

**NORTH CAROLINA DIVISION OF
AIR QUALITY**

Air Permit Review

Permit Issue Date: PROPOSED

Region: Raleigh Regional Office
County: Orange
NC Facility ID: 6800043
Inspector's Name: Brian Bland
Date of Last Inspection: 08/26/2009
Compliance Code: 3 / Compliance - inspection

Facility Data			Permit Applicability (this application only) SIP: N/A NSPS: N/A NESHAP: N/A PSD: N/A PSD Avoidance: N/A NC Toxics: N/A 112(r): N/A Other: 15A NCAC 2D .1109 <i>[112(j) – Part 2 MACT Hammer for Boilers & Process Heaters]</i>
Applicant (Facility's Name): University of North Carolina at Chapel Hill Facility Address: University of North Carolina at Chapel Hill 1120 Estes Drive Extension, CB# 1650 Chapel Hill, NC 27599 SIC: 8221 / Colleges And Universities, Nec NAICS: 61131 / Colleges, Universities, and Professional Schools Facility Classification: Before: Title V After: Title V Fee Classification: Before: Title V After: Title V			
Contact Data			Application Data Application Number: 6800043.09C Date Received: 09/10/2009 Application Type: 112(j) Part I Application Schedule: TV-Significant Existing Permit Data Existing Permit Number: 03069/T24 Existing Permit Issue Date: 10/29/2009 Existing Permit Expiration Date: 09/30/2011
Facility Contact Larry Daw Geologist (919) 962-6666 1120 Estes Drive Extension Chapel Hill, NC 27599	Authorized Contact Richard Mann Vice Chancellor Finance & Administration (919) 962-3798 302 South Building- CB#1000 Chapel Hill, NC 27599+1000	Technical Contact Larry Daw Geologist (919) 962-6666 1120 Estes Drive Extension Chapel Hill, NC 27599	
Review Engineer: Fern Paterson Review Engineer's Signature: _____ Date: _____		Comments / Recommendations: Issue 03069/T25 Permit Issue Date: PROPOSED Permit Expiration Date: 09/30/2011	

I. Purpose of Applications

A. Application No. 6800043.09C

The University of North Carolina at Chapel Hill is located in Chapel Hill, Orange County, North Carolina. Application No. 6800043.09C, received September 10, 2009, is a Part 2 MACT "Hammer" application for five existing boilers, as listed below:

- **ES-001-Boiler #6** – Coal/natural gas/No. 2 fuel oil-fired boiler, 323.17 MMBtu/hr heat input capacity
- **ES-002-Boiler #7** – Coal/natural gas/No. 2 fuel oil-fired boiler, 323.17 MMBtu/hr heat input capacity
- **ES-003-Boiler #8** – Natural gas/No. 2 fuel oil-fired boiler, 338 MMBtu/hr heat input capacity
- **ES-004-Boiler #9** – Natural gas/No. 2 fuel oil-fired boiler, 249 MMBtu/hr heat input capacity
- **ES-005-Boiler #10** – Natural gas/No. 2 fuel oil-fired boiler, 249 MMBtu/hr heat input capacity

All five boilers are affected by 40 CFR 60, Subpart Db.

On September 29, 2009, permit 03069T23 was issued to the facility as a "step one" state permit pursuant to 15A NCAC 2Q .0501(c)(2). This permit was issued based on the content of the combined permit applications 6800043.08B and 6800043.09B. The purposes of these applications included: (1) add two new permitted emergency generators (ES-EG#19 and #20); (2) add one new insignificant emergency generator

(IES-Gen-84); (3) add one new insignificant emergency fire water pump (IES-FP-1); (4) replace one insignificant emergency generator (IES-Gen-2); (5) remove two existing permitted non-emergency generators (ES-006 and 009); (6) Re-identify the existing source ES-008 as ES-006; and (7) update the associated facility-wide NAAQs modeling associated both with these changes as well as additional updated emissions limits and emission point configurations for existing permitted sources.

