2</sub> and NOx emissions were estimated using CEMS data, please refer to the attached data sheets entitled "Sulfur Dioxide Emissions from Boiler #7" and Nitrogen Dioxide Emissions from Boiler #7".

# Bituminous Coal Combustion

## 2012 Cogeneration Emissions Inventory

Facility **University of North Carolina at Chapel Hill**  
 City **Chapel Hill**  
 County **Orange County**

APP #/Fac ID **6800043**  
 Input By **RST Engineering**  
 Source ID **Boiler #7**

Operating Scenario #1

(ES-002-Boiler #7)

### ACTUAL TOXIC EMISSIONS (continued)

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
<i>Manganese*</i>	3.12E-04	3.88E-03	1.02E+01	5.11E-03
<i>Mercury*</i>	2.18E-05	2.70E-04	7.12E-01	3.56E-04
Methyl bromide	1.60E-04	1.99E-03	5.24E+00	2.62E-03
Methyl chloride	5.30E-04	6.59E-03	1.74E+01	8.68E-03
Methyl ethyl ketone	3.90E-04	4.85E-03	1.28E+01	6.38E-03
Methyl hydrazine	1.70E-04	2.11E-03	5.57E+00	2.78E-03
Methyl methacrylate	2.00E-05	2.49E-04	6.55E-01	3.27E-04
Methyl tert butyl ether	3.50E-05	4.35E-04	1.15E+00	5.73E-04
Methylene chloride	2.90E-04	3.60E-03	9.49E+00	4.75E-03
Naphthalene	1.30E-05	1.62E-04	4.26E-01	2.13E-04
<i>Nickel*</i>	2.54E-04	3.16E-03	8.32E+00	4.16E-03
Phenol	1.60E-05	1.99E-04	5.24E-01	2.62E-04
<i>Phosphorus*</i>	3.80E-05	4.72E-04	1.24E+00	6.21E-04
POM	5.82E-05	7.24E-04	1.91E+00	9.53E-04
Propionaldehyde	3.80E-04	4.72E-03	1.24E+01	6.22E-03
<i>Selenium*</i>	5.59E-06	6.95E-05	1.83E-01	9.15E-05
Styrene	2.50E-05	3.11E-04	8.18E-01	4.09E-04
2,3,7,8-TCDD	1.43E-11	1.78E-10	4.68E-07	2.34E-10
Tetrachloroethylene	4.30E-05	5.34E-04	1.41E+00	7.04E-04
Toluene	2.40E-04	2.98E-03	7.86E+00	3.93E-03
1,1,1-Trichloroethane	2.00E-05	2.49E-04	6.55E-01	3.27E-04
Vinyl acetate	7.60E-06	9.45E-05	2.49E-01	1.24E-04
Xylenes	3.70E-05	4.60E-04	1.21E+00	6.06E-04
Total HAPs		4.39	11,561.86	5.78

### Greenhouse Gases

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Carbon dioxide			see attached CEMs-based calculations	
<i>Methane*</i>	0.010	0.12	323.47	0.16
Nitrous Oxide	0.09	1.14	3,003	1.50

\*Emission rates for pollutants in italics from August 2009 Section 114 test of Boiler #6.

#### Notes :

- 1) Emission factors are from Supplement B to the 5th edition of AP-42, unless otherwise noted
- 2) Emission calculations will be based on the hours of operation only when actual fuel usage is not supplied
- 3) Particulate controls affect PM, PM-10, PM-2.5, and all toxics that are regulated as particulates except Mercury
- 4) VOC = NMTOC = TOC \* (1-%METHANE)
- 5) PM-2.5 and SO3 do not currently need to be reported
- 6) Dibenzofurans = Polychlorinated dibenzo-p-furans
- 7) The Br emission factor is based on a mass balance generated from a 3 year coal analysis for Duke Power (1990-1992, 7 samples per year). The average concentration of bromine was 55.33 ppm (wet basis) and a heating value of 13,500 Btu/lb was assumed
- 8) For fluidized bed combustion the emission factor for underfeed stokers is utilized whenever the calcium-to-sulfur ratio is outside of the acceptable range of 1.5 to 7

**Natural Gas Combustion Emissions Calculator NG2000 Revision C**  
**2012 Cogeneration Emissions Inventory**  
**Boiler #7**  
*(ES-002-Boiler #7)*

Facility ID # 6800043  
 Permit # 03069T31

**Operating Scenario #2**

<b>User Input</b>	<b>Emissions Output (for operation 19.22 hr/yr)</b>																																																																																							
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# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Boiler # 7 Wood Pellet Combustion

0.0 ton/yr, wood pellets burned  
 64.63 MMBtu/hr, HI from wood  
 8,000 Btu/lb, wood heating value  
 4.04 ton/hr, max. wood firing rate  
 8,760 hr/yr

0.00E+00 MMBtu/yr  
 99.8% PM control  
 67.8% HCl efficiency\*  
 92.3% Hg efficiency\*

