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May 28, 2009

Ms. Purva Prabhu
Georgia Department of Natural Resources
Environmental Protection Division
Air Protection Branch
4244 International Parkway, Suite 120
Atlanta, GA 30354

RE: Application No. 17924, dated January 17, 2008
Plant Washington
Sandersville, Georgia
Project No. 6122-07-0007

Dear Ms. Prabhu:

In light of recent permitting decisions regarding both permitted Volatile Organic Compound (VOC) emission limits and filterable Particulate Matter (PM) emission limits for coal fired utility boilers, supplemental data to the application is now being submitted to provide additional supporting documentation for the proposed VOC and PM emission limits for Plant Washington.

Discussions on both the PM and VOC limits is included in the text of this letter as follows. Also, supporting documentation discussed in this letter has been enclosed on the attached CD.

PM Limit Evaluation

Further questions have been raised regarding the proposed filterable PM emission limit for the main boiler at Plant Washington, 0.012 lb/MMBtu, in light of the proposal by the Longleaf Energy Station to reduce their filterable PM limit to 0.010 lb/MMBtu as part of the 112(g) Case-By-Case MACT application submitted for that facility in October 2008. One of the main differences between the Longleaf Energy Station and Plant Washington is the difference in the SO_2 emissions control strategy. Plant Washington will utilize a wet scrubber while the Longleaf Energy Station will utilize a dry scrubber for control of SO_2 emissions (as well as other pollutants).

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There are several operational issues that could cause a sudden increase or variability in PM CEMS readings from the main boiler unit. Those items include;

1. Carry over of mist from the wet scrubber introducing filterable PM into the gas stream. This would occur following the main PM control device for Plant Washington (fabric filter baghouse), and would not occur with a facility utilizing a dry scrubber (i.e. Longleaf Energy Station).
2. Soot blowing of the boiler causing a sudden increase in the PM loading to the baghouse system.
3. A change in load conditions/demand on the facility causing a sudden increase to the PM loading to the baghouse system.
4. The cleaning cycle of a baghouse system.
5. The response and variability of the PM CEMS device to changes in emissions.

The following discussions address the different topics addressed above;

Wet Scrubber Mist Carry Over

As discussed in Section 4.3.1 of the application, the wet scrubber for Plant Washington is downstream of the Particulate Matter (PM) control device. On occasion, the mist generated in the wet scrubber could introduce a small amount of filterable PM into the flue gas stream. The amount of mist carryover would be a function of the effectiveness of the mist eliminators used on the wet scrubber system. Mist eliminators are vanes installed inside the top of the wet scrubber to cause the flue gas exhaust stream to make changes in direction. These changes in direction cause the exhaust gas stream to impact the vanes, thereby causing the mist to drain back into the scrubber.

Discussions with an engineering design company indicated that there is the potential for carry over of wet scrubber slurry from a wet scrubber into the exhaust gas stack, particularly when all spray levels are in use. In order to meet the proposed BACT emission limits for SO_2, and the minimum removal efficiency for the wet scrubber for Plant Washington, it may be necessary to incorporate up to five spray levels into the wet scrubber. Operation of this many spray levels increases the chances of mist carryover from the wet scrubber into the flue gas stream.

A review of documentation on this issue found several technical documents regarding the potential for PM mist carryover from wet scrubbers. One document was a Burns & McDonnell technical paper from

November 2006 titled *PM CEMS: The Current Reality of Monitoring Particulate Matter*. In that document, the following statement was made; "As stated previously, some types of PM CEMS are not appropriate for use with certain other add-on control device chains. Optical instruments (light scattering, light extinction, optical scintillation) should be avoided on units controlled with a wet FGD unless the PM CEMS can remove the water droplets by heating the sample sufficiently." This is, therefore, inferring that there could be interferences with a PM CEMS following a wet scrubber.

A case study within this technical document was discussed, which involved installation of a PM CEMS following the wet scrubber at the Henderson Municipal Power and Light II Plant in Henderson, Kentucky. The results of the case study indicated that, after the PM CEMS was installed and certified, problems with the PM CEMS were encountered involving plugging of the monitor and probe. It was discovered that the problems were the result of excessive mist carryover from the wet scrubber, resultant from blockages in the mist eliminator. The problem was resolved by varying the temperature within the PM CEMS system. However, it was indicated that as a result of the study the PM CEMS device was now being used by plant personnel as an indication of maintenance issues with the wet scrubber. Therefore, the potential for mist carryover impacts from a wet scrubber negatively impacting a PM CEMS device have been well documented in literature, and this documentation supports the fact that PM is emitted due to wet scrubber operation.