B. Application No. 6800043.09E

Application No. 6800043.08B was submitted first as a single-step significant permit modification under Title V and Application No. 6800043.09B was submitted as a “step one” state permit modification per 15A NCAC 2Q .0501(c). Subsequently, the content of these two applications were combined and processed first as a single “step one” application which is the basis of the current permit, 03069T24. Pursuant to the requirements of 15A NCAC 2Q .0501(c)(2), the applicant then submitted Application No. 6800043.09E, a “step two” Title V significant modification, which is the basis of this application.

The significant modification includes the (1) addition of two new permitted emergency generators (**ES-EG#19 and #20**), addition of one new insignificant emergency generator (**IES-Gen-84**), addition of one new insignificant emergency fire water pump (**IES-FP-1**), replacement of one insignificant emergency generator (**IES-Gen-2**), removal of two existing permitted non-emergency generators (**ES-006 and 009**), renaming of two existing sources ES-008 as ES-006; and updating the associated facility-wide NAAQs modeling associated both with these changes as well as additional updated emissions limits and emission point configurations for existing permitted sources. These changes were originally made to Permit Nos. 03069T22 and 03069T23.

II. Permit Modifications/Changes

The following table describes the modifications to the current permit.

Page(s)	Section	Description of Change(s)
1	Permit Cover Page	Amend permit revision numbers and issuance/effective dates.
3	Section 1	Add 112(j) designations to table listing permitted sources.
7	Section 2.1.A., Table	Add 112(j) standards to table of applicable standards.
14	Section 2.1.A.4.	Add 112(j) standards and associated requirements for the two coal-fired boilers.
14	Section 2.1.B., Table	Add 112(j) standards to table of applicable standards.
16	Section 2.1.B.4.	Add 112(j) standards and associated requirements for the natural gas/fuel oil fired boiler.
17	Section 2.1.C., Table	Add 112(j) standards to table of applicable standards.
19	Section 2.1.C.4.	Add 112(j) standards and associated requirements for the natural gas/fuel oil fired boiler.
38-47	Section 3	Update General Provisions with the most recent revision (v. 3.0)

III. Regulatory Review – 15A NCAC 2D .1109 – CAA § 112(j); Case-by-Case MACT for Boilers & Process Heaters

1. Generally: On July 20, 2007, the D.C. Circuit Court vacated the National Emission Standard for Hazardous Air Pollutants (NESHAP) for Industrial, Commercial, and Institutional Boilers and Process Heaters, which had been promulgated under 40 CFR 63, Subpart DDDDD. The North Carolina Attorney General’s office has determined that the NESHAP vacatur equates to the failure of the U.S. EPA to promulgate a valid standard as required under Section 112(d) of the Clean Air Act (CAA). As a result, the site-specific Maximum Achievable Control Technology (MACT) standards required under CAA § 112(j), commonly referred to as the MACT “hammer” provisions, have been triggered. North Carolina regulations implementing the MACT hammer are found at 15A NCAC 2D .1109.

On September 10, 2009, the NC DAQ received a Part 2 MACT “Hammer” application from this facility asking that the NC DAQ establish 112(j) emissions limitations.

2. **Coal-Fired Boilers:** Two coal/natural gas/No. 2 fuel oil-fired, circulating fluidized combustion boilers, 323.17 MMBtu/hr heat input capacity each (**ID Nos. ES-001-Boiler #6 and ES-002-Boiler #7**) with associated bagfilters (**ID Nos. CD-004 and 005**)

The facility proposed total filterable particulate matter (PM), Hg, and CO emission limitations that are consistent with the NC DAQ application guidance (<http://daq.state.nc.us/permits/112j/>). NC DAQ has developed this guidance to provide standards and compliance procedures that it has determined meet the requirements of § 112(j).

The facility has chosen to comply with a Health-Based Compliance Alternative (HBCA) for HCl. The HBCA eligibility demonstration is consistent with the procedures provided by the EPA in the vacated § 112(d) standard for boilers and process heaters.