99.6% Metals control

\*Calculated from August 2009 EPA Tests

Pollutant	Emission Factor (lb/MMBtu) <sup>1</sup>	Emissions (lb/hr)	Emissions (lb/yr)	Emissions (ton/yr)
<b>NOx</b>	see attached CEMs-based calculations			
<b>CO</b>	0.17	10.99	0.0	0.00
<b>SO<sub>2</sub></b>	see attached CEMs-based calculations			
PM	0.417	0.054	0.00	0.00000
PM <sub>10</sub>	0.377	0.049	0.00	0.00000
PM <sub>2.5</sub>	0.327	0.042	0.00	0.00000
VOC	0.017	1.10	0.0	0.000
	<b>lb/MMBtu</b>			
Acetaldehyde	8.30E-04	5.36E-02	0.00E+00	0.00E+00
Acetophenone	3.20E-09	2.07E-07	0.00E+00	0.00E+00
Acrolein	4.00E-03	2.59E-01	0.00E+00	0.00E+00
Antimony	7.90E-06	2.04E-06	0.00E+00	0.00E+00
Arsenic	2.20E-05	5.69E-06	0.00E+00	0.00E+00
Benzene	4.20E-03	2.71E-01	0.00E+00	0.00E+00
Benzo(a)pyrene	2.60E-06	1.68E-04	0.00E+00	0.00E+00
Beryllium	1.10E-06	2.84E-07	0.00E+00	0.00E+00
Cadmium	4.10E-06	1.06E-06	0.00E+00	0.00E+00
Carbon tetrachloride	4.50E-05	2.91E-03	0.00E+00	0.00E+00
Chlorine	7.90E-04	5.11E-02	0.00E+00	0.00E+00
Chlorobenzene	3.30E-05	2.13E-03	0.00E+00	0.00E+00
Chloroform	2.80E-05	1.81E-03	0.00E+00	0.00E+00
Chromium	1.75E-05	4.52E-06	0.00E+00	0.00E+00
Cobalt	6.50E-06	1.68E-06	0.00E+00	0.00E+00
Di(2-ethylhexyl)phthalate	4.70E-08	3.04E-06	0.00E+00	0.00E+00
Dinitrophenol, 2,4-	1.80E-07	1.16E-05	0.00E+00	0.00E+00
Ethyl Benzene	3.10E-05	2.00E-03	0.00E+00	0.00E+00
Ethylene dichloride	2.90E-05	1.87E-03	0.00E+00	0.00E+00
Formaldehyde	4.40E-03	2.84E-01	0.00E+00	0.00E+00
Hexachlorodibenzo-p-dioxin	1.60E-06	1.03E-04	0.00E+00	0.00E+00
<b>Hydrogen Chloride</b>	1.90E-02	3.95E-01	0.00E+00	0.00E+00
Lead	4.80E-05	1.24E-05	0.00E+00	0.00E+00
Manganese	1.60E-03	4.14E-04	0.00E+00	0.00E+00
<b>Mercury</b>	3.50E-06	1.74E-05	0.00E+00	0.00E+00
Methyl bromide	1.50E-05	9.70E-04	0.00E+00	0.00E+00
Methyl chloride	2.30E-05	1.49E-03	0.00E+00	0.00E+00
Methyl chloroform	3.10E-05	2.00E-03	0.00E+00	0.00E+00
Methyl ethyl ketone	5.40E-06	3.49E-04	0.00E+00	0.00E+00
Methylene chloride	2.90E-04	1.87E-02	0.00E+00	0.00E+00
Naphthalene	9.70E-05	6.27E-03	0.00E+00	0.00E+00
Nickel	3.30E-05	8.53E-06	0.00E+00	0.00E+00
Nitrophenol, 4-	1.10E-07	7.11E-06	0.00E+00	0.00E+00
Pentachlorophenol	5.10E-08	3.30E-06	0.00E+00	0.00E+00
Perchloroethylene	3.80E-05	2.46E-03	0.00E+00	0.00E+00
Phenol	5.10E-05	3.30E-03	0.00E+00	0.00E+00
Phosphorus	2.70E-05	6.98E-06	0.00E+00	0.00E+00
Polychlorinated biphenyls	8.15E-09	5.27E-07	0.00E+00	0.00E+00
POM	1.25E-04	8.08E-03	0.00E+00	0.00E+00
Propionaldehyde	6.10E-05	3.94E-03	0.00E+00	0.00E+00
Propylene dichloride	3.30E-05	2.13E-03	0.00E+00	0.00E+00
Selenium	2.80E-06	7.24E-07	0.00E+00	0.00E+00
Styrene	1.90E-03	1.23E-01	0.00E+00	0.00E+00
2,3,7,8-TCDD	8.60E-12	5.56E-10	0.00E+00	0.00E+00
Toluene	9.20E-04	5.95E-02	0.00E+00	0.00E+00
Trichloroethylene	3.00E-05	1.94E-03	0.00E+00	0.00E+00
Trichlorofluoromethane	4.10E-05	2.65E-03	0.00E+00	0.00E+00
Trichlorophenol	2.20E-08	1.42E-06	0.00E+00	0.00E+00
Vinyl chloride	1.80E-05	1.16E-03	0.00E+00	0.00E+00
Xylenes	2.50E-05	1.62E-03	0.00E+00	0.00E+00
<b>Carbon Dioxide</b>	see attached CEMs-based calculations			
Methane	0.0705	4.557	0.0	0.0000
N <sub>2</sub> O	0.00926	0.60	0.0	0.0000

1-Emission factors based on DAQ wood combustion spreadsheet

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Sulfur Dioxide Emissions from Boiler #7

#### (ES-002-Boiler #7)

The exhaust duct at Boiler #7 is equipped with a continuous emissions monitor (CEMs) for SO<sub>2</sub> emissions.

For the 2012 calendar year, 30 day facility averages for the SO<sub>2</sub> emission rate measured by the CEM are as follows:

Month	30 day average CEM reading (lb/MMBtu)
January 2012	0.15
February 2012	0.15
March 2012	0.14
April 2012	0.14
May 2012	0.16
June 2012	0.16
July 2012	0.15
August 2012	0.16
September 2012	0.14
October 2012	0.15
November 2012	0.15
December 2012	0.16
<b>Annual Average</b>	<b>0.151</b>

This average includes SO<sub>2</sub> emissions from coal, fuel oil, wood, and natural gas from Boiler #7 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #7 for 2012

Boiler #7			
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr	Wood Pellets, Tons/yr
32,737	179,982	0	0.0
Coal (13,001 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)	Wood (8,185 btu/lb)
MMBtu/yr			
8.51E+05	1.85E+05	0.00E+00	0

Total for Boiler #7 (MMBtu/yr)	1.04E+06
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Total SO <sub>2</sub> Emissions from Boiler #7 (lb/yr)	156,355
<b>Total SO<sub>2</sub> Emissions from Boiler #7 (ton/yr)</b>	<b>78.177</b>

SO <sub>2</sub> Emissions Associated with Coal Combustion (ton/yr)	78.18
SO <sub>2</sub> Emissions Associated with No. 2 Fuel Oil Combustion (ton/yr)	0.00000
SO <sub>2</sub> Emissions Associated with Natural Gas Combustion (ton/yr)	0*
SO <sub>2</sub> Emissions Associated with Wood Pellet Combustion (ton/yr)	0*

\*All SO<sub>2</sub> measured by CEMS allocated to coal and No.2 fuel oil.

# University of North Carolina at Chapel Hill

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## 2012 Cogeneration Emissions Inventory

### Nitrogen Dioxide Emissions from Boiler #7

#### (ES-002-Boiler #7)

The exhaust duct at Boiler #7 is equipped with a continuous emissions monitor (CEMs) for NOx emissions.

For the 2012 calendar year, 30 day facility averages for the NOx emission rate measured by the CEM are as follows:

Month	30 day average CEM reading (lb/MMBtu)
January 2012	0.40
February 2012	0.41
March 2012	0.38
April 2012	0.38
May 2012	0.30
June 2012	0.36
July 2012	0.40
August 2012	0.27
September 2012	0.34
October 2012	0.39
November 2012	0.40
December 2012	0.45
<b>Annual Average</b>	<b>0.37</b>

This average includes NOx emissions from coal, fuel oil, wood, and natural gas within Boiler #7 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #7 for 2012

Boiler #7			
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr	Wood Pellets, Tons/yr
32,737	179,982	0	0.0
Coal (13,001 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)	Wood (8,185 btu/lb)
MMBtu/yr			
8.51E+05	1.85E+05	0.00E+00	0

Total for Boiler #7 (MMBtu/yr)	1.04E+06
--------------------------------	----------

NOx Emissions from Boiler #7 (lb/yr)	387,000
<b>NOx Emissions from Boiler #7 (ton/yr)</b>	<b>193.50</b>

NOx Emissions Associated with Coal Combustion (ton/yr)	158.90
NOx Emissions Associated with Fuel Oil No. 2 Combustion (ton/yr)	0.00
NOx Emissions Associated with Natural Gas Combustion (ton/yr)	34.60
NOx Emissions Associated with Wood Pellet Combustion (ton/yr)	0.0

