

2009 Cogeneration Facility Annual Air Emissions Inventory

**Cogeneration Facility
University of North Carolina at Chapel Hill
Chapel Hill, North Carolina**

**Facility ID # 6800043
Permit # 03069T25**

Prepared for:

University of North Carolina at Chapel Hill
Cogeneration Systems
501 Cameron Avenue, CB# 1855
Chapel Hill, North Carolina 27599-1855

Prepared by:

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

March 2010

2009 Cogeneration Facility Annual Air Emissions Inventory

Cogeneration Facility University of North Carolina at Chapel Hill Chapel Hill, North Carolina

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University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Supporting Documentation

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Facility Total CY 2009 Emissions Summary

Facility ID #: 6800043

Permit #(s): 03069T25

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 2009

Record Facility-Wide Totals Below From all Permitted and Non-Permitted Air Pollutant Emission Sources

<i>Criteria Pollutants</i>	ID #'s of Contributing Sources	Actual Emissions (Tons/Year)*	
			CY 2009
Carbon Monoxide (CO) (Reporting required, but no fees based on CO)	Boiler 6,7,8, 2-Generators		49.6
Oxides of Nitrogen (NOx) (Report as tons of NO ₂ equivalent)	Boiler 6,7,8, 2-Generators		450.7
PM/TSP - Particulate Matter (Total - not used for emission fees)	Boiler 6,7,8 & Coal and Ash Handling & 2-Generators		14.1
PM-10 Particulate Matter with mean aerodynamic particle size less than 10 micrometers. Include all condensibles, including Sulfur Trioxide and Sulfuric Acid as PM-10	Boiler 6,7,8 & Coal and Ash Handling & 2-Generators		14.1
PM-2.5 Particulate Matter with mean aerodynamic particle size less than 2.5 micrometers. This pollutant includes all condensibles using best information available.	Boiler 6,7,8 & Coal and Ash Handling & 2-Generators		9.2
Sulfur Dioxide (SO₂) Do not include Sulfur Trioxide and Sulfuric Acid	Boiler 6,7,8, 2-Generators		244.1
VOC Volatile Organic Compounds - See instructions for Federal definition excluding some non-photochemically reactive organics	Boiler 6,7,8, 2-Generators		1.1

<i>Greenhouse Gases</i>	ID #'s of Contributing Sources	Actual Emissions (Tons/Year)*	
			CY 2008
Carbon Dioxide (CO₂) (Reporting required, but no fees based on CO ₂)	Boiler 6,7,8, 2-Generators		284,598.3
Methane (MeOH) (Reporting required, but no fees based on MeOH)	Boiler 6,7,8, 2-Generators		0.6
Nitrous Oxide (N₂O) (Reporting required, but no fees based on CO ₂)	Boiler 6,7,8, 2-Generators		4.7

On Next Page: Enter, in Alphabetical Order, All HAPs/TAPs Required by Instructions

(Sum Source Emissions From Emission Source / Operating Scenario Forms)

Information on this form cannot be held confidential.

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 2009

Hazardous Air Pollutants (HAPs) and/or Toxic Air Pollutants (TAPs)	CAS Number or Symbol (see instructions)	ID Numbers of Contributing Sources	Actual Emissions (Pounds/Year)*	
				CY 2009
2,3,7,8-TCDD		Boilers 6,7,8		0.000001
2,4-Dinitrotoluene	121-14-2	Boilers 6,7,8		0.03
2-Chloroacetophenone	532-27-4	Boilers 6,7,8		0.73
Acetaldehyde	75-07-0	Boilers 6,7,8		59.63
Acetophenone	98-86-2	Boilers 6,7,8		1.57
Acrolein	107-02-8	Boilers 6,7,8		30.33
Arsenic	ARSENICCPDS	Boilers 6,7,8		0.82
Benzene	71-43-2	Boilers 6,7,8		136.55
Benzo(a)pyrene	50-32-8	Boilers 6,7,8		0.004
Benzyl Chloride	100-44-7	Boilers 6,7,8		73.21
Beryllium	BERYLCPDS	Boilers 6,7,8		0.14
Biphenyl	92-52-4	Boilers 6,7,8		0.18
Bis(2-ethylhexyl)phthalate (DEHP)		Boilers 6,7,8		7.63
Bromine	7726-95-6	Boilers 6,7,8		21.71
Bromoform	75-25-2	Boilers 6,7,8		4.08
Cadmium	CADMIUMCPDS	Boilers 6,7,8		0.48
Carbon Disulfide	75-15-0	Boilers 6,7,8		13.60
Chlorobenzene	108-90-7	Boilers 6,7,8		2.30
Chlorine	7782-50-5	Boilers 6,7,8		285.88
Chloroform	67-66-3	Boilers 6,7,8		6.17
Chromium	CROMCPDS	Boilers 6,7,8		12.85
Chromium VI	CHROM6CPDS	Boilers 6,7,8		0.17
Cobalt	COBALTCPDS	Boilers 6,7,8		0.73
Cumene	98-82-8	Boilers 6,7,8		0.55
Cyanide	CNC	Boilers 6,7,8		261
Dibenzofurans	132-64-9	Boilers 6,7,8		0.02
Dichlorobenzene	106-46-7	Boilers 6,7,8		0.12
Dimethyl Sulfate	77-78-1	Boilers 6,7,8		5.02
Ethyl Benzene	100-41-4	Boilers 6,7,8		9.84
Ethyl Chloride	75-00-3	Boilers 6,7,8		4.39
Ethylene Dibromide	106-93-4	Boilers 6,7,8		0.13
Ethylene Dichloride	107-06-2	Boilers 6,7,8		4.18

Inventory Report Prepared by RST Engineering, PLLC - S.G. "Butch" Smith, P.E.

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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 2009

Hazardous Air Pollutants (HAPs) and/or Toxic Air Pollutants (TAPs)	CAS Number or Symbol (see instructions)	ID Numbers of Contributing Sources	Actual Emissions (Pounds/Year)*	
				CY 2009
Fluoride	16984-48-8	Boilers 6,7,8		0.35
Formaldehyde	50-00-0	Boilers 6,7,8		182.21
Hexane	110-54-3	Boilers 6,7,8		188.15
Hydrogen Chloride	7647-01-0	Boilers 6,7,8		33,881.9
Hydrogen Fluoride	7664-39-3	Boilers 6,7,8		608.8
Isophorone	78-59-1	Boilers 6,7,8		60.66
Lead	LEADCPDS	Boilers 6,7,8		4.72
Manganese	MANGCPDS	Boilers 6,7,8		31.81
Mercury	MERCCPDS	Boilers 6,7,8		2.25
Methyl Chloride	74-87-3	Boilers 6,7,8		55.43
Methyl Ethyl Ketone	78-93-3	Boilers 6,7,8		40.79
Methyl Bromide	74-83-9	Boilers 6,7,8		16.73
Methyl Chloroform	71-55-6	Boilers 6,7,8		0.00
Methyl Hydrazine	60-34-4	Boilers 6,7,8		17.78
Methyl Methacrylate	80-62-6	Boilers 6,7,8		2.09
Methyl Tert Butyl Ether	1634-04-4	Boilers 6,7,8		3.66
Methylene Chloride	75-09-2	Boilers 6,7,8		30.33
Napthalene	91-20-3	Boilers 6,7,8		1.48
Nickel	NICKCPDS	Boilers 6,7,8		26.08
Phenol	108-95-2	Boilers 6,7,8		1.67
Phosphorus	7803-51-2	Boilers 6,7,8		3.86
POM	POM	Boilers 6,7,8		6.03
Propionaldehyde	123-38-6	Boilers 6,7,8		39.74
Selenium	SEC	Boilers 6,7,8		5.89E-01
Styrene	100-42-5	Boilers 6,7,8		2.61
Tetrachloroethane	79-34-5	Boilers 6,7,8		4.50
Toluene	108-88-3	Boilers 6,7,8		26.31
Vinyl Acetate	108-05-4	Boilers 6,7,8		0.79
Xylenes	1330-20-7	Boilers 6,7,8		3.97

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University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Facility Summary of Sources

University of North Carolina at Chapel Hill

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2009 Annual Emissions Inventory

Insignificant Activities

Enclosed Sorbent Railcar Dump Pit

Emission Sources

Source	Source ID #	Control Device #	Control Device
Boiler #6	ES-001-Boiler #6	CD-004	Bagfilter w/ CaCO ₃ Injection
Boiler #7	ES-002-Boiler #7	CD-005	Bagfilter w/ CaCO ₃ Injection
Boiler #8	ES-003-Boiler #8		
2,000 kW Generator	ES-007		
2,000 kW Generator	ES-008		
Three Enclosed Railcar Dump Pits	ES-010	CD-018	Wet Spray
One Coal Silo	ES-1	CD-011	Bagfilter
One Coal Silo	ES-2	CD-012	Bagfilter
Five Silo Feed Conveyors	ES-3	CD-019	Bagfilter
Coal Crusher Building	ES-010A	CD-013	Bagfilter
Ash Silo w/ Loadout	ES-030	CD-031	Bagfilter
Wet Ash Loadout	ES-030A	CD-032	Water Injection
Fuel Oil Storage Tanks	T-001, 002		

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2009 Annual Emissions Inventory

Fuel Use Summary

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

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Permit # 03069T25

2009 Annual Emissions Inventory

Seasonal Fuel Usage Breakdown

Month	Boiler #6			Boiler #7			Boiler #8	
	Coal (tons)	Gas (1,000cf)	Oil (gallons)	Coal (tons)	Gas (1,000cf)	Oil (gallons)	Gas (1,000cf)	Oil (gallons)
December 2009	6,027	0	0	5,759	0	0	490	0
January 2009	6,364	637	0	6,347	414	0	130	53
February 2009	5,477	0	15	5,519	0	7	1,670	74
<i>1st Quarter Total</i>	<i>17,868</i>	<i>637</i>	<i>15</i>	<i>17,626</i>	<i>414</i>	<i>7</i>	<i>2,290</i>	<i>127</i>
March 2009	6,572	2	0	3,099	300	0	9	9,189
April 2009	5,946	360	0	2,932	978	0	7,572	0
May 2009	3,388	20,421	0	3,090	19,980	0	1,419	0
<i>2nd Quarter Total</i>	<i>15,906</i>	<i>20,783</i>	<i>0</i>	<i>9,121</i>	<i>21,258</i>	<i>0</i>	<i>9,000</i>	<i>9,189</i>
June 2009	2,796	15,190	0	2,880	14,066	0	1,124	0
July 2009	3,876	750	0	3,469	741	0	2,420	0
August 2009	3,621	20	0	3,292	0	0	1,600	0
<i>3rd Quarter Total</i>	<i>10,293</i>	<i>15,960</i>	<i>0</i>	<i>9,640</i>	<i>14,807</i>	<i>0</i>	<i>5,144</i>	<i>0</i>
September 2009	2,061	837	0	4,594	1,296	0	4,048	0
October 2009	2,794	2,305	0	5,459	115	0	1,180	0
November 2009	4,832	0	0	4,395	10	0	550	0
<i>4th Quarter Total</i>	<i>9,687</i>	<i>3,142</i>	<i>0</i>	<i>14,448</i>	<i>1,421</i>	<i>0</i>	<i>5,778</i>	<i>0</i>
2009 TOTAL	53,753	40,522	15	50,835	37,899	7	22,212	9,316

Seasonal Btu Breakdown

Coal (btu/lb)	12,653	Natural Gas (btu/ft ³)	1,030	Fuel Oil (btu/gal)	138,813
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Month	Boiler #6			Boiler #7			Boiler #8	
	Coal	Gas	Oil	Coal	Gas	Oil	Gas	Oil
December 2009	1.53E+11	0.00E+00	0	1.46E+11	0.00E+00	0	5.05E+08	0
January 2009	1.61E+11	655595000	0	1.61E+11	4.26E+08	0	1.34E+08	7357089
February 2009	1.39E+11	0.00E+00	2109958	1.40E+11	0.00E+00	985572	1.72E+09	10272162
<i>1st Quarter Total</i>	<i>4.52E+11</i>	<i>6.56E+08</i>	<i>2109958</i>	<i>4.46E+11</i>	<i>4.26E+08</i>	<i>985572</i>	<i>2.36E+09</i>	<i>17629251</i>
March 2009	1.66E+11	2.06E+06	0	7.84E+10	3.09E+08	0	9270000	1275552657
April 2009	1.50E+11	3.71E+08	0	7.42E+10	1.01E+09	0	7.80E+09	0
May 2009	8.57E+10	2.10E+10	0	7.82E+10	2.06E+10	0	1461745100	0
<i>2nd Quarter Total</i>	<i>4.03E+11</i>	<i>2.14E+10</i>	<i>0</i>	<i>2.31E+11</i>	<i>2.19E+10</i>	<i>0</i>	<i>9.27E+09</i>	<i>1275552657</i>
June 2009	7.08E+10	1.56E+10	0	7.29E+10	1.45E+10	0	1.16E+09	0
July 2009	9.81E+10	7.73E+08	0	8.78E+10	7.63E+08	0	2.49E+09	0
August 2009	9.16E+10	2.06E+07	0	8.33E+10	0	0	1.65E+09	0
<i>3rd Quarter Total</i>	<i>2.60E+11</i>	<i>1.64E+10</i>	<i>0</i>	<i>2.44E+11</i>	<i>1.53E+10</i>	<i>0</i>	<i>5.30E+09</i>	<i>0</i>
September 2009	5.21E+10	8.62E+08	0.00E+00	1.16E+11	1334880000	0.00E+00	4169440000	0
October 2009	7.07E+10	2.37E+09	0	1.38E+11	1.18E+08	0	1.22E+09	0
November 2009	1.22E+11	0.00E+00	0	1.11E+11	1.03E+07	0	5.67E+08	0.00E+00
<i>4th Quarter Total</i>	<i>2.45E+11</i>	<i>3.24E+09</i>	<i>0.00E+00</i>	<i>3.66E+11</i>	<i>1.46E+09</i>	<i>0.00E+00</i>	<i>5.95E+09</i>	<i>0.00E+00</i>
2009 TOTAL	1.36E+12	4.17E+10	2.11E+06	1.29E+12	3.90E+10	9.86E+05	2.29E+10	1.29E+09