Both of the coal-fired boilers are affected by 40 CFR 60, Subpart Db, which requires a 90% reduction of sulfur dioxide or a maximum controlled SO₂ emission rate of 0.20 lbs/MMBtu. To meet this standard, the boilers are equipped with limestone injection systems and associated baghouses. The limestone injection systems and the filter cakes at the baghouses also control mercury (Hg) and hydrogen chloride (HCl) emissions. The boilers share a common stack with a stack height of 67 meters.

a. Filter able Particulate Matter (PM)

In accordance with the 112(j) application guidance provided by NC DAQ, affected facilities may propose either a total selected metal (TSM) limit or a filterable PM limit. The filterable PM is a surrogate for the regulated TSM, including arsenic, beryllium, cadmium, chromium, lead, manganese, nickel, and selenium. This facility proposed a filterable PM limit that is consistent with the NC DAQ application guidance, or 0.08 lbs/MMBtu.

b. Mercury (Hg)

This facility has proposed a mercury limit of 3.0e-06 lbs/MMBtu, which is consistent with the NC DAQ application guidance.

The limestone injection systems and the filter cakes at the baghouses control mercury (Hg) emissions. UNC-CH tested Boiler Nos. 6 and 7 on Nov. 25, 2003 and Feb. 19-20, 2004, respectively, to determine the controlled Hg emission rates from the combustion sources while firing coal. Test results are summarized in the following table:

Boiler ID No.	Hg (lbs/MMBtu)
ES-001-Boiler #6	1.1e-06
ES-002-Boiler #7	1.8e-06

Based on the test data provided above, UNC-CH does not anticipate that any further control will be required to comply with the 112(j) emission limitation for Hg.

To demonstrate compliance with the standard, UNC-CH will conduct an initial performance test and establish the minimum coal-to-sorbent emission rate required to demonstrate compliance with the Hg limit. If the facility believes that prior testing is sufficient to demonstrate compliance with the applicable limit and establish the operating parameter, it may submit the report to the NC DAQ – SSCB for review.

In addition, the facility must monitor proper operation of the baghouse, which will be demonstrated by limiting the opacity of the exhaust streams to no greater than 20% opacity (6-minute average), except for one 6-minute period per hour of not more than 27% opacity.

c. Carbon Monoxide (CO)

This facility proposed a CO limit of 133 ppmvd, corrected to 7% oxygen, which is consistent with the NC DAQ application guidance.

d. HBCA for HCl¹

UNC-CH submitted an HBCA eligibility demonstration in September 2006 in accordance with procedures promulgated by the EPA using a look-up table approach provided in the 112(d) standard for boilers and process heaters prior to the vacatur of the rule. NC DAQ agrees with EPA's risk based approach and is allowing use of the same approach in its implementation of the 112(j) requirements. The facility cross-referenced the original HBCA submittal to request the HBCA limit as its 112(j) emission limitation. A summary of the HBCA eligibility demonstration and resulting emissions limitations is provided below.

The look-up table approach to the HBCA requires the facility to determine the Allowable Toxicity Weighted Emission Rate in HCl-equivalent according to the following steps:

- Determine the worst-case HCl and Cl₂ emission rates through either stack testing or fuel analysis (in lbs/hr)
- Calculate the toxicity-weighted emission rate in HCl-equivalents (in lbs/hr)
- Calculate the weighted average stack height (in meters, m)
- Determine the distance to property boundary (in m)
- Use the look-up table provided in the NC DAQ application guidance, which is identical to the look-up table provided in the vacated 112(d) standard, to determine the Allowable Toxicity Weighted Emission Rate in HCl-equivalent (in lbs/hr)
- Compare the Allowable Toxicity Weighted Emission Rate in HCl-equivalent to the maximum toxicity-weighted emission rate to determine eligibility.