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## 2012 Cogeneration Emissions Inventory

### CO<sub>2</sub> Emissions from Boiler No.7 (ES-3)

The exhaust system on Boiler #7 is equipped with a continuous emissions monitor (CEMs) for CO<sub>2</sub> concentrations. The exhaust also includes a flow monitor. Mass CO<sub>2</sub> emissions are calculated by the DAHS for GHG reporting. For the 2012 calendar year, the monthly CO<sub>2</sub> emissions measured by the CEM/DAHS System are as follows:

Month	Metric Tons	Tons
January 2012	11,642	12,833
February 2012	10,336	11,393
March 2012	4,821	5,314
April 2012	4	4
May 2012	6,745	7,435
June 2012	7,124	7,852
July 2012	11,053	12,184
August 2012	8,454	9,319
September 2012	6,592	7,267
October 2012	14,511	15,995
November 2012	12,199	13,447
December 2012	4,673	5,151
<b>Annual Total</b>	<b>98,154</b>	<b>108,195</b>

This total includes CO<sub>2</sub> emissions from coal, fuel oil, wood pellets, and natural gas from Boiler #7 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #7 for 2012

Boiler #7			
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr	Wood Pellets, Tons/yr
32,737	179,982	0	0.0
Coal (13,001 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)	Wood (8,185 btu/lb)
MMBtu/yr			
8.51E+05	1.85E+05	0.00E+00	0

Total for Boiler #7 (MMBtu/yr)	1.04E+06
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#### CO<sub>2</sub> Emission Rate Ratios

	kg/MMBtu	Ratio
coal	93.40	1
n.gas	53.02	0.56767
No.2 oil	73.96	0.79186
wood	93.80	1.00428

CO <sub>2</sub> Emissions Associated with Coal Combustion (ton/yr)	96,290.5
CO <sub>2</sub> Emissions Associated with Fuel Oil No. 2 Combustion (ton/yr)	0.00
CO <sub>2</sub> Emissions Associated with Natural Gas Combustion (ton/yr)	11904.2
CO <sub>2</sub> Emissions Associated with Wood Pellet Combustion (ton/yr)	0.0

9.56E+05 Dist. Factor

108,195



# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

**Boiler #8**

**(ES-003-Boiler #8)**

*Operating Scenario #1 - Natural Gas Firing*  
*Operating Scenario #2 - No. 2 Fuel Oil Firing*

**Boiler #8 - Operating Scenario #1 - Natural Gas**

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name: University of North Carolina at Chapel HillFacility ID #: 6800043Permit #: 03069T31County: OrangeDAQ Region: Raleigh

## North Carolina Department of Environment and Natural Resources

## Division of Air Quality

## Air Pollutant Point Source Emissions Inventory - Calendar Year 2012

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-003-Boiler #8					
2. Emission Source Description		Natural Gas / No. 2 Fuel Oil Fired Boiler					
3. Operating Scenario Description		Operating Scenario #1 - Natural Gas					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		338.0 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		95,669			1,000 ft <sup>3</sup> /yr		
6. Fuel Information (if fuel used)		% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	1,030 Btu/ft <sup>3</sup>

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	N/A
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## 8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	None	None
ii.	None	None
iii.	None	None
iv.	None	None

## 9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
N/A	N/A	N/A	N/A	N/A	N/A	N/A
--	--	--	--	--	--	--
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## 10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	Standby	Days/Week	Standby	Weeks/Year	Standby	Hours/Year	1,833 Total
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

## 11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	19%	Mar-May	18%	June-Aug	16%	Sept-Nov	47%
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**Boiler #8 - Operating Scenario #1 - Natural Gas**  
 If Emission Source has multiple Operating Scenarios, complete one form for each.  
 (All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: 6800043  
 Permit #: 03069T31  
 County: Orange  
 DAQ Region: Raleigh

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

**Emissions:** Attach calculations and documentation of emission factors or other estimation methods used.

Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)

ES-003-Boiler #8

Criteria (NAAQS) Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Monoxide	CO	4.02	8	N/A
NOx	NOx	3.65	8	N/A
PM Total	PM	0.36	8	N/A
PM-2.5	PM-2.5	0.36	8	N/A
PM-10	PM-10	0.36	8	N/A
SO2	SO2	0.03	8	N/A
VOC	VOC	0.26	8	N/A
HAP/TAP Pollutants (In Alphabetical Order)	CAS # (or other code - see instructions)	Emissions HAP/TAP (Pounds/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Arsenic	ARSENICCPDS	1.91E-02	8	N/A
Benzene	71-43-2	0.20	8	N/A
Cadmium	CADMIUMCPDS	1.05E-01	8	N/A
Chromium	CROMCPDS	1.34E-01	8	N/A
Chromium VI	CHROM6CPDS	1.34E-01	8	N/A
Dichlorobenzene	106-46-7	1.15E-01	8	N/A
Formaldehyde	50-00-0	7.18	8	N/A
Hexane	HEXANEISO	1.72E+02	8	N/A
Lead	LEADCPDS	4.78E-02	8	N/A
Manganese	MANGCPDS	3.64E-02	8	N/A
Mercury	MERCPDS	2.49E-02	8	N/A
Napthalene	91-20-3	5.84E-02	8	N/A
Nickel	NICKCPDS	0.20	8	N/A
POM	POM	6.33E-02	8	N/A
Toluene	108-88-3	0.33	8	N/A
Greenhouse Gas Pollutants	Pollutant Code	Emissions Criteria (Tons/Year)	Emissions Estimation Method Code (see instructions for code)	Control Efficiency (Net after all controls)
Carbon Dioxide	CO <sub>2</sub>	5,571.35	8	N/A
Methane	CH <sub>4</sub>	1.09E-01	8	N/A
Nitrous oxide	N <sub>2</sub> O	1.09E-02	8	N/A

**Boiler #8 - Operating Scenario #2 - No. 2 Fuel Oil**  
 If Emission Source has multiple Operating Scenarios, complete one form for each.  
 (All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: **6800043**  
 Permit #: **03069T31**  
 County: **Orange**  
 DAQ Region: **Raleigh**

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-003-Boiler #8					
2. Emission Source Description		Natural Gas / No. 2 Fuel Oil Fired Boiler					
3. Operating Scenario Description		Operating Scenario #2 - No. 2 Fuel Oil					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		338.0 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		0 gallons/year					
6. Fuel Information (if fuel used)		% Sulfur	0.08%	% Ash		Heat Content (Btu/lb or mmCF)	139,043 Btu/gal

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	N/A
--	-----

8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	N/A	N/A
ii.	N/A	N/A
iii.	N/A	N/A
iv.	N/A	N/A

9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
N/A	N/A	N/A	N/A	N/A	N/A	N/A
--	--	--	--	--	--	--
--	--	--	--	--	--	--

