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November 20, 2006

Dr. Don Van der Vaart, P.E.
Division of Air Quality
1641 Mail Service Center
Raleigh, North Carolina 27699-1641Subject: Cliffside New Generation Project
PSD Construction Permit Application –
Revised Submittal on PM10 BACT Analysis

Dear Dr. Van der Vaart:

The attached document is a revision to the supplemental information we previously provided to you concerning issues around the ability to control PM10 emissions on a unit subject to BACT requirements. This was submitted to you by email on September 14 and included in a package of supplemental information submitted on October 10.

The previous document we provided may have incorrectly suggested that we are relying on the wet scrubber (FGD system) for control of PM10 emissions. We are not relying on the scrubber for particulate removal and our permit application forms do not include the scrubber as a control device for particulate removal. The BACT particulate controls we have proposed in our application include the use of a dry electrostatic precipitator and a polishing wet electrostatic precipitator (which we believe actually goes beyond BACT because the effectiveness of a wet precipitator in this application has not been adequately demonstrated).

If you have any questions, please contact Kris Knudsen (980-373-3225).

I certify under penalty of law that, based on information and belief formed after reasonable inquiry, the statements and information contained or referenced in this letter are true, accurate, and complete.

Sincerely,

A handwritten signature in black ink that reads "Rick R. Roper". The signature is written in a cursive, flowing style.

Rick R. Roper, Manager
Cliffside Steam Stationcc: Ed Martin, DAQ
DAQ Permit Branch - 5 copies w/ Attachment

Attachment

Duke Power Cliffside Unit 6 & 7 Permit Application PM₁₀ Emission Limits for New Coal Boilers

Duke Power (Duke) proposes to install PM₁₀ control technology on the proposed Cliffside Units 6 and 7 pulverized coal-fired boilers which represents the “top” control technology evaluated in its PSD top-down BACT evaluation. While not required for this permit, the technology chosen also represents the Lowest Achievable Emissions Rate (LAER) control technology. Duke has proposed to control emissions of PM₁₀ using a combination of dry electrostatic precipitator (ESP), followed by a polishing Wet Electrostatic Precipitator (WESP). Duke is not aware of any operating utility-scale pulverized coal-fired boiler operating in the US with this combination of PM₁₀ control devices, and considers its proposal to do so an innovative and advanced technology demonstration.

The North Carolina DAQ has requested additional justification for approval of the associated PM₁₀ emission limits proposed as BACT in the Cliffside Units 6 and 7 PSD Application. This attachment provides additional detail and justification of the proposed limits.

1.0 First of a Kind Application of Technology

The addition of a polishing Wet ESP to improve PM₁₀ capture downstream of a dry ESP, to ENSR’s knowledge, has yet to be demonstrated in practice on a 800 MW scale supercritical design PC boiler firing Eastern Bituminous coals. The closest applications identified to date are the Thoroughbred Station permitted in 2002 with dry ESP and polishing wet ESP and the WE Energies Elm Road Station permitted in 2004 with fabric filter and polishing WESP. However those units have not yet been operated or tested. WESP has been permitted for application to CFB boilers (a different emission source category), and we are not aware that any of those have actually been constructed or tested.

Duke’s vendors are certain that WESP technology can be applied to the saturated flue gas stream of a PC boiler downstream of an ESP and FGD system with good efficacy; what is presently still uncertain is the ultimate emission rate of condensable PM₁₀ that will be achieved in practice. A dry ESP is designed to control filterable particulate, but does little or nothing to control aerosols that condense at flue gas temperatures below the operating range of the ESP. Based on bids received from vendors for air quality control equipment, Duke expects to obtain filterable PM₁₀ emission guarantees to support a permit limit of 0.015 lb/MMBtu of filterable or solid particulate. As noted in Duke’s permit application, the dry ESP is expected to achieve this level of filterable emissions by itself. The wet ESP is intended to act as a polishing device and assure higher reliability for collecting filterable emissions but is not expected to appreciably reduce filterable particulate emissions further since the inlet concentration of filterable PM₁₀ will already be controlled by greater than 99%. While high removal percentages are documented in WESP’s with no upstream control, much lower removal percentages are expected when the larger size distribution of particles have already been “skimmed” by previous pollution control equipment.