Seasonal Total Fuel Usage (%)

	Boiler #6	Boiler #7	Boiler #8
Dec., Jan., Feb.	32.30	33.68	9.83
Mar., Apr., May	30.24	19.07	44
June, July, Aug.	19.75	19.56	21.92
Sept., Oct., Nov.	17.72	27.69	24.62
	100	100	100

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

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Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Coal Usage Breakdown

Month	Boiler #6 Coal (tons)	Boiler #7 Coal (tons)
December 2009	6,027	5,759
January 2009	6,364	6,347
February 2009	5,477	5,519
<i>1st Quarter Total</i>	<i>17,868</i>	<i>17,626</i>
March 2009	6,572	3,099
April 2009	5,946	2,932
May 2009	3,388	3,090
<i>2nd Quarter Total</i>	<i>15,906</i>	<i>9,121</i>
June 2009	2,796	2,880
July 2009	3,876	3,469
August 2009	3,621	3,292
<i>3rd Quarter Total</i>	<i>10,293</i>	<i>9,640</i>
September 2009	2,061	4,594
October 2009	2,794	5,459
November 2009	4,832	4,395
<i>4th Quarter Total</i>	<i>9,687</i>	<i>14,448</i>
2009 TOTAL	53,753	50,835

Facility-Wide Coal Usage 104,588 Tons/year

Seasonal Coal Usage (%)

	Boiler #6	Boiler #7	Average (%)
Dec., Jan., Feb.	33.24%	34.67%	33.96%
Mar., Apr., May	29.59%	17.94%	23.77%
June, July, Aug.	19.15%	18.96%	19.06%
Sept., Oct., Nov.	18.02%	28.42%	23.22%
	100%	100%	100%

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2009 Annual Emissions Inventory

Blackstart Generator Fuel Usage Breakdown

Month	DG1 & DG2 #2 Oil (gallons)
December 2009	245
January 2009	187
February 2009	887
<i>1st Quarter Total</i>	<i>1,319</i>
March 2009	0
April 2009	355
May 2009	117
<i>2nd Quarter Total</i>	<i>472</i>
June 2009	125
July 2009	513
August 2009	279
<i>3rd Quarter Total</i>	<i>917</i>
September 2009	0
October 2009	299
November 2009	205
<i>4th Quarter Total</i>	<i>504</i>
2008 TOTAL	3,211

Seasonal Oil Usage (%)

	DG1 & DG2
Dec., Jan., Feb.	41.07%
Mar., Apr., May	14.69%
June, July, Aug.	28.55%
Sept., Oct., Nov.	15.68%
	100%

University of North Carolina at Chapel Hill

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2009 Annual Emissions Inventory

Supporting Documentation

Facility Summary Forms

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

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2009 Annual Emissions Inventory

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

Emission Source/Operating Scenario Data Page 1 of 2		Facility ID #: 6800043					
Railcar Dump Pits <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>		Permit #: 03069T25					
Facility Name: University of North Carolina at Chapel Hill		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 2009							
1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)			ES-010				
2. Emission Source Description		Three Enclosed Railcar Dump Pits					
3. Operating Scenario Description		N/A					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		350 tons/hr					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		104,588	tons/yr				
6. Fuel Information (if fuel used)		% Sulfur	N/A				
		% Ash	N/A				
		Heat Content (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>							
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 # <small>(as listed in permit)</small>	Control Device Description					
<i>i.</i> (nearest stack)	N/A	Enclosed Dump Pits					
<i>ii.</i>	CD-018	Wet Spray Dust Suppression System					
<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>	
Fugitive							
--	--	--	--	--	--	--	
--	--	--	--	--	--	--	
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	33.96%	Mar-May	23.77%	June-Aug	19.06%	Sept-Nov	23.22%

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

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2009 Annual Emissions Inventory

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

(ES-010)

Assume that the total amount of coal unloaded is equal to the total amount of coal combusted in 2009.

Boiler #6	53,753	Tons/yr
Boiler #7	50,835	Tons/yr
Total	104,588	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 104,588 tons/yr

Emissions from the unloading of coal:

	Emission Factor (lb/ton)	Emissions (lb/yr)	Emissions (ton/yr)
PM	1.32E-04	13.81	6.91E-03
PM-10	6.25E-05	6.53	3.27E-03
PM-2.5	1.96E-05	2.05	1.03E-03

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2009 Annual Emissions Inventory

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

Emission Source/Operating Scenario Data Page 1 of 2				Facility ID #: 6800043			
<i>Coal Silos</i> <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>				Permit #: 03069T25			
Facility Name: University of North Carolina at Chapel Hill				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 2009							
1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)						ES-1 and ES-2	
2. Emission Source Description				Two Coal Storage Silos			
3. Operating Scenario Description				N/A			
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>				350 tons/hr			
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>				104,588		tons/yr	
6. Fuel Information (if fuel used)			% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)
				N/A			N/A
<small>If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.</small>							
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 # <small>(as listed in permit)</small>		Control Device Description				
<i>i.</i> (nearest stack)	CD-011		Bagfilter Installed on Silo ES-1				
<i>ii.</i>	CD-012		Bagfilter Installed on Silo ES-2				
<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 (F)	Velocity (feet/sec)	Volume Flow Rate (acfm)	Release Point Description <small>(Fugitive, Vertical, Vertical w/ cap, Horizontal, Downward - see instructions)</small>	
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	33.96%	Mar-May	23.77%	June-Aug	19.06%	Sept-Nov	23.22%

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 # 03069T25

2009 Annual Emissions Inventory

Emissions from the loading of 2 coal storage silos.

(ES-1, ES-2)

Assume that the total amount of coal fed to the silos is equal to the total amount of coal combusted in 2009.

Boiler #6	53,753	Tons/yr
Boiler #7	50,835	Tons/yr
Total	104,588	Tons/yr

The bulk density of coal is 47 lb/ft³

Total volume of coal combusted is = 4,450,547 ft³/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).

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

Total Emissions from the silos	66,758	gr/yr
	9.537	lb/yr
	0.005	ton/yr

100% of these emissions are PM-10

95% of these emissions are PM-2.5

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

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

Emission Source/Operating Scenario Data Page 1 of 2		Facility ID #: 6800043					
<i>Silo Feed Conveyors</i> <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>		Permit #: 03069T25					
Facility Name: University of North Carolina at Chapel Hill		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 2009							
1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-3					
2. Emission Source Description		Silo Feed Conveyors					
3. Operating Scenario Description		N/A					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		700 tons/hr					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		104,588 tons/yr					
6. Fuel Information (if fuel used)		% Sulfur	N/A				
		% Ash	N/A				
		Heat Content (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>							
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 # <small>(as listed in permit)</small>	Control Device Description					
i. (nearest stack)	CD-019	Bagfilter					
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 <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>	
EP-12-6901	200	2	Ambient	45	8,500	Vertical	
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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	25.00%	Mar-May	25.00%	June-Aug	25.00%	Sept-Nov	25.00%

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 # 03069T25

2009 Annual Emissions Inventory

Emissions from silo feed conveyors.

(ES-3)

Assume that the total amount of coal fed to the silos is equal to the total amount of coal combusted in 2009.

Boiler #6	53,753	Tons/yr
Boiler #7	50,835	Tons/yr
Total	104,588	Tons/yr

The bulk density of coal is 47 lb/ft³

Total volume of coal combusted is = 4,450,547 ft³/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).

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

Total Emissions from the conveyors	66,758	gr/yr
	9.537	lb/yr
	0.005	ton/yr

100% of these emissions are PM-10

95% of these emissions are PM-2.5

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Fuel Oil Storage Tanks

(T-001 and T-002)

Emission Source/Operating Scenario Data Page 1 of 2		Facility ID #: 6800043					
<i>Silo Feed Conveyors</i> <small>If Emission Source has multiple Operat</small>		Permit #: 03069T25					
Facility Name: University of North Carolina at Chapel Hill		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 2009							
1. Emission Source ID No. (<i>same as in permit - Use "U" prefix for non-permitted and "I" for insignificant</i>)		T-001, T-002					
2. Emission Source Description		2 - 500,000 gallon No.2 Fuel Oil Tanks					
3. Operating Scenario Description		No.2 Fuel Oil Storage					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		500,000 gallons capacity - each tank					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		12,550 gal/yr					
6. Fuel Information (<i>if fuel used</i>)		% Sulfur	N/A				
		% Ash	N/A				
		Heat Content (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>							
7. Capture Efficiency (<i>% Emissions from Emission Source Vented to Control Device or Stack</i>)		NA					
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	N/A					
<i>ii.</i>	N/A	N/A					
<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>	
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--	--	--	--	--	--	--	
--	--	--	--	--	--	--	
10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)							
Hours/Day	24	Days/Week	7	Weeks/Year	52	Hours/Year	8760
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	25.00%	Mar-May	25.00%	June-Aug	25.00%	Sept-Nov	25.00%

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 # 03069T25

2009 Annual 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	223.19	lb/yr	0.112	Tons/yr
T-002	223.19	lb/yr	0.112	Tons/yr
Total	446.38	lb/yr	0.223	Tons/yr

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

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

Operating Scenarios

#1 - Coal Firing

#2 - Natural Gas Firing

#4 - No.2 Fuel Oil 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 SO₂ and NO_x 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 2009 Annual Emission Inventory forms require that the emissions be divided among the three possible operating scenarios.

NO_x emissions have been divided between the three operating scenarios based on the percentage of total heat input by each fuel. These calculations are detailed in the attached spreadsheets.

SO₂ emissions from natural gas combustion are insignificant, therefore, SO₂ 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

SO₂ and NO_x 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 #: 03069T25

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 2009

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. 6 Fuel Oil / No. 2 Fuel Oil 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)		15		gallons/yr			
6. Fuel Information (if fuel used)		% Sulfur	0.5%	% Ash		Heat Content (Btu/lb or mmCF)	138,813 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 ₃) 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	8,057 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	100.00%	Mar-May	0.00%	June-Aug	0.00%	Sept-Nov	0.00%
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Facility ID #: **6800043**
 Permit #: **03069T25**
 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 2009**

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	3.80E-05	8	N/A
NOx	NOx	3.36E-04	1	N/A
PM Total	PM	1.00E-05	8	99.0%
PM-2.5	PM-2.5	2.51E-06	8	99.0%
PM-10	PM-10	1.00E-05	8	99.0%
SO2	SO2	1.99E-04	1	90.0%
VOC	VOC	1.52E-06	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	8.51E-08	8	99.0%
Benzene	71-43-2	4.18E-05	8	N/A
Beryllium	BERYLCPDS	6.38E-08	8	99.0%
Cadmium	CADMIUMCPDS	6.38E-08	8	99.0%
Chromium	CROMCPDS	6.38E-08	8	99.0%
Chromium VI	CHROM6CPDS	1.87E-08	8	99.0%
Cobalt	COBALTCPDS	0.00E+00	8	99.0%
Ethylbenzene	100-41-4	1.24E-05	8	N/A
Fluoride	16984-48-8	0.00	8	N/A
Formaldehyde	50-00-0	0.00	8	N/A
Lead	LEADCPDS	1.92E-07	8	99.0%
Manganese	MANGCPDS	1.28E-07	8	99.0%
Mercury	MERCPDS	6.38E-06	8	99.0%
Methyl chloroform	71-55-6	3.59E-06	8	N/A
Napthalene	91-20-3	5.06E-08	8	N/A
Nickel	NICKCPDS	6.38E-08	8	99.0%
POM	POM	5.02E-07	8	99.0%
Selenium	SEC	3.19E-07	8	99.0%
Toluene	108-88-3	0.00	8	N/A
Xylene	1330-20-7	2.13E-05	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 ₂	0.17	8	N/A
Methane	CH ₄	0.00	8	N/A
Nitrous oxide	N ₂ O	0.00	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 ID #: **6800043**
 Permit #: **03069T25**
 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 2009

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 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)		53,753			tons/yr		
6. Fuel Information (if fuel used)		% Sulfur	1.34%	% Ash	10.43%	Heat Content (Btu/lb or mmCF)	12,709 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 ₃) 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	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	33.24%	Mar-May	29.59%	June-Aug	19.15%	Sept-Nov	18.02%
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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 #: **03069T25**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 2009