The stack for the coal-fired boilers discharge vertically and are not equipped with a raincap or other structure that could restrict the vertical exhaust discharge. There is no complex terrain elevation within 5 kilometers of the stack. Finally, there are no structures near the stack that result in abnormally severe downwash effects.

Step 1. Worst-case HCl and Cl₂ Emission Rates

The limestone injection systems and the filter cakes at the baghouses control hydrogen chloride (HCl) emissions. UNC-CH tested Boiler Nos. 6 and 7 on Nov. 25, 2003 and Feb. 19-20, 2004, respectively, to determine the controlled HCl emission rates from the combustion sources while firing coal. Test results are summarized in the following table:

Boiler ID No.	HCl Emission Factor* (lbs/MMBtu)	Maximum Heat Input (MMBtu/hr)	HCl Emission Rate (lbs/hr)
ES-001-Boiler #6	0.068	323.17	21.98
ES-002-Boiler #7	0.093	323.17	30.05
Total Emission Rate			51.98

* Average chlorine contents of coal fired during the performance tests were as follows:

- ES-001-Boiler #6 : 822 ppm
- ES-002-Boiler #7 : 1,489 ppm

¹ The coal-fired units are the only sources at this facility with applicable HCl emissions limitations. There are no HCl emissions limitation associated with either distillate- or natural gas-fired sources.

Additional HCl testing was conducted on July 26-27, 2006. Test results are summarized in the following table:

Boiler ID No.	HCl* (lbs/MMBtu)	Maximum Heat Input (MMBtu/hr)	HCl Emission Rate (lbs/hr)
ES-001-Boiler #6	0.029	323.17	9.37
ES-002-Boiler #7	0.038	323.17	12.28
Total Emission Rate			28.65

* Average chlorine contents of coal fired during the performance tests were as follows:

- ES-001-Boiler #6 : 400 ppm
- ES-002-Boiler #7 : 600 ppm

Chlorine (Cl₂) testing was also conducted on July 26-27, 2006. Test results are summarized in the following table:

Boiler ID No.	Cl ₂ * (lbs/MMBtu)	Maximum Heat Input (MMBtu/hr)	Cl ₂ Emission Rate (lbs/hr)
ES-001-Boiler #6	0.0001	323.17	0.03
ES-002-Boiler #7	0.0001	323.17	0.03
Total Emission Rate			0.06

* Average chlorine contents of coal fired during the performance tests were as follows:

- ES-001-Boiler #6 : 400 ppm
- ES-002-Boiler #7 : 600 ppm

UNC-CH has indicated that the highest average chlorine content of coal fired at the facility is 1,600 ppm.

- Assuming a linear increase in the HCl emission rate with the chlorine content of the coal, the maximum potential emission rate from the two coal-fired boilers is approximately 63 lbs/hr.²
- Assuming a linear increase in the Cl₂ emission rate with the chlorine content of the coal, the maximum potential emission rate from the two coal-fired boilers is approximately 0.17 lbs/hr.³

Step 2. Calculate the Toxicity-Weighted Emission Rate in HCl-Equivalents

Using the following equation:

$$TW = E_{HCl} + E_{Cl_2} \left(\frac{RV_{HCl}}{RV_{Cl_2}} \right)$$

Where "RV" denotes the reference values. The reference value of HCl is 20 µg/m³. The reference value for Cl₂ is 0.2 µg/m³.

Using the test data provided above:

$$TW = 63 + 0.06 \left(\frac{20}{0.2} \right) = 69 \text{ lbs HCl-equivalent/hr}$$

The toxicity-weighted maximum emission rate for the two coal-fired boilers is 69 pounds of HCl-equivalent per hour.

Step 3. Calculated the Weighted Average Stack Height

The two coal-fired boilers share a common stack with a stack height of 67.06 meters. Because these are the only two affected boilers on-site with HCl emissions limitations, there is no need to calculate a weighted average stack height. The stack height is 67 meters (220 ft.)