A second document reviewed was a response to comments on a PSD permit application by the Basin Electric Power Cooperative to the South Dakota Department of Environment and Natural Resources. This document discussed use of mist eliminators for wet scrubbers, and discussed that guaranteed carryover emission rates from mist eliminators typically ranged from 0.01 to 0.015 grains per dry standard cubic foot of flue gas. Also, it was stated that these guarantees typically exclude droplets smaller than 40 microns in size. A carry over of PM ranging from 0.01 to 0.015 grains per dry standard cubic foot would translate for Plant Washington to values between 0.02 to 0.03 lb/MMBtu based on the stack conditions for the main boiler for Plant Washington. These value are higher than the proposed PM filterable limit of Plant Washington of 0.012 lb/MMBtu, and higher than the NSPS standard of 0.015 lb/MMBtu. The reportedly high level of guaranteed emission rates indicated for mist eliminators in wet scrubbers tends to indicate concern by equipment vendors regarding the level of mist carryover in wet scrubbers.

A review of available technical documentation indicates that wet scrubber mist carry over has been documented in literature, and could potentially introduce additional PM into the main boiler exhaust gas at

Plant Washington. The phenomenon of mist carry over could potentially occur from wet scrubber systems operating at a very high removal efficiency of SO_2, as is the case with Plant Washington. Mist carry over would not be expected from systems utilizing a dry scrubber such as the Longleaf Energy Station.

Soot Blowing

Slag from coal ash can build up on the walls of the boiler furnace. These deposits can negatively effect the efficiency of the boiler system, and negatively effect emissions. Soot-blowing refers to the method used to clean these deposits from the boiler, a common practice in pulverized coal fired boilers. Depending on the soot-blowing practices used, variable loadings of PM emissions can be added to the system that could be seen by a PM CEMS device, and not measured during a standard 3-hr stack testing event. A technical paper titled *PM2.5 and Mercury Emissions From a High Ratio Fabric Filter After a Pulverized Coal Fired Boiler* evaluated PM CEMS data during normal boiler operation and during soot-blowing in the boiler. A comparison of the PM CEMS data, as shown in Figure 4 and Figure 5 of the technical paper, documented an almost 300% increase in particles smaller than 3 μm at the fabric filter baghouse outlet. It was noted that the total increase in PM emissions from sootblowing was larger than that recorded since the PM CEMS device was only monitoring particles smaller than 3 μm and soot-blowing predominantly removes larger fly ash particles.

The source evaluated was a pulverized coal fired boiler utilizing emissions controls of Selective Catalytic Reduction (SCR), a fabric filter baghouse, and a wet scrubber. Therefore, there is documented evidence that soot-blowing activities can lead to an increase in PM emissions, and that increase in PM emissions would be captured by a PM CEMS device. This provides further evidence that by monitoring PM on a continuous basis with a CEMS device, routine operational practices that could cause increases in system PM emissions need to be taken into account.

Load Changes

Although Plant Washington will be a base load unit, depending on electricity demand the load demand on the main boiler will change over time. A sudden increase in boiler loading could cause a temporary increase in the loading to the system PM control device, leading to an increase in emissions. While a standard stack test could measure PM emissions at different load conditions (i.e. 40%, 100%, etc.), a PM

CEMS device will continuously monitor and capture the entire system response to load changes. As stated above, when monitoring PM on a continuous basis with a CEMS device, routine operational practices that could cause increases in system PM emissions need to be taken into account when determining a proper emission limit.

Baghouse Cleaning Cycle

During a baghouse cleaning cycle, there is the potential for a sudden increase in PM emissions, due to a lack of filter cake on the filter bag decreasing the efficiency of the filter, and the potential for a sudden "puff" of PM. These effects were documented in an evaluation of PM CEMS devices by the USEPA, in a document titled *Evaluation of Particulate Matter (PM) Continuous Emission Monitoring Systems (CEMS) – September 2000*. Pages 5-99 through 5-104 of the document discuss peaks in evaluated PM CEMS devices that seem to correspond with the baghouse cleaning cycle, and that the peaks observed in the PM CEMS are "likely caused by the brief puff of particulate when a cleaned compartment is first opened". Therefore, an EPA evaluation of PM CEMS devices has documented that baghouse cleaning cycles can cause spikes in PM emissions and PM CEMS readings.

A response to WDEQ comments to the Basin Electric Power Cooperative, Dry Fork Unit 1 application indicated the following "because of the potential for increased particulate emissions immediately following a cleaning cycle (i.e. before the filter cake is reestablished) and because of the potential for particulate emissions associated with filter housing integrity, fabric filter vendors have not provided guarantees below 0.012 lb/MMBtu". This unit was proposing compliance with its PM emission limit through stack testing, not PM CEMS. Although these discussions were several years ago (2005), it demonstrates that the baghouse cleaning cycle is an important consideration in assessment of a filterable PM emission limit and emission guarantees.