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	23.30	8	N/A
NOx	NOx	217.47	1	N/A
PM Total	PM	5.78	8	99.80%
PM-2.5	PM-2.5	3.33	8	97.90%
PM-10	PM-10	5.78	8	98.00%
SO2	SO2	129.07	1	90.00%
VOC	VOC	0.31	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	30.64	8	N/A
Acetophenone	98-86-2	0.81	8	N/A
Acrolein	107-02-8	15.59	8	N/A
Arsenic*	ARSENICPDS	0.41	8	99.60%
Benzene	71-43-2	69.88	8	N/A
Benzo(a)pyrene	50-32-8	2.04E-03	8	N/A
Benzyl chloride	100-44-7	37.63	8	N/A
Beryllium*	BERYLCPDS	0.07	8	N/A
Biphenyl	92-52-4	9.14E-02	8	N/A
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	3.92	8	N/A
Bromine	7726-95-6	11.20	8	99.60%
Bromoform	75-25-2	2.10	8	N/A
Cadmium*	CADMIUMCPDS	1.90E-01	8	99.60%
Carbon disulfide	75-10-0	6.99	8	N/A
2-Chloroacetophenone	532-27-4	0.38	8	N/A
Chlorobenzene	108-90-7	1.18	8	N/A
Chloroform	67-66-3	3.17	8	N/A
Chromium*	CROMCPDS	6.56	8	99.60%
Chromium (VI)	CHROM6CPDS	0.01	8	99.60%
Cumene	98-82-8	0.28	8	N/A
Cyanide	CNC	134.38	8	N/A
Dibenzofurans	132-64-9	1.08E-02	8	N/A
Dimethyl sulfate	77-78-1	2.58	8	N/A
2,4-Dinitrotoluene	121-14-2	1.51E-02	8	N/A
Ethyl benzene	100-41-4	5.05	8	N/A
Ethyl chloride	75-00-3	2.26	8	N/A
Ethylene dibromide	106-93-4	6.45E-02	8	N/A
Ethylene dichloride	107-06-2	2.15	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 #: 03069T25

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 2009

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*	50-00-00	89.90	8	N/A
Hexane	HEXANEISO	3.60	8	N/A
Hydrogen Chloride *	7647-01-0	17488.66	8	N/A
Hydrogen Fluoride *	7664-39-3	314.25	8	90% Control with CaCO ₃
Isophorone	78-59-1	31.18	8	N/A
Lead*	LEADCPDS	2.40	8	99.60%
Manganese*	MANGCPDS	16.40	8	99.60%
Mercury*	MERCCPDS	1.14	8	N/A
Methyl bromide	74-83-9	8.60	8	N/A
Methyl chloride	74-87-3	28.49	8	N/A
Methyl ethyl ketone	78-93-3	20.96	8	N/A
Methyl hydrazine	60-34-4	9.14	8	N/A
Methyl methacrylate	80-62-6	1.08	8	N/A
Methyl tert butyl ether	1634-04-4	1.88	8	N/A
Methylene chloride	75-09-2	15.59	8	N/A
Naphthalene	91-20-3	0.70	8	N/A
Nickel	NICKCPDS	13.35	8	99.60%
Phenol	108-95-2	0.86	8	N/A
POM	POM	3.06	8	N/A
Propionaldehyde	123-38-6	20.43	8	N/A
Styrene	100-42-5	1.34	8	N/A
2,3,7,8-TCDD	1746-01-6	7.69E-07	8	N/A
Tetrachloroethylene	79-34-5	2.31	8	N/A
Toluene	108-88-3	12.90	8	N/A
1,1,1-Trichloroethane	79-00-5	1.08	8	N/A
Vinyl acetate	108-05-4	0.41	8	N/A
Xylenes	1330-20-7	1.99	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 ₂	143,686.18	8	N/A
Methane	CH ₄	0.26	8	N/A
Nitrous oxide	N ₂ O	2.41	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 #: **03069T25**
 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 2009

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 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)		40,522			1,000 ft ³ /yr		
6. Fuel Information (if fuel used)		% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	1,030 Btu/ft ³

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 ₃) 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	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	1.57%	Mar-May	51.29%	June-Aug	39.39%	Sept-Nov	7.75%
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Facility ID #: **6800043**
 Permit #: **03069T25**
 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 2009**

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	1.70	8	N/A
NOx	NOx	6.64	1	N/A
PM Total	PM	0.15	8	N/A
PM-2.5	PM-2.5	0.15	8	N/A
PM-10	PM-10	0.15	8	N/A
SO2	SO2	0.00	1	N/A
VOC	VOC	0.11	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	8.10E-03	8	N/A
Benzene	71-43-2	0.09	8	N/A
Cadmium	CADMIUMCPDS	4.46E-02	8	N/A
Chromium	CROMCPDS	5.67E-02	8	N/A
Chromium VI	CHROM6CPDS	5.67E-02	8	N/A
Dichlorobenzene	106-46-7	4.86E-02	8	N/A
Formaldehyde	50-00-0	3.04	8	N/A
Hexane	HEXANEISO	72.94	8	N/A
Lead	LEADCPDS	2.03E-02	8	N/A
Manganese	MANGCPDS	1.54E-02	8	N/A
Mercury	MERCPDS	1.05E-02	8	N/A
Napthalene	91-20-3	2.47E-02	8	N/A
Nickel	NICKCPDS	0.09	8	N/A
POM	POM	2.68E-02	8	N/A
Toluene	108-88-3	0.14	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 ₂	2,439.31	8	N/A
Methane	CH ₄	0.046	8	N/A
Nitrous oxide	N ₂ O	0.005	8	N/A

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Boiler #6

(ES-001-Boiler #6)

Emissions Calculations

SO₂ and NO_x Emissions are Taken from CEMs Data

Other emission factors are from stack test or DAQ spreadsheets

**Fuel Oil Combustion Emissions Calculator FO2000 Revision A
2009 Annual Emissions Inventory**

**Boiler #6
(ES-001-Boiler #6)
Facility ID # 6800043
Permit # 03069T25**

Operating Scenario #4 - No.2 Fuel Oil

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 ³ gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.015
Maximum fuel sulfur content (%):	0.5
Latest Construction/Modification Date:	N/A
Enter the boiler type below ↘	
	15

Boilers =>100 mmBtu/hr 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)	Boilers =>100 mmBtu/hr (cont'd) 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
	Small Boilers (<100 mmBtu/hr) 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

2009 Annual Emissions Inventory

Boiler #6

(ES-001-Boiler #6)

Facility ID # 6800043

Permit # 03069T25

Operating Scenario #4 - No.2 Fuel Oil

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 ³ gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.015
Maximum fuel sulfur content (%):	0.5
Latest Construction/Modification Date:	N/A

Emission Controls

Particulate controls

Enter the control type below ▾	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 SO₂ controls

Enter the control type below ▾	Message Area	Or enter an SO ₂ control efficiency below to override built in values.
0		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input SO₂ 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>	
	NA	User entered control efficiency may be overestimated and should be documented.

NO_x controls

Enter the control type below ▾	Message Area	Or enter a NO _x control efficiency below to override built in values.
5		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input NO_x 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 _x burners (LNB)		
7 = Reduced air preheat (RAP)		
8 = Selective noncatalytic reduction (SNCR)		
9 = Conventional selective catalytic reduction (SCR)	<u>Remarks</u>	
	Available for boilers with sufficient operational flexibility	Message Area

Fuel Oil Combustion Emissions Calculator FO2000 Revision A
2009 Annual Emissions Inventory

Boiler #6
(ES-001-Boiler #6)
Facility ID # 6800043
Permit # 03069T25

Operating Scenario #4 - No.2 Fuel Oil

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 ³ gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.015
Maximum fuel sulfur content (%):	0.5
Latest Construction/Modification Date:	N/A

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

Toxic/Hazardous Air Pollutants				Emission Factor ¹
Pollutant	lb/hr ²	lb/day ⁷	lb/yr ³	(lb/10 ³ gal)
Antimony rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Arsenic rates @ 99% control	1.29E-05	NA	8.51E-08	5.60E-04
Benzene	6.35E-03	NA	4.18E-05	2.75E-03
Beryllium rates @ 99% control	9.70E-06	NA	6.38E-08	4.20E-04
Cadmium rates @ 99% control	9.70E-06	NA	6.38E-08	4.20E-04
Chromium rates @ 99% control	9.70E-06	NA	6.38E-08	4.20E-04
Chromium VI rates @ 99% control	2.85E-06	NA	1.87E-08	1.23E-04
Cobalt rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Ethylbenzene	1.89E-03	NA	1.24E-05	8.17E-04
Fluoride	8.61E-02	2.07E+00	5.67E-04	3.73E-02
Formaldehyde	1.11E-01	2.66E+00	7.30E-04	4.80E-02
Lead rates @ 99% control	2.91E-05	NA	1.92E-07	1.26E-03
Manganese rates @ 99% control	1.94E-05	4.65E-04	1.28E-07	8.40E-04
Mercury	9.70E-04	2.33E-02	6.38E-06	4.20E-04
Methyl chloroform (1,1,1-Trichloroethane)	5.45E-04	1.31E-02	3.59E-06	2.36E-04
Naphthalene	7.69E-04	NA	5.06E-08	3.33E-04
Nickel rates @ 99% control	9.70E-06	2.33E-04	6.38E-08	4.20E-04
POM rates @ 99% control	7.62E-05	NA	5.02E-07	3.30E-03
Selenium rates @ 99% control	4.85E-05	NA	3.19E-07	2.10E-03
Toluene	1.84E-01	4.41E+00	1.21E-03	7.97E-02
Xylene	3.23E-03	7.76E-02	2.13E-05	1.40E-03

Greenhouse Gases				Emission Factor
Pollutant	lb/hr ²	tpy	lb/yr ³	(lb/10 ³ gal)
Carbon dioxide	52,247	0.2	344	22633.77
Methane	2.12E+00	6.98E-06	1.40E-02	0.918
Nitrous Oxide	4.24E-01	1.40E-06	2.79E-03	0.18

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

²Hourly emission rates for all pollutants are based on hourly rated capacity.

³Annual emission rates for all pollutants are based on maximum annual fuel throughput.

⁴Wet scrubbers are assumed to control CPM whereas other PM control devices are assumed to only control FPM.

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

⁶Total 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**

2009 Annual Emissions Inventory

Boiler #6

(ES-001-Boiler #6)

Facility ID # 6800043

Permit # 03069T25

Operating Scenario #4 - No.2 Fuel Oil

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 ³ gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.015
Maximum fuel sulfur content (%):	0.5
Latest Construction/Modification Date:	N/A

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

**SOx and NOx emissions were estimated using CEMS data, please refer to the attached spreadsheets.

FO2000 Revision A dated March 9, 2000

Bituminous Coal Combustion

2009 Annual 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	Boiler Type:	<input type="text" value="7"/>
Boiler Size/Type	Large Industrial		1) Pulverized/Dry Bottom	6) Underfeed Stoker
Actual Fuel Usage	<input type="text" value="53,753"/>	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="12,709"/>	Btu/lb	Control Device Efficiencies:	
		ton/yr	PM	<input type="text" value="99.80"/> %
Sulfur Content	<input type="text" value="1.34"/>	%	PM-10	<input type="text" value="98.00"/> %
Ash Content :	<input type="text" value="10.4"/>	%	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.*

Bituminous Coal Combustion

2009 Annual 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)
<i>PM*</i>	<i>0.21</i>	<i>2.73</i>	<i>11,552</i>	<i>5.78</i>
<i>PM-10*</i>	<i>0.21</i>	<i>2.73</i>	<i>11,552</i>	<i>5.78</i>
<i>PM-2.5*</i>	<i>0.12</i>	<i>1.58</i>	<i>6,661</i>	<i>3.33</i>
SO2	11.66	**	**	**
SO3	0.08	**	**	**
NOx	#VALUE!	**	**	**
VOC*	<i>0.01</i>	<i>0.15</i>	<i>628</i>	<i>0.31</i>
CO*	<i>0.87</i>	<i>11.02</i>	<i>46,591</i>	<i>23.30</i>

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

ACTUAL TOXIC EMISSIONS

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Acetaldehyde	5.70E-04	7.25E-03	3.06E+01	1.53E-02
Acetophenone	1.50E-05	1.91E-04	8.06E-01	4.03E-04
Acrolein	2.90E-04	3.69E-03	1.56E+01	7.79E-03
Antimony*	<i>8.21E-06</i>	<i>1.04E-04</i>	<i>4.41E-01</i>	<i>2.21E-04</i>
Arsenic*	<i>7.65E-06</i>	<i>9.73E-05</i>	<i>4.11E-01</i>	<i>2.06E-04</i>
Benzene	1.30E-03	1.65E-02	6.99E+01	3.49E-02
Benzo(a)pyrene	3.80E-08	4.83E-07	2.04E-03	1.02E-06
Benzyl chloride	7.00E-04	8.90E-03	3.76E+01	1.88E-02
Beryllium*	<i>1.34E-06</i>	<i>1.71E-05</i>	<i>7.21E-02</i>	<i>3.61E-05</i>
Biphenyl	1.70E-06	2.16E-05	9.14E-02	4.57E-05
Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05	9.28E-04	3.92E+00	1.96E-03
Bromine	1.04E-01	2.65E-03	1.12E+01	5.60E-03
Bromoform	3.90E-05	4.96E-04	2.10E+00	1.05E-03
Cadmium*	<i>3.53E-06</i>	<i>4.49E-05</i>	<i>1.90E-01</i>	<i>9.50E-05</i>
Carbon disulfide	1.30E-04	1.65E-03	6.99E+00	3.49E-03
2-Chloroacetophenone	7.00E-06	8.90E-05	3.76E-01	1.88E-04
Chlorobenzene	2.20E-05	2.80E-04	1.18E+00	5.91E-04
Chlorine*	<i>2.75E-03</i>	<i>3.49E-02</i>	<i>1.48E+02</i>	<i>7.38E-02</i>
Chloroform	5.90E-05	7.50E-04	3.17E+00	1.59E-03
Chromium*	<i>1.22E-04</i>	<i>1.55E-03</i>	<i>6.56E+00</i>	<i>3.28E-03</i>
Chromium (VI)	1.22E-04	3.10E-06	1.31E-02	6.56E-06
Cobalt*	<i>7.02E-06</i>	<i>8.92E-05</i>	<i>3.77E-01</i>	<i>1.89E-04</i>
Cumene	5.30E-06	6.74E-05	2.85E-01	1.42E-04
Cyanide	2.50E-03	3.18E-02	1.34E+02	6.72E-02
Dibenzofurans	2.01E-07	2.56E-06	1.08E-02	5.40E-06
Dimethyl sulfate	4.80E-05	6.10E-04	2.58E+00	1.29E-03
2,4-Dinitrotoluene	2.80E-07	3.56E-06	1.51E-02	7.53E-06
Ethyl benzene	9.40E-05	1.20E-03	5.05E+00	2.53E-03
Ethyl chloride	4.20E-05	5.34E-04	2.26E+00	1.13E-03
Ethylene dibromide	1.20E-06	1.53E-05	6.45E-02	3.23E-05
Ethylene dichloride	4.00E-05	5.09E-04	2.15E+00	1.08E-03
Formaldehyde*	<i>1.67E-03</i>	<i>2.13E-02</i>	<i>8.99E+01</i>	<i>4.50E-02</i>
Hexane	6.70E-05	8.52E-04	3.60E+00	1.80E-03
Hydrogen Chloride *	<i>3.25E-01</i>	<i>4.14E+00</i>	<i>1.75E+04</i>	<i>8.74E+00</i>
Hydrogen Fluoride *	<i>5.85E-03</i>	<i>7.43E-02</i>	<i>3.14E+02</i>	<i>1.57E-01</i>
Isophorone	5.80E-04	7.37E-03	3.12E+01	1.56E-02
Lead*	<i>4.47E-05</i>	<i>5.69E-04</i>	<i>2.40E+00</i>	<i>1.20E-03</i>