10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	Standby	Days/Week	Standby	Weeks/Year	Standby	Hours/Year	1,833 Total
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	#DIV/0!	Mar-May	#DIV/0!	June-Aug	#DIV/0!	Sept-Nov	#DIV/0!
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**Natural Gas Combustion Emissions Calculator NG2000 Revision C**  
**2012 Cogeneration Emissions Inventory**  
**Boiler #8**  
*(ES-003-Boiler #8)*

Facility ID # 6800043  
 Permit # 03069T31

Operating Scenario #1

User Input	Emissions Output																																																																																																																																												
<p>Company Name: <b>University of North Carolina at Chapel Hill</b></p> <p>Plant County: <b>Orange County</b></p> <p>Plant City: <b>Chapel Hill</b></p> <p>Permit Number: <b>03069T31</b></p> <p>User: <b>RST Engineering</b></p> <p>Heat Input Capacity (mmBtu/hr): <b>338</b></p> <p>Fuel Input Capacity (10<sup>6</sup> scf/hr): <b>0.33</b></p> <p>Annual Fuel Throughput (10<sup>6</sup> scf): <b>95.67</b></p> <p>Latest Construction/Modification Date: <b>N/A</b></p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left;">Criteria Pollutants</th> <th style="text-align: center;">Emission Factor (lb/mmscf)</th> </tr> <tr> <th>Pollutant</th> <th>lb/hr</th> <th>lb/yr</th> <th>tpy</th> <th></th> </tr> </thead> <tbody> <tr> <td>PM</td> <td>2.5E+00</td> <td>7.3E+02</td> <td>3.6E-01</td> <td style="color: green;">7.6E+00</td> </tr> <tr> <td>PM-10</td> <td>2.5E+00</td> <td>7.3E+02</td> <td>3.6E-01</td> <td style="color: green;">7.6E+00</td> </tr> <tr> <td>PM-2.5</td> <td>2.5E+00</td> <td>7.3E+02</td> <td>3.6E-01</td> <td style="color: green;">7.6E+00</td> </tr> <tr> <td>NOx</td> <td colspan="3">see attached CEMs-based calculations</td> <td style="color: green;">1.9E+02</td> </tr> <tr> <td>VOC</td> <td>1.8E+00</td> <td>5.3E+02</td> <td>2.6E-01</td> <td style="color: green;">5.5E+00</td> </tr> <tr> <td>CO</td> <td>2.8E+01</td> <td>8.0E+03</td> <td>4.0E+00</td> <td style="color: green;">8.4E+01</td> </tr> <tr> <td>SO2</td> <td>2.0E-01</td> <td>5.7E+01</td> <td>2.9E-02</td> <td style="color: green;">6.0E-01</td> </tr> <tr> <td>Total HAP</td> <td>6.3E-01</td> <td>1.8E+02</td> <td>9.0E-02</td> <td style="color: green;">1.9E+00</td> </tr> <tr> <td>Largest HAP</td> <td>6.0E-01</td> <td>1.7E+02</td> <td>8.6E-02</td> <td style="color: green;">1.8E+00</td> </tr> </tbody> </table> <table border="1" style="width: 100%; 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Chromium	4.6E-04	NA	1.3E-01	1.4E-03																																																																																																																																									
Chromium VI	4.6E-04	NA	1.3E-01	1.4E-03																																																																																																																																									
Dichlorobenzene	4.0E-04	NA	1.1E-01	1.2E-03																																																																																																																																									
Formaldehyde	2.5E-02	NA	7.2E+00	7.5E-02																																																																																																																																									
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Toluene	1.1E-03	2.7E-02	3.3E-01	3.4E-03																																																																																																																																									
<p style="color: red;">Enter the boiler type below ▾</p> <p style="text-align: right; color: blue;">3 + 4</p>																																																																																																																																													
<p><b>Other NOx Control</b></p> <p>Enter 1 below if SNCR is applied to the boiler.</p> <p style="text-align: right; color: blue;">0</p>																																																																																																																																													
<p><b>Large Wall-Fired Boilers (=&gt;100 mmBtu/hr)</b></p> <p>1 = Uncontrolled (Pre-NSPS)</p> <p>2 = Uncontrolled (Post-NSPS)</p> <p>3 = Controlled - Low NOx burners</p> <p>4 = Controlled - Flue gas recirculation (FGR)</p>																																																																																																																																													
<p><b>Small Boilers (&lt;100 mmBtu/hr)</b></p> <p>5 = Uncontrolled</p> <p>6 = Controlled - Low NOx burners</p> <p>7 = Controlled - Low NOx burners/FGR</p>																																																																																																																																													
<p><b>Tangential-Fired Boilers (All Sizes)</b></p> <p>8 = Uncontrolled</p> <p>9 = Controlled - FGR</p>																																																																																																																																													
<p><b>Residential Furnaces (&lt;0.3 mmBtu/hr)</b></p> <p>10 = Uncontrolled</p>																																																																																																																																													
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: left;">Greenhouse Gas Pollutants</th> <th style="text-align: center;">Em. Factor (lb/mmBtu)</th> </tr> <tr> <th>Pollutant</th> <th>lb/hr</th> <th>lb/yr</th> <th>tpy</th> <th></th> </tr> </thead> <tbody> <tr> <td>Carbon dioxide</td> <td colspan="3">see attached CEMs-based calculations</td> <td style="color: green;">116.89</td> </tr> <tr> <td>Methane</td> <td>0.75</td> <td>217.24</td> <td>1.09E-01</td> <td style="color: green;">2.20E-03</td> </tr> <tr> <td>Nitrous Oxide</td> <td>0.075</td> <td>21.72</td> <td>1.09E-02</td> <td style="color: green;">2.20E-04</td> </tr> </tbody> </table>	Greenhouse Gas Pollutants				Em. Factor (lb/mmBtu)	Pollutant	lb/hr	lb/yr	tpy		Carbon dioxide	see attached CEMs-based calculations			116.89	Methane	0.75	217.24	1.09E-01	2.20E-03	Nitrous Oxide	0.075	21.72	1.09E-02	2.20E-04																																																																																																																			
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**Fuel Oil Combustion Emissions Calculator FO2000 Revision A**

**Boiler #8**

**2012 Cogeneration Emissions Inventory**

**(ES-003-Boiler #8)**

**Facility ID # 6800043**

**Permit # 03069T31**

**Operating Scenario #2**

<b>User Input</b>	
Company Name:	<b>University of North Carolina at</b>
Plant County:	<b>Chapel Hill</b>
Plant City:	<b>Orange County</b>
Permit Number:	<b>Chapel Hill</b>
User:	<b>03069T31</b>
Heat Input Capacity (mmBtu/hr):	<b>RST Engineering</b>
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	<b>338</b>
Annual Fuel Throughput (1000 gal):	<b>2.41</b>
Maximum fuel sulfur content (%):	<b>0.00</b>
Latest Construction/Modification Date:	<b>0.08</b>
	<b>N/A</b>