Step 4. Determine the Distance to Property Boundary

² From 2003-2004 tests: (51.98 lbs/hr) * (1,400 ppm) / [(822 ppm + 1,489 ppm)/2] = 62.98 lbs/hr

³ From 2006 tests: (0.06 lbs/hr) * (1,400 ppm) / [(400 ppm + 600 ppm)/2] = 0.168 lbs/hr

The property boundary distance is measured from the base of the stack to the nearest boundary limiting public access. In this case, the public access is limited by a fence. The distance to property boundary between the stack and the fence is 19.8 meters.

Step 5. Determine the Allowable Toxicity Weighted Emission Rate in HCl-Equivalents

Based on the following look-up table:

Stack Ht. (m)	Distance to Property Boundary (m)											
	0	50	100	150	200	250	500	1000	1500	2000	3000	5000
5	114.9	114.9	114.9	114.9	114.9	114.9	144.3	287.3	373.0	373.0	373.0	373.0
10	188.5	188.5	188.5	188.5	188.5	188.5	195.3	328.0	432.5	432.5	432.5	432.5
20	386.1	386.1	386.1	386.1	386.1	386.1	386.1	425.4	580.0	602.7	602.7	602.7
30	396.1	396.1	396.1	396.1	396.1	396.1	396.1	436.3	596.2	690.6	807.8	816.5
40	408.1	408.1	408.1	408.1	408.1	408.1	408.1	448.2	613.3	715.5	832.2	966.0
50	421.4	421.4	421.4	421.4	421.4	421.4	421.4	460.6	631.0	746.3	858.2	1002.8
60	435.5	435.5	435.5	435.5	435.5	435.5	435.5	473.4	649.0	778.6	885.0	1043.4
70	450.2	450.2	450.2	450.2	450.2	450.2	450.2	486.6	667.4	813.8	912.4	1087.4
80	465.5	465.5	465.5	465.5	465.5	465.5	465.5	500.0	685.9	849.8	940.9	1134.8
100	497.5	497.5	497.5	497.5	497.5	497.5	497.5	527.4	723.6	917.1	1001.2	1241.3
200	677.3	677.3	677.3	677.3	677.3	677.3	677.3	682.3	919.8	1167.1	1390.4	1924.6

For a stack height of 67 meters and a distance to boundary of 19.8 meters, the allowable toxicity weighted emission rate is **435.5 lbs/hr**.

Step 6. Compare the Allowable Toxicity Weighted Emission Rate in HCl-Equivalents to the Maximum Emission Rate to Determine Eligibility

The maximum emission rate (69 lbs/hr) is less than 20% of the allowable toxicity-weighted emission rate determined using the look-up table approach. Based on this large compliance margin, NC DAQ had determined that UNC-CH is eligible to use the HBCA compliance option for HCl for its two coal-fired boilers.

3. Natural Gas and No. 2 Fuel Oil Fired Boilers: One natural gas/No. 2 fuel oil-fired boiler, 338 MMBtu/hr heat input capacity, (**ID No. ES-003-Boiler #8**). Two natural gas/No. 2 fuel oil-fired boilers, 249 MMBtu/hr heat input capacity each (**ID Nos. ES-004-Boiler#9 and ES-005-Boiler#10**).

For these boilers, the facility has proposed total filterable particulate matter (PM), Hg, HCl, and CO emission limitations that are consistent with the NC DAQ application guidance. NC DAQ has developed this guidance to provide standards and compliance procedures that it has determined meet the requirements of § 112(j).

There are no testing or reporting requirements associated with the emissions limitations for natural gas and No. 2 fuel oil firing. The facility must retain monthly records of the type and quantity of fuel fired in the affected boilers to demonstrate compliance with the standard.

IV. Recommendations

This permit modification application for the UNC facility located in Chapel Hill, Orange County, North Carolina has been reviewed by NC DAQ to determine compliance with all procedures and requirements. NC DAQ has determined that this facility appears to be complying with all applicable requirements.

Issue Permit No. 03069T24