**SO₂ 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

2009 Annual 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>	<i>3.05E-04</i>	<i>3.88E-03</i>	<i>1.64E+01</i>	<i>8.20E-03</i>
<i>Mercury*</i>	<i>2.13E-05</i>	<i>2.70E-04</i>	<i>1.14E+00</i>	<i>5.72E-04</i>
Methyl bromide	1.60E-04	2.03E-03	8.60E+00	4.30E-03
Methyl chloride	5.30E-04	6.74E-03	2.85E+01	1.42E-02
Methyl ethyl ketone	3.90E-04	4.96E-03	2.10E+01	1.05E-02
Methyl hydrazine	1.70E-04	2.16E-03	9.14E+00	4.57E-03
Methyl methacrylate	2.00E-05	2.54E-04	1.08E+00	5.38E-04
Methyl tert butyl ether	3.50E-05	4.45E-04	1.88E+00	9.41E-04
Methylene chloride	2.90E-04	3.69E-03	1.56E+01	7.79E-03
Naphthalene	1.30E-05	1.65E-04	6.99E-01	3.49E-04
<i>Nickel*</i>	<i>2.48E-04</i>	<i>3.16E-03</i>	<i>1.33E+01</i>	<i>6.67E-03</i>
Phenol	1.60E-05	2.03E-04	8.60E-01	4.30E-04
<i>Phosphorus*</i>	<i>3.71E-05</i>	<i>4.72E-04</i>	<i>1.99E+00</i>	<i>9.97E-04</i>
POM	5.69E-05	7.24E-04	3.06E+00	1.53E-03
Propionaldehyde	3.80E-04	4.83E-03	2.04E+01	1.02E-02
<i>Selenium*</i>	<i>5.46E-06</i>	<i>6.95E-05</i>	<i>2.94E-01</i>	<i>1.47E-04</i>
Styrene	2.50E-05	3.18E-04	1.34E+00	6.72E-04
2,3,7,8-TCDD	1.43E-11	1.82E-10	7.69E-07	3.84E-10
Tetrachloroethylene	4.30E-05	5.47E-04	2.31E+00	1.16E-03
Toluene	2.40E-04	3.05E-03	1.29E+01	6.45E-03
1,1,1-Trichloroethane	2.00E-05	2.54E-04	1.08E+00	5.38E-04
Vinyl acetate	7.60E-06	9.66E-05	4.09E-01	2.04E-04
Xylenes	3.70E-05	4.70E-04	1.99E+00	9.94E-04
Total HAPs		4.39	18,568.76	9.28

Greenhouse Gases

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Carbon dioxide	5233.81	66543.82	281,334,625	140,667.31
<i>Methane*</i>	<i>0.010</i>	<i>0.12</i>	<i>519.19</i>	<i>0.26</i>
Nitrous Oxide	0.09	1.14	4,819	2.41

***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
2009 Annual Emissions Inventory

Boiler #6

(ES-001-Boiler #6)

Facility ID # 6800043

Permit # 03069T25

Operating Scenario #2

User Input		Emissions Output (for operation 18.53 hr/yr)			Emission	
Company Name:	University of North Carolina at Chapel Hill	Criteria Pollutants			Factor	
Plant County:	Orange County	Pollutant	lb/hr	lb/yr	(lb/mmscf)	
Plant City:	Chapel Hill	PM	2.4E+00	3.1E+02	1.5E-01	7.6E+00
Permit Number:	03069T25	PM-10	2.4E+00	3.1E+02	1.5E-01	7.6E+00
User:	RST Engineering	PM-2.5	2.4E+00	3.1E+02	1.5E-01	7.6E+00
Heat Input Capacity (mmBtu/hr):	323.17	NOx	**	**	**	1.9E+02
Fuel Input Capacity (10 ⁶ scf/hr):	0.32	VOC	1.7E+00	2.2E+02	1.1E-01	5.5E+00
Annual Fuel Throughput (10 ⁶ scf):	40.52	CO	2.7E+01	3.4E+03	1.7E+00	8.4E+01
Latest Construction/Modification Date:	N/A	SO2	**	**	**	6.0E-01
Enter the boiler type below ▾		Total HAP	6.0E-01	7.7E+01	3.8E-02	1.9E+00
2		Largest HAP	5.7E-01	7.3E+01	3.6E-02	1.8E+00
Other NOx Control		Toxic/Hazardous Air Pollutants				
4		Pollutant	lb/hr	lb/day	lb/yr	
Large Wall-Fired Boilers (=>100 mmBtu/hr)		Arsenic	6.3E-05	NA	8.1E-03	2.0E-04
1 = Uncontrolled (Pre-NSPS)		Benzene	6.7E-04	NA	8.5E-02	2.1E-03
2 = Uncontrolled (Post-NSPS)		Cadmium	3.5E-04	NA	4.5E-02	1.1E-03
3 = Controlled - Low NOx burners		Chromium	4.4E-04	NA	5.7E-02	1.4E-03
4 = Controlled - Flue gas recirculation (FGR)		Chromium VI	4.4E-04	NA	5.7E-02	1.4E-03
Small Boilers (<100 mmBtu/hr)		Dichlorobenzene	3.8E-04	NA	4.9E-02	1.2E-03
5 = Uncontrolled		Formaldehyde	2.4E-02	NA	3.0E+00	7.5E-02
6 = Controlled - Low NOx burners		Hexane	5.7E-01	1.4E+01	7.3E+01	1.8E+00
7 = Controlled - Low NOx burners/FGR		Lead	1.6E-04	NA	2.0E-02	5.0E-04
Tangential-Fired Boilers (All Sizes)		Manganese	1.2E-04	2.9E-03	1.5E-02	3.8E-04
8 = Uncontrolled		Mercury	8.2E-05	2.0E-03	1.1E-02	2.6E-04
9 = Controlled - FGR		Naphthalene	1.9E-04	NA	2.5E-02	6.1E-04
Residential Furnaces (<0.3 mmBtu/hr)		Nickel	6.7E-04	1.6E-02	8.5E-02	2.1E-03
10 = Uncontrolled		POM	2.1E-04	NA	2.7E-02	6.6E-04
		Toluene	1.1E-03	2.6E-02	1.4E-01	3.4E-03
		Greenhouse Gas Pollutants			Em. Factor	
		Pollutant	lb/hr	lb/yr	(lb/mmscf)	
		Carbon dioxide	37,775	4,878,626	2439.31	116.89
		Methane	0.71	92.01	4.60E-02	2.20E-03
		Nitrous Oxide	0.071	9.20	4.60E-03	2.20E-04

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual 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 SO₂ emissions.

For the 2009 calendar year, 30 day facility averages for the SO₂ emission rate measured by the CEM are as follows:

Month	30 day average CEM reading (lb/MMBtu)
January 2009	0.18
February 2009	0.16
March 2009	0.15
April 2009	0.17
May 2009	0.17
June 2009	0.18
July 2009	0.18
August 2009	0.18
September 2009	0.19
October 2009	0.29
November 2009	0.17
December 2009	0.18
Annual Average	0.183

This average includes SO₂ 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 2009

Boiler #6		
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr
53,753	40,522	15
Coal (12,709 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (138,813 btu/gal)
MMBtu/yr		
1.37E+06	4.17E+04	2.11E+00

Total for Boiler #6 (MMBtu/yr)	1.41E+06
--------------------------------	----------

Total SO ₂ Emissions from Boiler #6 (lb/yr)	258,141
Total SO₂ Emissions from Boiler #6 (ton/yr)	129.07

SO₂ Emissions Associated with Coal Combustion (ton/yr)	129.07
SO₂ Emissions Associated with No. 2 Fuel Oil Combustion (ton/yr)	0.00

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual 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 2009 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 2009	0.31
February 2009	0.31
March 2009	0.33
April 2009	0.30
May 2009	0.26
June 2009	0.29
July 2009	0.27
August 2009	0.29
September 2009	0.34
October 2009	0.37
November 2009	0.36
December 2009	0.39
Annual Average	0.32

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 2009

Boiler #6		
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr
53,753	40,522	15
Coal (12,709 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (138,813 btu/gal)
MMBtu/yr		
1.37E+06	4.17E+04	2.11E+00

Total for Boiler #6 (MMBtu/yr)	1.41E+06
--------------------------------	----------

Total NOx Emissions from Boiler #6 (lb/yr)	448,226
Total NOx Emissions from Boiler #6 (ton/yr)	224.11

NOx Emissions Associated with Coal Combustion (ton/yr)	217.47
NOx Emissions Associated with Fuel Oil No. 2 Combustion (ton/yr)	0.00
NOx Emissions Associated with Natural Gas Combustion (ton/yr)	6.64

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Boiler No.6

CO₂ Emissions from Limestone.

(ES-3)

Assume that the amount of total limestone distributed between boilers is proportional to percentage of total coal burned in each boiler.

Boiler #6	53,753	Tons/yr	51.4%
Boiler #7	50,835	Tons/yr	48.6%
Total	104,588	Tons/yr	100.0%

Total Limestone Used **14,680** Tons/yr

Limestone Used in Boiler No.6 **7,545** Tons/yr

85.0% CaCO₃

100.09 MW, CaCO₃

44.01 MW, CO₂

5.00% MgCO₃

83.43 MW, MgCO₃

44.01 MW, CO₂

CO₂ emission rate 800.2 lb/ton

Boiler No.6 3,019 tons/yr, CO₂

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Boiler #7

(ES-002-Boiler #7)

Operating Scenarios

#1 - Coal Firing

#2 - Natural Gas Firing

#4 - No.2 Fuel Oil 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 SO₂ and NO_x 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 2009 Annual Emission Inventory forms require that the emissions be divided among the three possible operating scenarios.

NO_x emissions have been divided between the three operating scenarios based on the percentage of total heat input by each fuel. These calculations are detailed in the attached spreadsheets.