<b>Enter the boiler type below ▾</b>	
	<b>17</b>

<b>Boilers =&gt;100 mmBtu/hr</b>
1 = No. 6 oil fired, normal firing (U)
2 = No. 6 oil fired, normal firing (I)
3 = No. 6 oil fired, normal firing (C)
4 = No. 6 oil fired, normal firing, low NOx burner (U)
5 = No. 6 oil fired, normal firing, low NOx burner (I)
6 = No. 6 oil fired, normal firing, low NOx burner (C)
7 = No. 6 oil fired, tangential firing (U)
8 = No. 6 oil fired, tangential firing, low NOx burner (U)
9 = No. 5 oil fired, normal firing (U)
10 = No. 5 oil fired, normal firing (I)
11 = No. 5 oil fired, tangential firing (U)
12 = No. 4 oil fired, normal firing (U)
13 = No. 4 oil fired, normal firing (I)
14 = No. 4 oil fired, tangential firing (U)
15 = No. 2 oil fired (U,I)

<b>Boilers =&gt;100 mmBtu/hr (cont'd)</b>
16 = No. 2 oil fired (C)
17 = No. 2 oil fired, LNB/FGR (U,I)
18 = No. 2 oil fired, LNB/FGR (C)
19 = Vertical fired utility boiler
<b>Small Boilers (&lt;100 mmBtu/hr)</b>
20 = No. 6 oil fired (I)
21 = No. 6 oil fired (C)
22 = No. 5 oil fired (C)
23 = No. 4 oil fired (C)
24 = No. 2 oil fired (I)
25 = No. 2 oil fired (C)
26 = Residential Furnace

**Fuel Oil Combustion Emissions Calculator FO2000 Revision A**

**Boiler #8**

**2012 Cogeneration Emissions Inventory**

**(ES-003-Boiler #8)**

**Facility ID # 6800043**

**Permit # 03069T31**

**Operating Scenario #2**

<b>User Input</b>	
Company Name:	<b>University of North Carolina at Chapel Hill</b>
Plant County:	<b>Orange County</b>
Plant City:	<b>Chapel Hill</b>
Permit Number:	<b>03069T31</b>
User:	<b>RST Engineering</b>
Heat Input Capacity (mmBtu/hr):	<b>338</b>
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.41
Annual Fuel Throughput (1000 gal):	<b>0.00</b>
Maximum fuel sulfur content (%):	<b>0.08</b>
Latest Construction/Modification Date:	<b>N/A</b>

**Emission Controls**

Particulate controls

<b>Enter the control type below</b> ▾	Message Area	Or enter a PM control efficiency below to override built in values.
<b>0</b>		
<u>Control Device</u>	<u>Avg. Cont. Effic.</u>	<u>User Input PM Cont. Effic.</u>
0 = None/other	0.0	<b>0.0</b>
1 = ESP		Message Area
2 = Scrubber		
3 = Bagfilter	0.0	
4 = Multiple cyclone		

Postcombustion SO<sub>2</sub> controls

<b>Enter the control type below</b> ▾	Message Area	Or enter an SO <sub>2</sub> control efficiency below to override built in values.
<b>0</b>		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input SO<sub>2</sub> Cont. Effic.</u>
0 = None/other		<b>0.0</b>
1 = Wet scrubber, Lime/limestone	0.0	Message Area
2 = Wet scrubber, Sodium carbonate		
3 = Wet scrubber, Magnesium oxide/hydroxide		
4 = Wet scrubber, Dual alkali		
5 = Spray drying, calcium hydroxide slurry, vap. in spray vessel	<u>Remarks</u>	
6 = Furnace injection, Dry calcium carbonate/hydrate inj. in upper furn. cavity	NA	
7 = Duct injection, Dry sorbent injection into duct, sometimes combined with water spray		

NO<sub>x</sub> controls

<b>Enter the control type below</b> ▾		Or enter a NO <sub>x</sub> control efficiency below to override built in values.
<b>5 + 6</b>		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input NO<sub>x</sub> Cont. Effic.</u>
0 = None/other		<b>0.0</b>
1 = Low excess air (LEA)	0.0	Message Area
2 = Staged combustion (SC)		
3 = Burners out of service (BOOS)		
4 = Flue gas recirculation (FGR)	<u>Remarks</u>	
5 = Flue gas recirculation plus staged combustion	NA	
6 = Low NO <sub>x</sub> burners (LNB)		
7 = Reduced air preheat (RAP)		
8 = Selective noncatalytic reduction (SNCR)		
9 = Conventional selective catalytic reduction (SCR)		



**Fuel Oil Combustion Emissions Calculator FO2000 Revision A**

**Boiler #8**

**2012 Cogeneration Emissions Inventory**

**(ES-003-Boiler #8)**

**Facility ID # 6800043**

**Permit # 03069T31**

**Operating Scenario #2**

<b>User Input</b>	
Company Name:	<b>University of North Carolina at Chapel Hill</b>
Plant County:	<b>Orange County</b>
Plant City:	<b>Chapel Hill</b>
Permit Number:	<b>03069T31</b>
User:	<b>RST Engineering</b>
Heat Input Capacity (mmBtu/hr):	<b>338</b>
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.41
Annual Fuel Throughput (1000 gal):	<b>0.00</b>
Maximum fuel sulfur content (%):	<b>0.08</b>
Latest Construction/Modification Date:	<b>N/A</b>

**Emissions Output**

**Criteria Pollutants**

Pollutant	lb/hr <sup>2</sup>	tpy	lb/yr <sup>3</sup>	Emission Factor <sup>1</sup> (lb/10 <sup>3</sup> gal)
Total PM (FPM + CPM)	8.0	0.0000	0	3.30E+00
Filterable PM (FPM) rates uncontrolled	4.8	0.0000	0	2.00E+00
Condensable PM (CPM) <sup>4</sup>	3.1	0.0000	0	1.30E+00
Filterable PM-10 <sup>5</sup>	2.4	0.0000	0	1.00E+00
Filterable PM-2.5 <sup>5</sup>	0.6	0.0000	0	2.50E-01
NOx rates uncontrolled	see attached CEMs-based calculations			2.40E+01
NMTOC	0	0.0000	0	2.00E-01
CO	12	0.0000	0	5.00E+00
SO2 rates uncontrolled	59.2	0.0000	0	2.45E+01
Total HAP <sup>6</sup>	4.36E-01	0.0000	0	1.81E-01
Largest HAP <sup>6</sup>	1.92E-01	0.0000	0	7.97E-02