On the other hand, the WESP is intended to effectively capture condensed aerosols that enter the WESP at saturated flue gas conditions. Since the test method required to measure the condensable emission fraction condenses and counts all gaseous species that will condense down to 32° F, there are some PM₁₀ aerosols that will never condense or be captured at all in the WESP due to actual stack exhaust temperatures of 120° F. As a result, uncertainty exists as to what level of condensable PM₁₀ will reach the WESP and what level of reduction can be commercially guaranteed. As indicated in Duke's permit application, we expect that the total PM₁₀ emissions exiting the WESP will be 0.024 lb/MMBtu or less although there are significant concerns given the lack of demonstrated performance and the measurement problems discussed below. Regardless of these concerns, operation of the combination of dry and wet ESP technology will assure actual emissions, both filterable and condensable PM₁₀ are as low as achievable.

2.0 The Composition of PM10

The composition and amount of particulate matter emitted from coal-fired boilers are a function of firing configuration, boiler operation, coal properties and emission controls. Particulate matter will be emitted from the pulverized coal-fired boilers as a result of entrainment of incombustible inert matter (ash) and condensable substances such as condensable organics and acid gases. Particulate matter (PM) and particulate matter smaller than 10 microns (PM₁₀) has historically been regulated from coal-fired boilers as the filterable, or front half catch only. Many permits contain filterable only limits, and/or require stack testing for filterable particulate only for demonstration of compliance. US EPA has clarified that when considering the air quality impacts under the PSD review process, both filterable and condensable fractions of PM₁₀ must be addressed. However, for purposes of establishing continuous compliance limits, North Carolina DENR recognizes the inherent difficulties of monitoring condensable PM₁₀ as well as the fact that air pollution control equipment is not designed for capture of condensable PM₁₀. Therefore, NC has historically set PM₁₀ permit limits based on filterable PM₁₀. ENSR has included an estimate of condensable PM₁₀ of 0.009 lb/MMBtu (total PM₁₀ of 0.024 lb/MMBtu) in dispersion modeling to support the Cliffside Units 6 and 7 PSD Application. This is a reasonable estimate for purposes of modeling air quality impacts, but it is not a good measure of control technology performance.

Control technologies in practical and demonstrated use for PM₁₀ control are primarily designed to capture solid or filterable materials only, and any capture of condensable emissions is secondary. This is also true of wet ESPs. While a wet ESP will capture aerosol emissions that have condensed, the technology is not capable of condensing and capturing a large fraction of pollutants in the flue gas that have not condensed (A small fraction of the condensable pollutants may condense and be captured, but the temperature differential through the wet ESP is too small to condense a substantial fraction). Thus, in setting a BACT standard, an emission standard based on the filterable-only fraction may be appropriate once the facility has addressed the air quality analysis required by the PSD

review. The constituents of condensable PM₁₀ are primarily made of pollutants which are regulated separately and typically addressed through use of other control technologies than those used for solid particles. These include sulfuric acid mist, VOC, HCL and HF. Since these species are regulated separately, and have their own BACT emission limits, their BACT emission rates should be summed to calculate the estimated emission rate of condensable aerosols (condensable PM₁₀). For the Cliffside Units 6 and 7, this results in a total allowable condensable PM₁₀ emission rate of .0198 lb/MMBtu.

3.0 Benchmarking

Previously permitted PM₁₀ emission limits are difficult to assess as many permits do not specify test methods and some emission limits only reflect filterable PM₁₀ while some others include condensable PM₁₀. The permit for AES-Puerto Rico (a CFB) addressed this issue in detail. AES's permit limited filterable PM₁₀ to 0.015 lb/MMBtu and allowed stack testing to determine an achievable total PM₁₀ emission limit. Stack tests showed that filterable PM₁₀ emissions were below 0.015 lb/MMBtu; however, based on stack test results, AES received an administrative change to their permit to set the total PM₁₀ emission limit at 0.03 lb/MMBtu a value that accounts for the additional contribution of measured condensable PM₁₀ at that facility. Several recent coal-fired boiler projects are listed with emission rates in the range of 0.010 lb/MMBtu to 0.015 lb/MMBtu based on front half (filterable) PM only, and this level is representative of BACT for PM.

Several facilities are listed in USEPA's BACT/LAER Clearinghouse with low levels of PM₁₀ for both filterable and condensable PM₁₀. Two of those permits include a polishing wet ESP following a primary control device (baghouses for the Elm Road Facility and dry precipitators for the Thoroughbred facility). None of the units identified have been operated or tested, nor has the application of WESP been demonstrated in practice as capable of meeting total PM₁₀ emission limit between 0.018 and 0.024 lb/MMBtu.