SO₂ emissions from natural gas combustion are insignificant, therefore, SO₂ 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

SO₂ and NO_x Emissions are taken from CEMs data

Other emission factors are from stack test or DAQ spreadsheets

Emission Source/Operating Scenario Data Page 1 of 2		Facility ID #: 680043					
<i>Boiler #7 - Operating Scenario #4 - No. 2 Fuel Oil</i> <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>		Permit #: 03069T25					
Facility Name: University of North Carolina at Chapel Hill		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 2009							
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. 6 Fuel Oil Fired Circulating Fluidized Bed Combustion - Steam Generating Unit					
3. Operating Scenario Description		Operating Scenario #4 - No. 2 Fuel Oil					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		323.17 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		7 gallons/yr					
6. Fuel Information (if fuel used)		% Sulfur	0.5%				
		% Ash					
		Heat Content (Btu/lb or mmCF)	138,813 Btu/gal				
<small>If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.</small>							
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 # <small>(as listed in permit)</small>	Control Device Description					
i. (nearest stack)	CD-004	Bagfilter with Calcium Carbonate (CaCO ₃) 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 <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>	
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	7,848 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	100.00%	Mar-May	0.00%	June-Aug	0%	Sept-Nov	0.00%

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 OilIf Emission Source has multiple Operating Scenarios, complete one form for each.
(All permitted, Insignificant and/or Non-permitted Sources)Facility ID #: **6800043**Permit #: **03069T25**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 2009**

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	1.78E-05	8	N/A
NOx	NOx	1.68E-04	1	N/A
PM Total	PM	4.69E-06	8	99.0%
PM-2.5	PM-2.5	1.17E-06	8	99.0%
PM-10	PM-10	4.69E-06	8	99.0%
SO2	SO2	8.84E-05	1	90.00%
VOC	VOC	7.10E-07	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	3.98E-08	8	99.0%
Benzene	71-43-2	1.95E-05	8	N/A
Beryllium	BERYLCPDS	2.98E-08	8	99.0%
Cadmium	CADMIUMPDS	2.98E-08	8	99.0%
Chromium	CROMCPDS	2.98E-08	8	99.0%
Chromium VI	CHROM6CPDS	8.75E-09	8	99.0%
Cobalt	COBALTCPDS	0.00E+00	8	99.0%
Ethylbenzene	100-41-4	5.80E-06	8	N/A
Fluoride	16984-48-8	0.00	8	N/A
Formaldehyde	50-00-0	0.00	8	N/A
Lead	LEADCPDS	8.95E-08	8	99.0%
Manganese	MANGCPDS	5.96E-08	8	99.0%
Mercury	MERCPDS	2.98E-06	8	99.0%
Methyl chloroform	71-55-6	1.68E-06	8	N/A
Napthalene	91-20-3	0.000	8	N/A
Nickel	NICKCPDS	2.98E-08	8	99.0%
POM	POM	2.34E-07	8	99.0%
Selenium	SEC	1.49E-07	8	99.0%
Toluene	108-88-3	0.00	8	N/A
Xylene	1330-20-7	9.94E-06	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 ₂	0.08	8	N/A
Methane	CH ₄	0.00	8	N/A
Nitrous oxide	N ₂ O	0.00	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 #: 03069T25
 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 2009**

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)		50,835				tons/yr	
6. Fuel Information (if fuel used)		% Sulfur	1.34%	% Ash	10.73%	Heat Content (Btu/lb or mmCF)	12,597 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 ₃) 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	34.67%	Mar-May	17.94%	June-Aug	18.96%	Sept-Nov	28.42%
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Boiler #7 - Operating Scenario #1 - CoalIf 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 #: 03069T25County: OrangeDAQ Region: Raleigh

North Carolina Department of Environment and Natural Resources
Division of Air Quality
Air Pollutant Point Source Emissions Inventory - Calendar Year 2009

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	21.84	8	N/A
NOx	NOx	218.79	1	N/A
PM Total	PM	5.46	8	99.80%
PM-2.5	PM-2.5	3.15	8	97.90%
PM-10	PM-10	5.46	8	98.00%
SO2	SO2	114.93	1	90.00%
VOC	VOC	0.29	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	28.98	8	N/A
Acetophenone	98-86-2	0.76	8	N/A
Acrolein	107-02-8	14.74	8	N/A
Arsenic*	ARSENICPDS	0.39	8	99.60%
Benzene	71-43-2	66.08	8	N/A
Benzo(a)pyrene	50-32-8	1.93E-03	8	N/A
Benzyl chloride	100-44-7	35.58	8	N/A
Beryllium*	BERYLCPDS	0.07	8	N/A
Biphenyl	92-52-4	8.64E-02	8	N/A
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	3.71	8	N/A
Bromine	7726-95-6	10.50	8	99.60%
Bromoform	75-25-2	1.98	8	N/A
Cadmium*	CADMIUMCPDS	1.78E-01	8	99.60%
Carbon disulfide	75-10-0	6.61	8	N/A
2-Chloroacetophenone	532-27-4	0.36	8	N/A
Chlorobenzene	108-90-7	1.12	8	N/A
Chloroform	67-66-3	3.00	8	N/A
Chromium*	CROMCPDS	6.15	8	99.60%
Chromium (VI)	CHROM6CPDS	0.01	8	99.60%
Cumene	98-82-8	0.27	8	N/A
Cyanide	CNC	127.09	8	N/A
Dibenzofurans	132-64-9	1.02E-02	8	N/A
Dimethyl sulfate	77-78-1	2.44	8	N/A
2,4-Dinitrotoluene	121-14-2	1.42E-02	8	N/A
Ethyl benzene	100-41-4	4.78	8	N/A
Ethyl chloride	75-00-3	2.14	8	N/A
Ethylene dibromide	106-93-4	6.10E-02	8	N/A
Ethylene dichloride	107-06-2	2.03	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 #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 ID #: 6800043

Permit #: 03069T25

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 2009

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*	50-00-00	84.27	8	N/A
Hexane	HEXANEISO	3.41	8	N/A
Hydrogen Chloride *	7647-01-0	16393.29	8	N/A
Hydrogen Fluoride *	7664-39-3	294.57	8	90% Control with CaCO ₃
Isophorone	78-59-1	29.48	8	N/A
Lead*	LEADCPDS	2.25	8	99.60%
Manganese*	MANGCPDS	15.37	8	99.60%
Mercury*	MERCCPDS	1.07	8	N/A
Methyl bromide	74-83-9	8.13	8	N/A
Methyl chloride	74-87-3	26.94	8	N/A
Methyl ethyl ketone	78-93-3	19.83	8	N/A
Methyl hydrazine	60-34-4	8.64	8	N/A
Methyl methacrylate	80-62-6	1.02	8	N/A
Methyl tert butyl ether	1634-04-4	1.78	8	N/A
Methylene chloride	75-09-2	14.74	8	N/A
Naphthalene	91-20-3	0.66	8	N/A
Nickel	NICKCPDS	12.51	8	99.60%
Phenol	108-95-2	0.81	8	N/A
POM	POM	2.87	8	N/A
Propionaldehyde	123-38-6	19.32	8	N/A
Styrene	100-42-5	1.27	8	N/A
2,3,7,8-TCDD	1746-01-6	7.27E-07	8	N/A
Tetrachloroethylene	79-34-5	2.19	8	N/A
Toluene	108-88-3	12.20	8	N/A
1,1,1-Trichloroethane	79-00-5	1.02	8	N/A
Vinyl acetate	108-05-4	0.39	8	N/A
Xylenes	1330-20-7	1.88	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 ₂	134,711.83	8	N/A
Methane	CH ₄	0.24	8	N/A
Nitrous oxide	N ₂ O	2.26	8	N/A

Emission Source/Operating Scenario Data Page 1 of 2		Facility ID #: 6800043					
<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>		Permit #: 03069T25					
Facility Name: University of North Carolina at Chapel Hill		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 2009							
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 #2 - Natural Gas					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		323.17 MMBtu/hr					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		37,899	1,000 ft ³ /yr				
6. Fuel Information (if fuel used)	% Sulfur	N/A	% Ash				
		N/A	Heat Content (Btu/lb or mmCF)				
			1,030 Btu/ft ³				
<small>If you do not provide annual throughput/fuel use, your inventory will be deemed incomplete and returned to you.</small>							
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 # <small>(as listed in permit)</small>	Control Device Description					
i. (nearest stack)	CD-004	Bagfilter with Calcium Carbonate (CaCO ₃) 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 <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>	
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	7,848 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	1.09%	Mar-May	56.09%	June-Aug	39.07%	Sept-Nov	3.75%

Facility ID #: **6800043**
 Permit #: **03069T25**
 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 2009**

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	1.59	8	N/A
NOx	NOx	6.67	1	N/A
PM Total	PM	0.14	8	N/A
PM-2.5	PM-2.5	0.14	8	N/A
PM-10	PM-10	0.14	8	N/A
SO2	SO2	0.00	1	N/A
VOC	VOC	0.10	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	7.58E-03	8	N/A
Benzene	71-43-2	0.08	8	N/A
Cadmium	CADMIUMCPDS	4.17E-02	8	N/A
Chromium	CROMCPDS	5.31E-02	8	N/A
Chromium VI	CHROM6CPDS	5.31E-02	8	N/A
Dichlorobenzene	106-46-7	4.55E-02	8	N/A
Formaldehyde	50-00-0	2.84	8	N/A
Hexane	HEXANEISO	6.82E+01	8	N/A
Lead	LEADCPDS	1.89E-02	8	N/A
Manganese	MANGCPDS	1.44E-02	8	N/A
Mercury	MERCPDS	9.85E-03	8	N/A
Napthalene	91-20-3	2.31E-02	8	N/A
Nickel	NICKCPDS	0.08	8	N/A
POM	POM	2.51E-02	8	N/A
Toluene	108-88-3	0.13	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 ₂	2,281.41	8	N/A
Methane	CH ₄	0.043	8	N/A
Nitrous oxide	N ₂ O	0.004	8	N/A

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Boiler #7

(ES-002-Boiler #7)

Emissions Calculations

SO₂ and NO_x Emissions are Taken from CEMs data

Other emission factors are from stack test or DAQ spreadsheets

Fuel Oil Combustion Emissions Calculator FO2000 Revision A
2009 Annual Emissions Inventory
Boiler #7
(ES-002-Boiler #7)
Facility ID # 6800043
Permit # 03069T25

Operating Scenario #4 - No.2 Fuel Oil

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	323.17
Fuel Input Capacity (10 ³ gal/hr):	2.31
Annual Fuel Throughput (1000 gal):	0.007
Maximum fuel sulfur content (%):	0.5
Latest Construction/Modification Date:	N/A
Enter the boiler type below ▾	
	15

Boilers =>100 mmBtu/hr 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)	Boilers =>100 mmBtu/hr (cont'd) 16 = No. 2 oil fired (C) 17 = No. 2 oil fired, LNB/FGR (U,I) 18 = No. 2 oil fired, LNB/FGR (C) <hr/> 19 = Vertical fired utility boiler <hr/> Small Boilers (<100 mmBtu/hr) 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) <hr/> 26 = Residential Furnace
--	--

Emission Controls

Particulate controls

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

Postcombustion SO₂ controls

Enter the control type below ▾	Message Area	Or enter an SO ₂ control efficiency
---------------------------------------	--------------	--

0	below to override built in values.
Control Technology/Process	User Input SO₂ Cont. Effic.
0 = None/other	90.0
1 = Wet scrubber, Lime/limestone	User entered control efficiency may be overestimated and should be documented.
2 = Wet scrubber, Sodium carbonate	Avg. Cont. Effic.
3 = Wet scrubber, Magnesium oxide/hydroxide	0.0
4 = Wet scrubber, Dual alkali	Remarks
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_x controls

Enter the control type below ▾	Message Area	Or enter a NO _x control efficiency below to override built in values.
0		
Control Technology/Process	User Input NO_x Cont. Effic.	
0 = None/other	0.0	
1 = Low excess air (LEA)	Avg. Cont. Effic.	Message Area
2 = Staged combustion (SC)	0.0	
3 = Burners out of service (BOOS)	Remarks	
4 = Flue gas recirculation (FGR)	NA	
5 = Flue gas recirculation plus staged combustion		
6 = Low NO _x 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)

Criteria Pollutants				Emission Factor¹
Pollutant	lb/hr ²	tpy	lb/yr ³	(lb/10 ³ 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) ⁴	3.0	0.0000	0	1.30E+00
Filterable PM-10 ⁵	0.0	0.0000	0	1.00E+00
Filterable PM-2.5 ⁵	0.0	0.0000	0	2.50E-01
NO _x 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 ₂ rates @ 90% control	see attached CEMs-based calculations			2.98E+02
Total HAP ⁶	4.17E-01	0.0000	0	1.81E-01
Largest HAP ⁶	1.84E-01	0.0000	0	7.97E-02

Toxic/Hazardous Air Pollutants.				Emission Factor¹
Pollutant	lb/hr ²	lb/day ⁷	lb/yr ³	(lb/10 ³ gal)
Antimony rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Arsenic rates @ 99% control	1.29E-05	NA	3.98E-08	5.60E-04
Benzene	6.35E-03	NA	1.95E-05	2.75E-03
Beryllium rates @ 99% control	9.70E-06	NA	2.98E-08	4.20E-04
Cadmium rates @ 99% control	9.70E-06	NA	2.98E-08	4.20E-04
Chromium rates @ 99% control	9.70E-06	NA	2.98E-08	4.20E-04
Chromium VI rates @ 99% control	2.85E-06	NA	8.75E-09	1.23E-04
Cobalt rates @ 99% control	0.00E+00	NA	0.00E+00	0.00E+00
Ethylbenzene	1.89E-03	NA	5.80E-06	8.17E-04
Fluoride	8.61E-02	2.07E+00	2.65E-04	3.73E-02
Formaldehyde	1.11E-01	2.66E+00	3.41E-04	4.80E-02
Lead rates @ 99% control	2.91E-05	NA	8.95E-08	1.26E-03
Manganese rates @ 99% control	1.94E-05	4.65E-04	5.96E-08	8.40E-04
Mercury	9.70E-04	2.33E-02	2.98E-06	4.20E-04
Methyl chloroform (1,1,1-Trichloroethane)	5.45E-04	1.31E-02	1.68E-06	2.36E-04
Napthalene	7.69E-04	NA	2.36E-06	3.33E-04
Nickel rates @ 99% control	9.70E-06	2.33E-04	2.98E-08	4.20E-04
POM rates @ 99% control	7.62E-05	NA	2.34E-07	3.30E-03
Selenium rates @ 99% control	4.85E-05	NA	1.49E-07	2.10E-03

Toluene	1.84E-01	4.41E+00	5.66E-04	7.97E-02
Xylene	3.23E-03	7.76E-02	9.94E-06	1.40E-03

Greenhouse Gases				Emission Factor (lb/10 ³ gal)
Pollutant	lb/hr ²	tpy	lb/yr ³	
Carbon dioxide	52,247	0.1	161	22633.77
Methane	2.12E+00	3.26E-06	6.52E-03	0.918
Nitrous Oxide	4.24E-01	6.52E-07	1.30E-03	0.18

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

²Hourly emission rates for all pollutants are based on hourly rated capacity.

³Annual emission rates for all pollutants are based on maximum annual fuel throughput.