*\*\*NOx emissions based on CEMs data.*

**Toxic/Hazardous Air Pollutants.**

Pollutant	lb/hr <sup>2</sup>	lb/day <sup>7</sup>	lb/yr <sup>3</sup>	Emission Factor <sup>1</sup> (lb/10 <sup>3</sup> gal)
<b>Antimony rates uncontrolled</b>	<b>0.00E+00</b>	<b>NA</b>	<b>0.00E+00</b>	0.00E+00
Arsenic rates uncontrolled	1.35E-03	NA	0.00E+00	5.60E-04
Benzene	6.64E-03	NA	0.00E+00	2.75E-03
Beryllium rates uncontrolled	1.01E-03	NA	0.00E+00	4.20E-04
Cadmium rates uncontrolled	1.01E-03	NA	0.00E+00	4.20E-04
<b>Chromium rates uncontrolled</b>	<b>1.01E-03</b>	<b>NA</b>	<b>0.00E+00</b>	4.20E-04
Chromium VI rates uncontrolled	2.98E-04	NA	0.00E+00	1.23E-04
<b>Cobalt rates uncontrolled</b>	<b>0.00E+00</b>	<b>NA</b>	<b>0.00E+00</b>	0.00E+00
<b>Ethylbenzene</b>	<b>1.97E-03</b>	<b>NA</b>	<b>0.00E+00</b>	8.17E-04
Fluoride	9.01E-02	2.16E+00	0.00E+00	3.73E-02
Formaldehyde	1.16E-01	2.78E+00	0.00E+00	4.80E-02
<b>Lead rates uncontrolled</b>	<b>3.04E-03</b>	<b>NA</b>	<b>0.00E+00</b>	1.26E-03
Manganese rates uncontrolled	2.03E-03	4.87E-02	0.00E+00	8.40E-04
Mercury	1.01E-03	2.43E-02	0.00E+00	4.20E-04
Methyl chloroform (1,1,1-Trichloroethane)	5.70E-04	1.37E-02	0.00E+00	2.36E-04
<b>Naphthalene</b>	<b>8.04E-04</b>	<b>NA</b>	<b>0.00E+00</b>	3.33E-04
Nickel rates uncontrolled	1.01E-03	2.43E-02	0.00E+00	4.20E-04
<b>POM rates uncontrolled</b>	<b>7.97E-03</b>	<b>NA</b>	<b>0.00E+00</b>	3.30E-03
<b>Selenium rates uncontrolled</b>	<b>5.07E-03</b>	<b>NA</b>	<b>0.00E+00</b>	2.10E-03
Toluene	1.92E-01	4.62E+00	0.00E+00	7.97E-02
Xylene	3.38E-03	8.12E-02	0.00E+00	1.40E-03

**Greenhouse Gases**

Pollutant	lb/hr <sup>2</sup>	tpy	lb/yr <sup>3</sup>	Emission Factor (lb/10 <sup>3</sup> gal)
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**Fuel Oil Combustion Emissions Calculator FO2000 Revision A**

**Boiler #8**

**2012 Cogeneration Emissions Inventory**

**(ES-003-Boiler #8)**

**Facility ID # 6800043**

**Permit # 03069T31**

**Operating Scenario #2**

<b>User Input</b>	
Company Name:	<b>University of North Carolina at Chapel Hill</b>
Plant County:	<b>Orange County</b>
Plant City:	<b>Chapel Hill</b>
Permit Number:	<b>03069T31</b>
User:	<b>RST Engineering</b>
Heat Input Capacity (mmBtu/hr):	<b>338</b>
Fuel Input Capacity (10 <sup>3</sup> gal/hr):	2.41
Annual Fuel Throughput (1000 gal):	<b>0.00</b>
Maximum fuel sulfur content (%):	<b>0.08</b>
Latest Construction/Modification Date:	<b>N/A</b>

Carbon dioxide	see attached CEMs-based calculations			22671.27
Methane	2.22E+00	0.00E+00	0.00E+00	0.920
Nitrous Oxide	4.44E-01	0.00E+00	0.00E+00	0.18

<sup>1</sup>Emission factors represent AP-42 uncontrolled values. Emission rates are reflective of controls where applicable.

<sup>2</sup>Hourly emission rates for all pollutants are based on hourly rated capacity.

<sup>3</sup>Annual emission rates for all pollutants are based on maximum annual fuel throughput.

<sup>4</sup>Wet scrubbers are assumed to control CPM whereas other PM control devices are assumed to only control FPM.

<sup>5</sup>AP-42 assumes PM-10 and PM-2.5 assumes these pollutants are controlled with the same efficiency as total PM.

<sup>6</sup>Total and largest HAP factors and emission rates do not reflect control of metals. Individual metal emission rates are reflective of particulate matter controls where applicable.

<sup>7</sup>Daily emission rates are based on operation 24 hours per day at rated capacity.

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Nitrogen Dioxide Emissions from Boiler #8 (ES-003-Boiler #8)

The exhaust duct at Boiler #8 is equipped with a continuous emissions monitor (CEMs) for NOx emissions. For the 2012 calendar year, 30 day facility averages for the NOx emission rate measured by the CEM are as follows:

Month	30 day average CEM reading (lb/MMBtu)
January 2012	0.07
February 2012	0.08
March 2012	0.08
April 2012	0.08
May 2012	0.08
June 2012	0.08
July 2012	0.07
August 2012	0.07
September 2012	0.06
October 2012	0.06
November 2012	0.08
December 2012	0.08
<b>Annual Average</b>	<b>0.074</b>

This average includes NOx emissions from fuel oil and natural gas from Boiler #8 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #8 for 2012

Boiler #8	
Gas 1,000cf/yr	Oil Gallons/yr
95,669	0
Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)
MMBtu/yr	
9.85E+04	0.00E+00

Total for Boiler #8 (MMBtu/yr)	9.85E+04
--------------------------------	----------

NOx Emissions from Boiler #8 (lb/yr)	7,308
NOx Emissions from Boiler #8 (ton/yr)	3.65

NOx Emissions Associated with Fuel Oil Combustion (ton/yr)	0.000
NOx Emissions Associated with Natural Gas Combustion (ton/yr)	3.654

# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### CO<sub>2</sub> Emissions from Boiler No.8

(ES-3)

The exhaust system on Boiler #8 is equipped with a continuous emissions monitor (CEMs) for CO<sub>2</sub> concentrations. The natural gas and oil flow rates to the boiler are monitored. Mass CO<sub>2</sub> emissions are calculated by the DAHS for GHG reporting. For the 2012 calendar year, the monthly CO<sub>2</sub> emissions measured by the CEM/DAHS System are as follows:

Month	Metric Tons	Tons
January 2012	29	32
February 2012	380	419
March 2012	435	480
April 2012	456	502
May 2012	100	110
June 2012	3	4
July 2012	539	594
August 2012	285	314
September 2012	60	66
October 2012	113	125
November 2012	2,157	2,378
December 2012	497	548
<b>Annual Total</b>	<b>5,054</b>	<b>5,571</b>

This total includes CO<sub>2</sub> emissions from No.2 fuel oil and natural gas from Boiler #8 over the entire year, representing a composite average for all fuels combusted.