Duke is also aware of the PSD Permit issued to Santee Cooper for the Cross facility in NC, with a total PM₁₀ limit of 0.018 lb/MMBtu. It is unknown if Santee Cooper will be able to demonstrate compliance with that limit, especially since that facility has not even proposed a polishing WESP. Again, Santee Cooper has not been operated or tested, nor has it been proven capable of meeting a very low permit limit for total PM₁₀ in practice. The permit includes an initial demonstration to verify expected total PM₁₀ emissions but does not set an ongoing control technology performance standard. After initial startup testing, the Cross facility will only be subject to periodic testing using filterable PM test methods (Method 5 or 17).

The existence of very low emission limits in new permits that have yet to be demonstrated in practice does not imply that new achievable emission levels have been proven or are achievable. The proponents of those projects have accepted risk for any number of reasons; however, Duke has proposed to install a greater level of control technology than Santee Cooper as a first of a kind demonstration, while capping PM₁₀ emission rates at levels that

are achievable in practice. Because the technology has not been proven in commercial application for the proposed configuration, it would not be appropriate to set a BACT limit based on expected (but not proven) emission rates. However, upon successful operation of the Cliffside project (and other potential coal-fired projects if they are actually constructed), measured performance of this technology may be useful in assessing future BACT limits for other sources.

4.0 Uncertainty in Measurement of Total PM₁₀ from a Super-saturated WESP Stack

In setting permit limits for total PM₁₀, consideration should be given to the difficulty of measuring the very low concentrations of particulate emissions and the super saturated wet stack conditions after a WESP where the measurements would have to be conducted. The EPA reference methods require manual manipulations of test equipment and laboratory analysis which can introduce significant error, and little or no experience exists with actually testing condensable PM₁₀ after a polishing WESP on a utility-scale boiler. Measurement of condensables also presents the problem of collection of secondary particulates (sulfates and nitrates) which are technically not part of PM₁₀ because they form artificially in Method 202 and would not form in the air pollution control train or stack. In proposing very low limits, such as the Santee Cooper limit, consideration should also be given to potential testing artifacts that may be present for a WESP-equipped stack such as the proposed Cliffside Units vs. a hotter and dryer stack as proposed for Santee Cooper. With no field test experience in measuring condensable PM₁₀ from a new utility coal unit with polishing WESP, as yet undiscovered variations and potential inaccuracies resulting from the test methods themselves create additional compliance risks for the proposed Cliffside Units.

5.0 Proposed BACT Limit for Total PM₁₀

Duke proposes a total PM₁₀ limit of 0.024 lb/MMBtu for the Cliffside Units, which is consistent with the value used in PSD dispersion modeling (which indicated compliance with National Ambient Air Quality Standards and PSD increment requirements). This value is based on the proposed limit of 0.015 lb/MMBtu for filterable PM₁₀, and adding 0.009 lb/MMBtu of non-otherwise regulated condensable PM₁₀ (i.e. excluding H₂SO₄, HF, HCL, VOC). While Duke expects that emissions testing will demonstrate compliance at this level if appropriate test methods are approved, Duke will accept permit conditions and a Continuous Assurance Monitoring (CAM) Plan that will require each PM₁₀ control device to be operated at all times per good pollution control practice. Those conditions will ensure that the primary ESP and polishing WESP will operate to reduce total PM₁₀ to the minimum levels that can be achieved in practice using the state-of-the-art or LAER particulate control technology for clean coal supercritical PC boilers. Duke proposes that compliance will be demonstrated by performing periodic (annual) testing at the stack to verify performance of the installed control technology (dry ESP and wet ESP). Because these technologies have limited ability to control the

condensation and capture of condensable aerosols, the performance testing will be limited to filterable PM emissions. In summary, Duke is proposing the following permit conditions for PM₁₀:

- Total PM₁₀ emissions for BACT analysis: 0.024 lb/MMBtu
- Filterable PM₁₀ Performance Standard: 0.015 lb/MMBtu
- Compliance demonstrated by:
 - Initial and Annual Filterable Emissions: Emissions below 0.015 lb/MMBtu based on Method 5 or 17
 - Best practice for continuous operation of all pollution control devices
 - Initial total PM₁₀ test to demonstrate actual emissions (based on Method 202 or other approved test method).