⁴Wet scrubbers are assumed to control CPM whereas other PM control devices are assumed to only control FPM.

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

⁶Total 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.

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

Bituminous Coal Combustion

2009 Annual 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	Boiler Type:	<input type="text" value="7"/>
Boiler Size/Type	Large Industrial		1) Pulverized/Dry Bottom	6) Underfeed Stoker
Actual Fuel Usage	<input type="text" value="50,835"/>	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="12,597"/>	Btu/lb	Control Device Efficiencies:	
		ton/yr	PM	<input type="text" value="99.80"/> %
Sulfur Content	<input type="text" value="1.34"/>	%	PM-10	<input type="text" value="98.00"/> %
Ash Content :	<input type="text" value="10.7"/>	%	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.*

Bituminous Coal Combustion

2009 Annual 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 CRITERIA EMISSIONS

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
<i>PM*</i>	<i>0.21</i>	<i>2.73</i>	<i>10,925</i>	<i>5.46</i>
<i>PM-10*</i>	<i>0.21</i>	<i>2.73</i>	<i>10,925</i>	<i>5.46</i>
<i>PM-2.5*</i>	<i>0.12</i>	<i>1.58</i>	<i>6,299</i>	<i>3.15</i>
SO2	11.66	**	**	**
SO3	0.08	**	**	**
NOx	#VALUE!	**	**	**
<i>VOC*</i>	<i>0.01</i>	<i>0.15</i>	<i>589</i>	<i>0.29</i>
<i>CO*</i>	<i>0.86</i>	<i>11.02</i>	<i>43,673</i>	<i>21.84</i>

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

ACTUAL TOXIC EMISSIONS

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Acetaldehyde	5.70E-04	7.31E-03	2.90E+01	1.45E-02
Acetophenone	1.50E-05	1.92E-04	7.63E-01	3.81E-04
Acrolein	2.90E-04	3.72E-03	1.47E+01	7.37E-03
<i>Antimony*</i>	<i>8.14E-06</i>	<i>1.04E-04</i>	<i>4.14E-01</i>	<i>2.07E-04</i>
<i>Arsenic*</i>	<i>7.58E-06</i>	<i>9.73E-05</i>	<i>3.85E-01</i>	<i>1.93E-04</i>
Benzene	1.30E-03	1.67E-02	6.61E+01	3.30E-02
Benzo(a)pyrene	3.80E-08	4.87E-07	1.93E-03	9.66E-07
Benzyl chloride	7.00E-04	8.98E-03	3.56E+01	1.78E-02
<i>Beryllium*</i>	<i>1.33E-06</i>	<i>1.71E-05</i>	<i>6.76E-02</i>	<i>3.38E-05</i>
Biphenyl	1.70E-06	2.18E-05	8.64E-02	4.32E-05
Bis(2-ethylhexyl)phthalate (DEHP)	7.30E-05	9.36E-04	3.71E+00	1.86E-03
Bromine	1.03E-01	2.65E-03	1.05E+01	5.25E-03
Bromoform	3.90E-05	5.00E-04	1.98E+00	9.91E-04
<i>Cadmium*</i>	<i>3.50E-06</i>	<i>4.49E-05</i>	<i>1.78E-01</i>	<i>8.90E-05</i>
Carbon disulfide	1.30E-04	1.67E-03	6.61E+00	3.30E-03
2-Chloroacetophenone	7.00E-06	8.98E-05	3.56E-01	1.78E-04
Chlorobenzene	2.20E-05	2.82E-04	1.12E+00	5.59E-04
<i>Chlorine*</i>	<i>2.72E-03</i>	<i>3.49E-02</i>	<i>1.38E+02</i>	<i>6.92E-02</i>
Chloroform	5.90E-05	7.57E-04	3.00E+00	1.50E-03
<i>Chromium*</i>	<i>1.21E-04</i>	<i>1.55E-03</i>	<i>6.15E+00</i>	<i>3.07E-03</i>
Chromium (VI)	1.21E-04	3.10E-06	1.23E-02	6.15E-06
<i>Cobalt*</i>	<i>6.95E-06</i>	<i>8.92E-05</i>	<i>3.53E-01</i>	<i>1.77E-04</i>
Cumene	5.30E-06	6.80E-05	2.69E-01	1.35E-04
Cyanide	2.50E-03	3.21E-02	1.27E+02	6.35E-02
Dibenzofurans	2.01E-07	2.58E-06	1.02E-02	5.11E-06
Dimethyl sulfate	4.80E-05	6.16E-04	2.44E+00	1.22E-03
2,4-Dinitrotoluene	2.80E-07	3.59E-06	1.42E-02	7.12E-06
Ethyl benzene	9.40E-05	1.21E-03	4.78E+00	2.39E-03
Ethyl chloride	4.20E-05	5.39E-04	2.14E+00	1.07E-03
Ethylene dibromide	1.20E-06	1.54E-05	6.10E-02	3.05E-05
Ethylene dichloride	4.00E-05	5.13E-04	2.03E+00	1.02E-03
<i>Formaldehyde*</i>	<i>1.66E-03</i>	<i>2.13E-02</i>	<i>8.43E+01</i>	<i>4.21E-02</i>
Hexane	6.70E-05	8.59E-04	3.41E+00	1.70E-03
<i>Hydrogen Chloride *</i>	<i>3.22E-01</i>	<i>4.14E+00</i>	<i>1.64E+04</i>	<i>8.20E+00</i>
<i>Hydrogen Fluoride *</i>	<i>5.79E-03</i>	<i>7.43E-02</i>	<i>2.95E+02</i>	<i>1.47E-01</i>
Isophorone	5.80E-04	7.44E-03	2.95E+01	1.47E-02
<i>Lead*</i>	<i>4.43E-05</i>	<i>5.69E-04</i>	<i>2.25E+00</i>	<i>1.13E-03</i>

**SO₂ 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

2009 Annual 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>	<i>3.02E-04</i>	<i>3.88E-03</i>	<i>1.54E+01</i>	<i>7.68E-03</i>
<i>Mercury*</i>	<i>2.11E-05</i>	<i>2.70E-04</i>	<i>1.07E+00</i>	<i>5.36E-04</i>
Methyl bromide	1.60E-04	2.05E-03	8.13E+00	4.07E-03
Methyl chloride	5.30E-04	6.80E-03	2.69E+01	1.35E-02
Methyl ethyl ketone	3.90E-04	5.00E-03	1.98E+01	9.91E-03
Methyl hydrazine	1.70E-04	2.18E-03	8.64E+00	4.32E-03
Methyl methacrylate	2.00E-05	2.57E-04	1.02E+00	5.08E-04
Methyl tert butyl ether	3.50E-05	4.49E-04	1.78E+00	8.90E-04
Methylene chloride	2.90E-04	3.72E-03	1.47E+01	7.37E-03
Naphthalene	1.30E-05	1.67E-04	6.61E-01	3.30E-04
<i>Nickel*</i>	<i>2.46E-04</i>	<i>3.16E-03</i>	<i>1.25E+01</i>	<i>6.26E-03</i>
Phenol	1.60E-05	2.05E-04	8.13E-01	4.07E-04
<i>Phosphorus*</i>	<i>3.68E-05</i>	<i>4.72E-04</i>	<i>1.87E+00</i>	<i>9.35E-04</i>
POM	5.64E-05	7.24E-04	2.87E+00	1.43E-03
Propionaldehyde	3.80E-04	4.87E-03	1.93E+01	9.66E-03
<i>Selenium*</i>	<i>5.42E-06</i>	<i>6.95E-05</i>	<i>2.75E-01</i>	<i>1.38E-04</i>
Styrene	2.50E-05	3.21E-04	1.27E+00	6.35E-04
2,3,7,8-TCDD	1.43E-11	1.83E-10	7.27E-07	3.63E-10
Tetrachloroethylene	4.30E-05	5.52E-04	2.19E+00	1.09E-03
Toluene	2.40E-04	3.08E-03	1.22E+01	6.10E-03
1,1,1-Trichloroethane	2.00E-05	2.57E-04	1.02E+00	5.08E-04
Vinyl acetate	7.60E-06	9.75E-05	3.86E-01	1.93E-04
Xylenes	3.70E-05	4.75E-04	1.88E+00	9.40E-04
Total HAPs		4.39	17,409.76	8.70

Greenhouse Gases

Pollutant	Factor		Emission Rates	
	(lb poll./ton coal)	(lb/hr)	(lb/yr)	(tpy)
Carbon dioxide	5187.69	66543.82	263,713,758	131,856.88
<i>Methane*</i>	<i>0.010</i>	<i>0.12</i>	<i>486.68</i>	<i>0.24</i>
Nitrous Oxide	0.09	1.14	4,518	2.26

*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,

Natural Gas Combustion Emissions Calculator NG2000 Revision C
2009 Annual Emissions Inventory
Boiler #7
(ES-002-Boiler #7)

Facility ID # 6800043
 Permit # 03069T25

Operating Scenario #2

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

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual 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 SO₂ emissions.

For the 2009 calendar year, 30 day facility averages for the SO₂ emission rate measured by the CEM are as follows:

Month	30 day average CEM reading (lb/MMBtu)
January 2009	0.17
February 2009	0.17
March 2009	0.16
April 2009	0.16
May 2009	0.17
June 2009	0.18
July 2009	0.18
August 2009	0.18
September 2009	0.18
October 2009	0.18
November 2009	0.18
December 2009	0.18
Annual Average	0.174

This average includes SO₂ emissions from coal, fuel oil, and natural gas from Boiler #7 over the entire year, representing a composite average for all fuels combusted.

Fuel Inputs to Boiler #7 for 2009

Boiler #7		
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr
50,835	37,899	7
Coal (12,597 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (138,813 btu/gal)
MMBtu/yr		
1.28E+06	3.90E+04	9.86E-01

Total for Boiler #7 (MMBtu/yr)	1.32E+06
--------------------------------	----------

Total SO ₂ Emissions from Boiler #7 (lb/yr)	229,859
Total SO₂ Emissions from Boiler #7 (ton/yr)	114.929

SO ₂ Emissions Associated with Coal Combustion (ton/yr)	114.93
SO ₂ Emissions Associated with No. 2 Fuel Oil Combustion (ton/yr)	0.00009

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual 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 2009 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 2009	0.40
February 2009	0.40
March 2009	0.37
April 2009	0.27
May 2009	0.27
June 2009	0.29
July 2009	0.26
August 2009	0.26
September 2009	0.38
October 2009	0.39
November 2009	0.39
December 2009	0.42
Annual Average	0.34

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

Fuel Inputs to Boiler #7 for 2009

Boiler #7		
Coal Tons/yr	Gas 1,000cf/yr	No. 2 Oil Gallons/yr
50,835	37,899	7
Coal (12,597 btu/lb)	Nat. Gas (1,030 btu/cf)	Oil (138,813 btu/gal)
MMBtu/yr		
1.28E+06	3.90E+04	9.86E-01

Total for Boiler #7 (MMBtu/yr)	1.32E+06
--------------------------------	----------

NOx Emissions from Boiler #7 (lb/yr)	450,919
NOx Emissions from Boiler #7 (ton/yr)	225.46

NOx Emissions Associated with Coal Combustion (ton/yr)	218.79
NOx Emissions Associated with Fuel Oil No. 2 Combustion (ton/yr)	0.0002
NOx Emissions Associated with Natural Gas Combustion (ton/yr)	6.67

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Boiler No.7

CO₂ Emissions from Limestone.

(ES-3)

Assume that the amount of total limestone distributed between boilers is proportional to percentage of total coal burned in each boiler.