#### Fuel Inputs to Boiler #8 for 2012

Boiler #8	
Gas 1,000cf/yr	No. 2 Oil Gallons/yr
95,669	0
Nat. Gas (1,030 btu/cf)	Oil (139,043 btu/gal)
MMBtu/yr	
9.85E+04	0.00E+00
Total for Boiler #7 (MMBtu/yr)	
9.85E+04	

CO <sub>2</sub> Emissions Associated with Fuel Oil No. 2 Combustion (ton/yr)	0.00
CO <sub>2</sub> Emissions Associated with Natural Gas Combustion (ton/yr)	5,571.35

#### CO<sub>2</sub> Emission Rate Ratios

	kg/MMBtu	Ratio
n.gas	53.02	1
No.2 oil	73.96	1.3949

9.85E+04 Dist. Factor

**The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

**2012 Annual Emissions Inventory**

**Coal Crusher/Conveyor Building  
(ES-010A)**

<b>Emission Source/Operating Scenario Data</b> Page 1 of 2	<b>Facility ID #:</b> 6800043
<b>Coal Crusher/Conveyor Building</b>	<b>Permit #:</b> 03069T31
If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)	<b>County:</b> Orange
<b>Facility Name:</b> University of North Carolina at Chapel Hill	<b>DAQ Region:</b> Raleigh

**North Carolina Department of Environment and Natural Resources**  
**Division of Air Quality**  
**Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

<b>1. Emission Source ID No.</b> (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)	<b>ES-010A</b>						
<b>2. Emission Source Description</b>	<b>Coal Crusher / Conveyor Building</b>						
<b>3. Operating Scenario Description</b>	N/A						
<b>4. Maximum Permitted Operating Rate</b> With Units (Ex. gal/hr, mmBtu/hr)	<b>60 tons/hr</b>						
<b>5. Throughput in CY</b> (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)	<b>66,905 tons/yr</b>						
<b>6. Fuel Information</b> (if fuel used)	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">% Sulfur</td> <td style="width:15%;">N/A</td> <td style="width:15%;">% Ash</td> <td style="width:15%;">N/A</td> <td style="width:40%;">Heat Content (Btu/lb or mmCF)</td> <td style="width:10%;">N/A</td> </tr> </table>	% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A
% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A		

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

<b>7. Capture Efficiency</b> (% Emissions from Emission Source Vented to Control Device or Stack)	<b>100%</b>	
<b>8. Control Device Information</b> , if none, write "none"		
	<b>Control Device ID #</b> (as listed in permit)	<b>Control Device Description</b>
i. (nearest stack)	<b>CD-013</b>	<b>Bagfilter</b>
ii.	N/A	N/A
iii.	N/A	N/A
iv.	N/A	N/A

<b>9. Stack Information</b> (sources vented to more than one stack use additional entry lines)						
Stack ID #	Height (in whole feet)	Diameter (feet) <small>Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)</small>	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description <small>(Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)</small>
EP-12-053	47	1.8	Ambient	44	6,500	Vertical
--	--	--	--	--	--	--
--	--	--	--	--	--	--

<b>10. Operating Schedule</b> (Source/Operating Scenario that best characterizes calendar year)							
Hours/Day	<b>6</b>	Days/Week	<b>7</b>	Weeks/Year	<b>52</b>	Hours/Year	<b>1,115</b>
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

<b>11. Seasonal Periods Percent Annual Throughput</b> (for Emission Source in CY, MUST total 100%)							
Jan-Feb, 2002 + Dec, 2002	<b>30.63%</b>	Mar-May	<b>19.44%</b>	June-Aug	<b>24.29%</b>	Sept-Nov	<b>25.63%</b>



# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Annual Emissions Inventory

### Emissions from the Conveyor/Crusher Building

(ES-010A)

Assume that the total amount of coal conveyed to the crusher is equal to the total amount of coal combusted in 2012.

Boiler #6	34,168	Tons/yr
Boiler #7	32,737	Tons/yr
Total	66,905	Tons/yr

The conveyor transfer points and crushers in the Coal Crusher Building are controlled by a vacuum dust pick-up system ducted to a baghouse. The air flow rate through the baghouse is 6,650 acfm. Emissions from the baghouse are conservatively estimated at 0.015 gr/acfm.

60 ton/hr, conveying rate  
1,115.1 hrs/yr, conveying time

$\text{lb/yr} = (6,650 \text{ acfm}) (60 \text{ min/hr}) (\text{hr/yr}) (0.015 \text{ gr/acfm}) (1/7000 \text{ lb/gr})$

<b>Total Emissions from the Crusher</b>	<b>6,673,724</b>	<b>gr/yr</b>
	<b>953</b>	<b>lb/yr</b>
	<b>0.48</b>	<b>ton/yr</b>

100% of these emissions are PM-10

95% of these emissions are PM-2.5



# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

**Ash Silo with Loadout  
(ES-030)**

**Ash Silo with Loadout**

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility Name: University of North Carolina at Chapel Hill

Facility ID #: 6800043

Permit #: 03069T31

County: Orange

DAQ Region: Raleigh

**North Carolina Department of Environment and Natural Resources  
Division of Air Quality  
Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		<b>ES-030</b>					
2. Emission Source Description		<b>Ash Silo with Loadout</b>					
3. Operating Scenario Description		N/A					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		<b>16 tons/hr</b>					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		<b>13,719</b>			<b>tons/yr</b>		
6. Fuel Information (if fuel used)		% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	<b>100%</b>
--	-------------

8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	<b>CD-031</b>	<b>Bagfilter</b>
ii.	N/A	N/A
iii.	N/A	N/A
iv.	N/A	N/A

9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
<b>Fugitive</b>						
--	--	--	--	--	--	--
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10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	<b>10</b>	Days/Week	<b>7</b>	Weeks/Year	<b>52</b>	Hours/Year	<b>2,564</b>
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	<b>30.63%</b>	Mar-May	<b>19.44%</b>	June-Aug	<b>24.29%</b>	Sept-Nov	<b>25.63%</b>
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# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Ash Silo with Loadout

(ES-030)

Ash is conveyed to the silo and loaded into trucks for off-site transport. The ash is pneumatically conveyed to the silo with the conveying air filtered through a baghouse (CD-031) prior to discharge. The ash loadout to the transfer trucks is via a pipe within a pipe configuration. The annular space between the internal and external pipes is under a vacuum. This vacuum system collects the dust generated during truck loading and ducts it to the baghouse (CD-031). Ash is composed of coal flyash and  $\text{CaCO}_3$  /  $\text{CaSO}_3$  from desulfurization. Ash is similar to flyash used in concrete batching operations.

13,719 ton/yr, ash loaded in 2012

#### 1. Uncaptured Truck Loading Fugitives

Truck loading operations are in an enclosure with discharge into an enclosed truck bed. The vacuum at the ash discharge point and enclosures should insure a minimum of 95% capture. Uncontrolled emissions are based on a conservatively high estimated 0.5 lb/ton emission factor (0.02 lb/ton AP-42 for batch truck loading at concrete plants).