Boiler #6	53,753	Tons/yr	51.4%
Boiler #7	50,835	Tons/yr	48.6%
Total	104,588	Tons/yr	100.0%

Total Limestone Used **14,680** Tons/yr

Limestone Used in Boiler No.7 **7,135** Tons/yr

85.0% CaCO₃

100.09 MW, CaCO₃

44.01 MW, CO₂

5.00% MgCO₃

83.43 MW, MgCO₃

44.01 MW, CO₂

CO₂ emission rate 800.2 lb/ton

Boiler No.7 2,855 tons/yr, CO₂

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Boiler #8

(ES-003-Boiler #8)

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

Emission Source/Operating Scenario Data Page 1 of 1

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 #: **03069T25**
 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 2009

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)		22,212			1,000 ft ³ /yr		
6. Fuel Information (if fuel used)		% Sulfur	N/A	% Ash	N/A	Heat Content (Btu/lb or mmCF)	1,030 Btu/ft ³

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)
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	10%	Mar-May	41%	June-Aug	23%	Sept-Nov	26%
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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

Facility ID #: **6800043**
 Permit #: **03069T25**
 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 2009**

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	0.93	8	N/A
NOx	NOx	0.65	8	N/A
PM Total	PM	0.08	8	N/A
PM-2.5	PM-2.5	0.08	8	N/A
PM-10	PM-10	0.08	8	N/A
SO2	SO2	0.01	8	N/A
VOC	VOC	0.06	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	4.44E-03	8	N/A
Benzene	71-43-2	0.05	8	N/A
Cadmium	CADMIUMCPDS	2.44E-02	8	N/A
Chromium	CROMCPDS	3.11E-02	8	N/A
Chromium VI	CHROM6CPDS	3.11E-02	8	N/A
Dichlorobenzene	106-46-7	2.67E-02	8	N/A
Formaldehyde	50-00-0	1.67	8	N/A
Hexane	HEXANEISO	4.00E+01	8	N/A
Lead	LEADCPDS	1.11E-02	8	N/A
Manganese	MANGCPDS	8.44E-03	8	N/A
Mercury	MERCPDS	5.78E-03	8	N/A
Napthalene	91-20-3	1.35E-02	8	N/A
Nickel	NICKCPDS	0.05	8	N/A
POM	POM	1.47E-02	8	N/A
Toluene	108-88-3	0.08	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 ₂	1,337.11	8	N/A
Methane	CH ₄	0.025	8	N/A
Nitrous oxide	N ₂ O	0.003	8	N/A

Emission Source/Operating Scenario Data Page 1 of 1

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 #: **03069T25**

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 2009

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)			9,316			gallons/year	
6. Fuel Information (if fuel used)		% Sulfur	0.5%	% Ash		Heat Content (Btu/lb or mmCF)	135,344 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>i.</i> (nearest stack)	N/A	N/A
<i>ii.</i>	N/A	N/A
<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 (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	1%	Mar-May	99%	June-Aug	0%	Sept-Nov	0%
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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 #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 #: 03069T25

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 2009

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	0.02	8	N/A
NOx	NOx	0.04	8	N/A
PM Total	PM	0.02	8	N/A
PM-2.5	PM-2.5	0.00	8	N/A
PM-10	PM-10	0.00	8	N/A
SO2	SO2	0.11	8	N/A
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)
Arsenic	ARSENICPDS	5.22E-03	8	N/A
Benzene	71-43-2	2.56E-02	8	N/A
Beryllium	BERYLCPDS	3.91E-03	8	N/A
Cadmium	CADMIUMCPDS	3.91E-03	8	N/A
Chromium	CROMCPDS	3.91E-03	8	N/A
Chromium VI	CHROM6CPDS	1.15E-03	8	N/A
Ethylbenzene	100-41-4	7.61E-03	8	N/A
Fluoride	16984-48-8	0.35	8	N/A
Formaldehyde	50-00-0	0.45	8	N/A
Lead	LEADCPDS	1.17E-02	8	N/A
Manganese	MANGCPDS	7.83E-03	8	N/A
Mercury	MERCPDS	3.91E-03	8	N/A
Methyl chloroform	71-55-6	2.20E-03	8	N/A
Napthalene	91-20-3	0.0031	8	N/A
Nickel	NICKCPDS	3.91E-03	8	N/A
POM	POM	3.07E-02	8	N/A
Selenium	SEC	1.96E-02	8	N/A
Toluene	108-88-3	0.74	8	N/A
Xylene	1330-20-7	1.30E-02	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 ₂	105.43	8	N/A
Methane	CH ₄	0.00	8	N/A
Nitrous oxide	N ₂ O	0.00	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.

Natural Gas Combustion Emissions Calculator NG2000 Revision C
2009 Annual Emissions Inventory

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

Facility ID # 6800043
 Permit # 03069T25

Operating Scenario #1

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	338
Fuel Input Capacity (10 ⁶ scf/hr):	0.33
Annual Fuel Throughput (10 ⁶ scf):	22.21
Latest Construction/Modification Date:	N/A

Enter the boiler type below ▾	
	3 + 4

Other NOx Control
Enter 1 below if SNCR is applied to the boiler.
0

Large Wall-Fired Boilers (=>100 mmBtu/hr)
1 = Uncontrolled (Pre-NSPS)
2 = Uncontrolled (Post-NSPS)
3 = Controlled - Low NOx burners
4 = Controlled - Flue gas recirculation (FGR)

Small Boilers (<100 mmBtu/hr)
5 = Uncontrolled
6 = Controlled - Low NOx burners
7 = Controlled - Low NOx burners/FGR

Tangential-Fired Boilers (All Sizes)
8 = Uncontrolled
9 = Controlled - FGR

Residential Furnaces (<0.3 mmBtu/hr)
10 = Uncontrolled

Emissions Output				Emission
Criteria Pollutants				Factor
Pollutant	lb/hr	lb/yr	tpy	(lb/mmscf)
PM	2.5E+00	1.7E+02	8.4E-02	7.6E+00
PM-10	2.5E+00	1.7E+02	8.4E-02	7.6E+00
PM-2.5	2.5E+00	1.7E+02	8.4E-02	7.6E+00
NOx	**	**	**	1.9E+02
VOC	1.8E+00	1.2E+02	6.1E-02	5.5E+00
CO	2.8E+01	1.9E+03	9.3E-01	8.4E+01
SO2	2.0E-01	1.3E+01	6.7E-03	6.0E-01
Total HAP	6.3E-01	4.2E+01	2.1E-02	1.9E+00
Largest HAP	6.0E-01	4.0E+01	2.0E-02	1.8E+00

Toxic/Hazardous Air Pollutants				
Pollutant	lb/hr	lb/day	lb/yr	
Arsenic	6.6E-05	NA	4.4E-03	2.0E-04
Benzene	7.0E-04	NA	4.7E-02	2.1E-03
Cadmium	3.6E-04	NA	2.4E-02	1.1E-03
Chromium	4.6E-04	NA	3.1E-02	1.4E-03
Chromium VI	4.6E-04	NA	3.1E-02	1.4E-03
Dichlorobenzene	4.0E-04	NA	2.7E-02	1.2E-03
Formaldehyde	2.5E-02	NA	1.7E+00	7.5E-02
Hexane	6.0E-01	1.4E+01	4.0E+01	1.8E+00
Lead	1.7E-04	NA	1.1E-02	5.0E-04
Manganese	1.3E-04	3.0E-03	8.4E-03	3.8E-04
Mercury	8.6E-05	2.1E-03	5.8E-03	2.6E-04
Naphthalene	2.0E-04	NA	1.4E-02	6.1E-04
Nickel	7.0E-04	1.7E-02	4.7E-02	2.1E-03
POM	2.2E-04	NA	1.5E-02	6.6E-04
Toluene	1.1E-03	2.7E-02	7.6E-02	3.4E-03

Greenhouse Gas Pollutants				Em. Factor
Pollutant	lb/hr	lb/yr	tpy	(lb/mmscf)
Carbon dioxide	39,508	2,674,224	1337.11	116.89
Methane	0.75	50.44	2.52E-02	2.20E-03
Nitrous Oxide	0.075	5.04	2.52E-03	2.20E-04

Fuel Oil Combustion Emissions Calculator FO2000 Revision A

Boiler #8

2009 Annual Emissions Inventory

(ES-003-Boiler #8)

Facility ID # 6800043

Permit # 03069T25

Operating Scenario #2

User Input	
Company Name:	University of North Carolina at
Plant County:	Chapel Hill
Plant City:	Orange County
Permit Number:	Chapel Hill
User:	03069T25
Heat Input Capacity (mmBtu/hr):	RST Engineering
Fuel Input Capacity (10 ³ gal/hr):	338
Annual Fuel Throughput (1000 gal):	2.41
Maximum fuel sulfur content (%):	9.32
Latest Construction/Modification Date:	0.50
	N/A

Enter the boiler type below ▾	
	17

<p>Boilers =>100 mmBtu/hr</p> <p>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)</p>	<p>Boilers =>100 mmBtu/hr (cont'd)</p> <p>16 = No. 2 oil fired (C) 17 = No. 2 oil fired, LNB/FGR (U,I) 18 = No. 2 oil fired, LNB/FGR (C)</p> <hr/> <p>19 = Vertical fired utility boiler</p> <hr/> <p>Small Boilers (<100 mmBtu/hr)</p> <p>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)</p> <hr/> <p>26 = Residential Furnace</p>
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Fuel Oil Combustion Emissions Calculator FO2000 Revision A

Boiler #8

2009 Annual Emissions Inventory

(ES-003-Boiler #8)

Facility ID # 6800043

Permit # 03069T25

Operating Scenario #2

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	338
Fuel Input Capacity (10 ³ gal/hr):	2.41
Annual Fuel Throughput (1000 gal):	9.32
Maximum fuel sulfur content (%):	0.50
Latest Construction/Modification Date:	N/A

Emission Controls

Particulate controls

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

Postcombustion SO₂ controls

Enter the control type below ▾	Message Area	Or enter an SO ₂ control efficiency below to override built in values.
0		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input SO₂ Cont. Effic.</u>
0 = None/other		0.0
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_x controls

Enter the control type below ▾		Or enter a NO _x control efficiency below to override built in values.
5 + 6		
<u>Control Technology/Process</u>	<u>Avg. Cont. Effic.</u>	<u>User Input NO_x Cont. Effic.</u>
0 = None/other		0.0
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 _x 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

2009 Annual Emissions Inventory

(ES-003-Boiler #8)

Facility ID # 6800043

Permit # 03069T25

Operating Scenario #2

User Input	
Company Name:	University of North Carolina at Chapel Hill
Plant County:	Orange County
Plant City:	Chapel Hill
Permit Number:	03069T25
User:	RST Engineering
Heat Input Capacity (mmBtu/hr):	338
Fuel Input Capacity (10 ³ gal/hr):	2.41
Annual Fuel Throughput (1000 gal):	9.32
Maximum fuel sulfur content (%):	0.50
Latest Construction/Modification Date:	N/A

Emissions Output

Criteria Pollutants

Pollutant	lb/hr ²	tpy	lb/yr ³	Emission Factor ¹ (lb/10 ³ gal)
Total PM (FPM + CPM)	8.0	0.0154	31	3.30E+00
Filterable PM (FPM) rates uncontrolled	4.8	0.0093	19	2.00E+00
Condensable PM (CPM) ⁴	3.1	0.0061	12	1.30E+00
Filterable PM-10 ⁵	2.4	0.0047	9	1.00E+00
Filterable PM-2.5 ⁵	0.6	0.0012	2	2.50E-01
NOx rates uncontrolled	**	**	**	2.40E+01
NMTOC	0	0.0009	2	2.00E-01
CO	12	0.0233	47	5.00E+00
SO2 rates uncontrolled	59.2	0.1141	228	2.45E+01
Total HAP ⁶	4.36E-01	0.0008	2	1.81E-01
Largest HAP ⁶	1.92E-01	0.0004	1	7.97E-02

***NOx emissions based on CEMs data.*

Toxic/Hazardous Air Pollutants.

Pollutant	lb/hr ²	lb/day ⁷	lb/yr ³	Emission Factor ¹ (lb/10 ³ gal)
Antimony rates uncontrolled	0.00E+00	NA	0.00E+00	0.00E+00
Arsenic rates uncontrolled	1.35E-03	NA	5.22E-03	5.60E-04
Benzene	6.64E-03	NA	2.56E-02	2.75E-03
Beryllium rates uncontrolled	1.01E-03	NA	3.91E-03	4.20E-04
Cadmium rates uncontrolled	1.01E-03	NA	3.91E-03	4.20E-04
Chromium rates uncontrolled	1.01E-03	NA	3.91E-03	4.20E-04
Chromium VI rates uncontrolled	2.98E-04	NA	1.15E-03	1.23E-04
Cobalt rates uncontrolled	0.00E+00	NA	0.00E+00	0.00E+00
Ethylbenzene	1.97E-03	NA	7.61E-03	8.17E-04
Fluoride	9.01E-02	2.16E+00	3.47E-01	3.73E-02
Formaldehyde	1.16E-01	2.78E+00	4.47E-01	4.80E-02
Lead rates uncontrolled	3.04E-03	NA	1.17E-02	1.26E-03
Manganese rates uncontrolled	2.03E-03	4.87E-02	7.83E-03	8.40E-04
Mercury	1.01E-03	2.43E-02	3.91E-03	4.20E-04
Methyl chloroform (1,1,1-Trichloroethane)	5.70E-04	1.37E-02	2.20E-03	2.36E-04
Naphthalene	8.04E-04	NA	3.10E-03	3.33E-04
Nickel rates uncontrolled	1.01E-03	2.43E-02	3.91E-03	4.20E-04
POM rates uncontrolled	7.97E-03	NA	3.07E-02	3.30E-03
Selenium rates uncontrolled	5.07E-03	NA	1.96E-02	2.10E-03
Toluene	1.92E-01	4.62E+00	7.42E-01	7.97E-02
Xylene	3.38E-03	8.12E-02	1.30E-02	1.40E-03

Greenhouse Gases

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

Boiler #8

2009 Annual Emissions Inventory

(ES-003-Boiler #8)

Facility ID # 6800043

Permit # 03069T25

Operating Scenario #2

User Input				
Company Name:	University of North Carolina at Chapel Hill			
Plant County:	Orange County			
Plant City:	Chapel Hill			
Permit Number:	03069T25			
User:	RST Engineering			
Heat Input Capacity (mmBtu/hr):	338			
Fuel Input Capacity (10 ³ gal/hr):	2.41			
Annual Fuel Throughput (1000 gal):	9.32			
Maximum fuel sulfur content (%):	0.50			
Latest Construction/Modification Date:	N/A			
Carbon dioxide	54,644	105.4	210,856	22633.77
Methane	2.22E+00	4.28E-03	8.55E+00	0.918
Nitrous Oxide	4.43E-01	8.55E-04	1.71E+00	0.18

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

²Hourly emission rates for all pollutants are based on hourly rated capacity.

³Annual emission rates for all pollutants are based on maximum annual fuel throughput.

⁴Wet scrubbers are assumed to control CPM whereas other PM control devices are assumed to only control FPM.

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

⁶Total 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.

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

**SO₂ and NO_x emissions were estimated using CEMS data, please refer to the attached spreadsheets.

FO2000 Revision A dated March 9, 2000

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual 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 2009 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 2009	0.06
February 2009	0.06
March 2009	0.06
April 2009	0.06
May 2009	0.06
June 2009	0.06
July 2009	0.05
August 2009	0.06
September 2009	0.06
October 2009	0.05
November 2009	0.05
December 2009	0.05
Annual Average	0.06

This average includes NOx emissions from coal, 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 2009

Boiler #8	
Gas 1,000cf/yr	Oil Gallons/yr
22,212	9,316
Nat. Gas (1,030 btu/cf)	Oil (138,813 btu/gal)
MMBtu/yr	
2.29E+04	1.29E+03

Total for Boiler #8 (MMBtu/yr)	2.42E+04
--------------------------------	----------

NOx Emissions from Boiler #8 (lb/yr)	1,370
NOx Emissions from Boiler #8 (ton/yr)	0.7

NOx Emissions Associated with Fuel Oil Combustion (ton/yr)	0.037
NOx Emissions Associated with Natural Gas Combustion (ton/yr)	0.648

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

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

Emission Source/Operating Scenario Data Page 1 of 2					Facility ID #: 6800043		
Coal Crusher/Conveyor Building <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>					Permit #: 03069T25		
Facility Name: <u>University of North Carolina at Chapel Hill</u>					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 2009							
1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)					ES-010A		
2. Emission Source Description			Coal Crusher / Conveyor Building				
3. Operating Scenario Description			N/A				
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>			60 tons/hr				
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>				104,588		tons/yr	
6. Fuel Information (if fuel used)			% Sulfur	N/A	% Ash	N/A	Heat Content (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>							
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 # <small>(as listed in permit)</small>		Control Device Description				
<i>i.</i> (nearest stack)	CD-013		Bagfilter				
<i>ii.</i>	N/A		N/A				
<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 (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	
--	--	--	--	--	--	--	
--	--	--	--	--	--	--	
10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)							
Hours/Day	6	Days/Week	7	Weeks/Year	52	Hours/Year	1,743
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	33.96%	Mar-May	23.77%	June-Aug	19.06%	Sept-Nov	23.22%

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 # 03069T25

2009 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 2009.

Boiler #6	53,753	Tons/yr
Boiler #7	50,835	Tons/yr
Total	104,588	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
1,743.1 hrs/yr, conveying time

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

Total Emissions from the Crusher	10,432,638	gr/yr
	1,490	lb/yr
	0.75	ton/yr

100% of these emissions are PM-10

95% of these emissions are PM-2.5

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

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

Emission Source/Operating Scenario Data Page 1 of 2

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 #:	03069T25
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 2009**

1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-030					
2. Emission Source Description		Ash Silo with Loadout					
3. Operating Scenario Description		N/A					
4. Maximum Permitted Operating Rate With Units (Ex. gal/hr, mmBtu/hr)		16 tons/hr					
5. Throughput in CY (e.g. production or fuel use) With Units (Ex. lbs/yr, gal/yr)		25,593			tons/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)	100%
--	------

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

	Control Device ID # (as listed in permit)	Control Device Description
i. (nearest stack)	CD-031	Bagfilter
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)
Fugitive						
--	--	--	--	--	--	--
--	--	--	--	--	--	--

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

Hours/Day	10	Days/Week	7	Weeks/Year	52	Hours/Year	4,783
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	33.96%	Mar-May	23.77%	June-Aug	19.06%	Sept-Nov	23.22%
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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 # 03069T25

2009 Annual 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 CaCO_3 / CaSO_3 from desulfurization. Ash is similar to flyash used in concrete batching operations.

25,593.28 ton/yr, ash loaded in 2009

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 based on conservatively high estimated 0.5 lb/ton emission factor (0.02 lb/ton AP-42 for batch truck loading at concrete plants).

25,593	ton/yr, Ash Generated
0.5	lb/ton, Emission Factor
95%	Capture Efficiency
639.8	lb/yr, Emissions
0.32	ton/yr, Emissions

Fugitives from the Enclosure:

0.017	ton/yr, Emissions
-------	-------------------

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
4,783	hrs/yr, Operating Hours
0.015	gr/acfm, Emission Factor from Baghouse
2,761	lb/yr, Emissions
1.38	ton/yr, Emissions

3. Total Emissions

0.32	ton/yr, Emissions Truck Loading
0.017	ton/yr, Emissions, Truck Fugitives
1.38	ton/yr, Emissions, Baghouse
1.72	ton/yr, Total Emissions PM
1.72	ton/yr, Total Emissions PM-10
1.63	ton/yr, Total Emissions PM-2.5

100% as PM-10

95% as PM-2.5

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

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

(This unit was not in operation during CY 2009)

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 #: **03069T25**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 2009

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
--	-----

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
--	--	--	--	--	--	--
--	--	--	--	--	--	--

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 2004.

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 # 03069T25

2009 Annual Emissions Inventory

Enclosed Sorbent Railcar Dump Pit (Insignificant Source)

IS-53

14,680 tons of sorbent delivered by rail in 2009. There are no emission sources associated with truck delivery.

Emission Source/Operating Scenario Data Page 1 of 2				Facility ID #: 6800043											
Enclosed Sorbent Railcar Dump Pit <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>				Permit #: 03069T25											
Facility Name: University of North Carolina at Chapel Hill				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 2009															
1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)						"I" Insignificant - ID No. 020									
2. Emission Source Description			Enclosed Sorbent Railcar Dump Pit												
3. Operating Scenario Description			N/A												
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>			50 ton/hr												
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>			14,680		tons/yr										
6. Fuel Information (if fuel used)		% Sulfur	N/A	% Ash	N/A	Heat Content (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>															
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 # <small>(as listed in permit)</small>		Control Device Description												
<i>i.</i> (nearest stack)	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 <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>									
Fugitive															
--	--	--	--	--	--	--									
--	--	--	--	--	--	--									
10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)															
Hours/Day	1		Days/Week	3		Weeks/Year	52								
Hours/Year				156											
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		33.96%		Mar-May		23.77%		June-Aug		19.06%		Sept-Nov		23.22%	

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 # 03069T25

2009 Annual 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.

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

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 14,680 tons/yr

Emissions from the unloading of sorbent into the dump pit:

	Emission Factor (lb/ton)	Emissions (lb/yr)	Emissions (ton/yr)
PM	1.32E-04	26.23	1.31E-02
PM-10	6.25E-05	12.41	6.20E-03
PM-2.5	1.96E-05	3.90	1.95E-03

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

**Four Coal Bunkers
(ES-01, 02, 03 and 04)**

(These units do not discharge to the ambient air.)

Emission Source/Operating Scenario Data Page 1 of 2		Facility ID #: 6800043					
<i>Coal Storage Bunkers</i> <small>If Emission Source has multiple Operating Scenarios, complete one form for each. (All permitted, Insignificant and/or Non-permitted Sources)</small>		Permit #: 03069T25					
Facility Name: University of North Carolina at Chapel Hill		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 2009							
1. Emission Source ID No. (same as in permit - Use "U" prefix for non-permitted and "I" for insignificant)		ES-01, 02, 03, 04					
2. Emission Source Description		Four Coal Storage Bunkers					
3. Operating Scenario Description		N/A					
4. Maximum Permitted Operating Rate <small>With Units (Ex. gal/hr, mmBtu/hr)</small>		60 tons/hr (each)					
5. Throughput in CY (e.g. production or fuel use) <small>With Units (Ex. lbs/yr, gal/yr)</small>		104,588 tons/yr					
6. Fuel Information (if fuel used)		% Sulfur N/A	% Ash N/A				
		Heat Content (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>							
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 # <small>(as listed in permit)</small>	Control Device Description					
<i>i. (nearest stack)</i>	CD-014	Bagfilter on Bunker ES-01					
<i>ii.</i>	CD-015	Bagfilter on Bunker ES-02					
<i>iii.</i>	CD-016	Bagfilter on Bunker ES-03					
<i>iv.</i>	CD-017	Bagfilter on Bunker ES-04					
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>	
EP-14-054	137	0.52	Ambient	78	1,000	Horizontal	
EP-14-056	137	0.52	Ambient	78	1,000	Horizontal	
EP-15-054	137	0.52	Ambient	78	1,000	Horizontal	
EP-15-056	137	0.52	Ambient	78	1,000	Horizontal	
10. Operating Schedule (Source/Operating Scenario that best characterizes calendar year)							
Hours/Day	1.5	Days/Week	7	Weeks/Year	52	Hours/Year	546
Typical Start & End Times in CY:				Start:	N/A	End:	N/A
Jan-Feb, 2002		+ Dec, 2002					
Jan-Feb, 2002 + Dec, 2002	33.96%	Mar-May	23.77%	June-Aug	19.06%	Sept-Nov	23.22%

These Sources are Vented Inside the Boiler Building. There is NO Discharge to the Ambient Air.

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 # 03069T25

2009 Annual Emissions Inventory

4 Coal Bunker Storage Areas

(ES-01, 02, 03, 04)

Coal is transported from the coal crusher building in enclosed conveyors to the boiler building. Inside the boiler building the coal is stored in four coal bunkers.

Assume that the total amount of coal fed to the bunkers is equal to the total amount of coal combusted in 2008.

Boiler #6	53,753	Tons/yr
Boiler #7	50,835	Tons/yr
Total	104,588	Tons/yr

The bulk density of coal is 47 lb/ft³

Total volume of coal combusted is = 4,450,547 ft³/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).

$$\text{lb/yr} = (\text{ft}^3/\text{yr}) (0.015 \text{ gr/acfm}) (1/7000 \text{ lb/gr})$$

Total Emissions from the bunkers	66,758	gr/yr
	9.537	lb/yr
	0.005	ton/yr

This baghouse is vented inside the Boiler Building, therefore there are no emissions to the ambient air.

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

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2009 Annual Emissions Inventory

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

(ES-007 & ES-008)

Emission Source/Operating Scenario Data Page 1 of 2		Facility ID #: 6800043					
<i>Emergency Generators Classified as Insignificant Sources</i>		Permit #: 03069T25					
Facility Name: <u>University of North Carolina at Chapel Hill</u>		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 2009							
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)		3,211					
		gallons/year, Total No. 2 Fuel Oil					
6. Fuel Information (if fuel used)		% Sulfur	0.5%				
		% Ash	N/A				
		Heat Content (Btu/lb or mmCF)	137,006 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)	
Common Stack Parameters with 2-generators and Boiler No. 8 operating concurrently							
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	1.3%	Mar-May	3.0%	June-Aug	94.4%	Sept-Nov	1.3%

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 2009**

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	0.19	8	N/A
NOx	NOx	0.42	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	0.11	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	0.01	8	N/A
Acrolein	107-02-8	0.00	8	N/A
Benzene	71-43-2	0.35	8	N/A
Formaldehyde	50-00-0	0.04	8	N/A
Napthalene	91-20-3	0.06	8	N/A
Propylene	115-07-1	1.24	8	N/A
Toluene	108-88-3	0.13	8	N/A
Xylene	1330-20-7	0.09	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 ₂	36.78	8	N/A
Methane	CH ₄	1.97E-03	8	N/A

University of North Carolina at Chapel Hill

Chapel Hill, North Carolina

Orange County

Facility ID # 6800043

Permit # 03069T25

2009 Annual Emissions Inventory

Blackstart Generators G1 & G2

(ES-007 & ES-008)

Fuel Input Rates	
Hourly Fuel Usage (gallons):	270 (2-units)
Annual Fuel Usage (gallons):	3,211 (2-units)
Fuel Sulfur Content (%)	0.5
Heat Input Rates	
Fuel Heating Values (Btu/gallon)	138,813
Hourly Fuel Usage (mmBtu):	37.48
Annual Fuel Usage (mmBtu):	446

Emissions Output				Emission Factor (lb/mmBtu)
Criteria Pollutants				
Pollutant	lb/hr	lb/yr	tpy	
PM	3.7E+00	4.5E+01	2.2E-02	1.00E-01
PM-10	3.7E+00	4.5E+01	2.2E-02	1.00E-01
PM-2.5	3.7E+00	4.5E+01	2.2E-02	1.00E-01
NOx	7.1E+01	8.5E+02	4.2E-01	1.90E+00
NMTOC, Total	3.1E+00	3.7E+01	1.8E-02	8.19E-02
CO	3.2E+01	3.8E+02	1.9E-01	8.50E-01
SO _x	1.9E+01	2.3E+02	1.1E-01	5.05E-01
Toxic/Hazardous Air Pollutants				
Pollutant	lb/hr	lb/day	lb/yr	
Acetaldehyde	9.4E-04	NA	1.1E-02	2.52E-05
Acrolein	3.0E-04	NA	3.5E-03	7.88E-06
Benzene	2.9E-02	NA	3.5E-01	7.76E-04
Formaldehyde	3.0E-03	NA	3.5E-02	7.89E-05
Naphthalene	4.9E-03	NA	5.8E-02	1.30E-04
Propylene	1.0E-01	NA	1.2E+00	2.79E-03
Toluene	1.1E-02	2.5E-01	1.3E-01	2.81E-04
Xylene	7.2E-03	1.7E-01	8.6E-02	1.93E-04
Greenhouse Gas Pollutants				Em. Factor (lb/mmBtu)
Pollutant	lb/hr	lb/yr	tpy	
Carbon dioxide	6,184	73,554	36.78	165
Methane	3.3E-01	3.9E+00	2.0E-03	8.82E-03

Emission factors are from AP-42 Chapter 3, Section 3.4, Large Stationary Diesel Engines, dated October 1996.

Hourly emission rates for all pollutants are based on the hourly engine output. Annual emissions are based on the annual engine output.

Daily emissions are based on operation at the hourly input rate for 24 hours.