13,719	ton/yr, Ash Generated
0.5	lb/ton, Emission Factor
95%	Capture Efficiency
343.0	lb/yr, Emissions
0.17	ton/yr, Emissions

Fugitives from the Enclosure:

0.009	ton/yr, Emissions
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#### 2. Baghouse Emissions

The air flow rate through the baghouse is 4,490 acfm. Emissions from the baghouse are conservatively estimated at 0.015 gr/acfm.

$$\text{lb/yr} = (4,490 \text{ acfm}) (60 \text{ min/hr}) (\text{hr/yr}) (0.015 \text{ gr/acfm}) (1/7000 \text{ lb/gr})$$

4,490	acfm, Baghouse Flow Rate
2,564	hrs/yr, Operating Hours
0.015	gr/acfm, Emission Factor from Baghouse
1,480	lb/yr, Emissions
0.74	ton/yr, Emissions

#### 3. Total Emissions

0.17	ton/yr, Emissions Truck Loading
0.009	ton/yr, Emissions, Truck Fugitives
0.74	ton/yr, Emissions, Baghouse
0.92	ton/yr, Total Emissions PM
0.92	ton/yr, Total Emissions PM-10
0.87	ton/yr, Total Emissions PM-2.5

100% as PM-10

95% as PM-2.5

**The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

**2012 Annual Emissions Inventory**

**Wet Ash Loadout  
(ES-030A)**

*(This unit was not in operation during CY 2012)*

**Wet Ash Loadout**

If Emission Source has multiple Operating Scenarios, complete one form for each.  
(All permitted, Insignificant and/or Non-permitted Sources)

Facility ID #: **6800043**  
 Permit #: **03069T31**  
 County: **Orange**  
 DAQ Region: **Raleigh**

Facility Name: University of North Carolina at Chapel Hill

**North Carolina Department of Environment and Natural Resources  
 Division of Air Quality  
 Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-030A					
2. Emission Source Description		Wet Ash Loadout					
3. Operating Scenario Description		N/A					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		N/A					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		0		ton/yr			
6. Fuel Information (if fuel used)		% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

7. Capture Efficiency (% Emissions from Emission Source Vented to Control Device or Stack)	N/A
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8. Control Device Information, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	None	None
ii.	None	None
iii.	None	None
iv.	None	None

9. Stack Information (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
N/A	N/A	N/A	N/A	N/A	N/A	N/A
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10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	N/A	Days/Week	N/A	Weeks/Year	N/A	Hours/Year	N/A
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

11. Seasonal Periods Percent Annual Throughput (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	0%	Mar-May	0%	June-Aug	0%	Sept-Nov	0%
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**This Unit Was Not in Operation During CY 2008.**

To review instructions or get a blank copy, go to web page: <http://daq.state.nc.us/Offices/Planning/Attainment/est.html>

Copy and Use additional Sheets as needed

# **The University of North Carolina at Chapel Hill**

Chapel Hill, North Carolina

*Orange County*

Facility ID # 6800043

Permit # 03069T31

## **2012 Annual Emissions Inventory**

### **Enclosed Sorbent Railcar Dump Pit**

**(Insignificant Source)**

**IS-53**

10,561 tons of sorbent delivered by rail in 2012. There are no emission sources associated with truck delivery.

<b>Emission Source/Operating Scenario Data</b> Page 1 of 2	<b>Facility ID #:</b> 6800043
<b>Enclosed Sorbent Railcar Dump Pit</b>	<b>Permit #:</b> 03069T31
If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)	<b>County:</b> Orange
<b>Facility Name:</b> University of North Carolina at Chapel Hill	<b>DAQ Region:</b> Raleigh

**North Carolina Department of Environment and Natural Resources**  
**Division of Air Quality**  
**Air Pollutant Point Source Emissions Inventory - Calendar Year 2012**

<b>1. Emission Source ID No.</b> (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)	<b>"I" Insignificant - ID No. 020</b>						
<b>2. Emission Source Description</b>	<b>Enclosed Sorbent Railcar Dump Pit</b>						
<b>3. Operating Scenario Description</b>	N/A						
<b>4. Maximum Permitted Operating Rate</b> With Units (Ex. gal/hr, mmBtu/hr)	<b>50 ton/hr</b>						
<b>5. Throughput in CY</b> (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)	<b>10,561 tons/yr</b>						
<b>6. Fuel Information</b> (if fuel used)	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:15%;">% Sulfur</td> <td style="width:15%;">N/A</td> <td style="width:15%;">% Ash</td> <td style="width:15%;">N/A</td> <td style="width:40%;">Heat Content (Btu/lb or mmCF)</td> <td style="width:10%;">N/A</td> </tr> </table>	% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A
% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	N/A		

If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.

<b>7. Capture Efficiency</b> (% Emissions from Emission Source Vented to Control Device or Stack)	N/A
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**8. Control Device Information**, if none, write "none"

	Control Device ID # (as listed in permit)	Control Device Description
<i>i. (nearest stack)</i>	None	None
<i>ii.</i>	None	None
<i>iii.</i>	None	None
<i>iv.</i>	None	None

**9. Stack Information** (sources vented to more than one stack use additional entry lines)

Stack ID #	Height (in whole feet)	Diameter (feet) Circle (enter #), Rectangle (L#, W#) (in 0.1 feet)	Temperature (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description (Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)
<b>Fugitive</b>						
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**10. Operating Schedule** (Source/Operating Scenario that best characterizes calendar year)

Hours/Day	<b>1</b>	Days/Week	<b>3</b>	Weeks/Year	<b>52</b>	Hours/Year	<b>156</b>
Typical Start & End Times in CY:				Start:	N/A	End:	N/A

**11. Seasonal Periods Percent Annual Throughput** (for Emission Source in CY, MUST total 100%)

Jan-Feb, 2002 + Dec, 2002	<b>30.63%</b>	Mar-May	<b>19.44%</b>	June-Aug	<b>24.29%</b>	Sept-Nov	<b>25.63%</b>
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# University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T31

## 2012 Cogeneration Emissions Inventory

### Enclosed Sorbent (Lime) Railcar Dump Pit

(Insignificant Source - ID No. 020)

Sorbent is transported from the railcar dump pit in enclosed conveyors to the storage area. Emissions can be best estimated using the drop equation.

From section 13.2.4 of the AP-42: The following equation represents the particulate emissions generated by the dropping of sorbent into the dump pit.

$$E = k (0.0032) \frac{(u/5)^{1.3}}{(m/2)^{1.4}}$$

E = Emission Factor (lb/ton)

k = Particle Size Multiplier

u = Mean Wind Speed (mph)

m = Material Moisture Content (%)

k Value	Particulate Size	Emission Factor (lb/ton)
0.74	PM	1.787E-03
0.35	PM-10	8.45E-04
0.11	PM-2.5	2.66E-04

Average moisture content of sorbent is 0.7%

The dump area is fully enclosed, therefore the minimum wind speed of 1.3 mph was used.

**Total Sorbent 10,561 tons/yr**

*Emissions from the unloading of sorbent into the dump pit:*

	Emission Factor (lb/ton)	Emissions (lb/yr)	Emissions (ton/yr)
PM	1.79E-03	18.87	9.44E-03
PM-10	8.45E-04	8.93	4.46E-03
PM-2.5	2.66E-04	2.81	1.40E-03