Response and Variability of PM CEMS

PM CEMS devices are required to comply with Performance Specification 11 (PS-11), Specifications and Test Procedures for Particulate Matter Continuous Emission Monitoring Systems at Stationary Sources. Commenters to PS-11 noted that the reduction of the minimum correlation coefficient from 0.90 to 0.85 between the correlation test and the PM CEMS was allowing for PM CEMS to be less accurate, and was an admission that PM CEMS are inappropriate for compliance. Another commenter noted that use of the correlation coefficient of 0.85 was evidence that the response of PM CEMS is variable and unreliable.

The EPA responded to these comments by stating that they agreed with commenters that reduction in the required minimum correlation coefficient allowed for more variability in the data. However, the EPA did not agree that this was an indication that PM CEMS were unreliable. However, with a low allowable value for the minimum correlation coefficient, combined with the fact that stack testing is required for correlation with these devices and stack testing methods for fine PM ($PM_{2.5}$), which will comprise a large portion of the PM emissions, are still in development, the response and variability of readings from a PM CEMS device could further make compliance with stringent PM emission limits difficult on a continuous basis.

PM Limit Evaluation Summary

Considering all of the above discussed variables, a PM CEMS device may best be used as an indicator of the performance of the pollution control devices in use, rather than an accurate long term measurement of emissions. When taking into account the five issues discussed above, the emissions control strategy of Plant Washington (wet scrubber) which could have unplanned increases in PM emissions, in combination with normal operational procedures that could cause increases in PM emissions that would be measured by a PM CEMS device, and the potential variability of a PM CEMS device, an emission limit of 0.012 lb/MMBtu for filterable PM is justified.

VOC Limit Evaluation

A VOC emission limit lower than that proposed by Plant Washington was recently issued in a permit to the John W. Turk Jr. Power Plant in November 2008. The Arkansas DEQ determined that an appropriate VOC emission limit for the main boiler was 0.00078 lb/MMBtu through the 112(g) Case-By-Case MACT analysis for the main boiler, although the VOC BACT determination for the main boiler at the site was listed as 0.0036 lb/MMBtu. The proposed BACT emission limit for VOC for Plant Washington is 0.003 lb/MMBtu.

The VOC emission limit for the John W. Turk Jr. Power Plant was derived from five years of VOC stack testing data (2002 to 2006) of the Kansas City Power & Light Hawthorn Unit 5 in Kansas City, Missouri.

The emission limit of 0.00078 lb/MMBtu was derived from the mean of the five years of VOC testing data, plus three standard deviations. Hawthorn Unit 5 is a pulverized coal fired boiler (550 MW net) utilizing PRB coal which began commercial operation in 2001. Emission controls at the facility include a dry scrubber, low NOx burners, overfire air, Selective Catalytic Reduction (SCR), and a Fabric Filter Baghouse. This site is, therefore, utilizing modern emission controls for control of pollutants.

ADEQ Derivation Method for the VOC Limit for the John W. Turk Jr. Power Plant

The first point on this issue to address is the method used to derive the pertinent VOC emission limit for the John W. Turk Jr. Power Plant. In Permit # 2123-AOP-R0 for the John W. Turk Jr. Power Plant, pages 16 and 17, the Main Boiler BACT limit for VOC is identified as 0.0036 lb/MMBtu on a 3-hr average basis, with compliance determined through USEPA Method 25. However, a footnote to the VOC emission limit indicates "VOC rate based on 112(g) analysis will be set at 0.00078 lb/MMBtu". A review of the 112(g) Draft Permit Decision for the John W. Turk Jr. facility indicates that, as part of the 112(g) analysis, VOC is being used as a surrogate for compliance for all volatile organic HAPs. The evaluation concluded that good combustion practices was the most effective control, and that there were no practical add-on controls for VOC for the unit. As indicated in the permit issued in November 2008 for the John W. Turk Jr. facility, the site is required to conduct annual stack testing for VOC emissions.

With Plant Washington, the Case-By-Case MACT (112(g)) determination also determined that by effective control of combustion, through good combustion practices and engineering combustion controls, the emissions of organic HAPs would be controlled. Therefore, the proposed BACT and MACT control strategy for VOCs and organic HAPs for Plant Washington and the John W. Turk Jr. facility are the same.

However, Plant Washington has proposed use of surrogate monitoring of CO as opposed to VOC. Through monitoring of CO, and compliance with the proposed CO surrogate monitoring limits, effective combustion will be maintained thereby minimizing emissions of organic HAPs. CO emissions will be monitored using a Continuous Emissions Monitor (CEM) device, with a proposed limit of 0.10 lb/MMBtu on a 30-day rolling average, as opposed to the John W. Turk Jr. organic HAPs surrogate monitoring of VOC with a proposed limit of 0.00078 lb/MMBtu, on a 3-hr. average, verified once per year by a stack test. Therefore, through the continuous monitoring of CO emissions by Plant Washington, the emissions of organic HAPs will be more effectively monitored and controlled than through establishment of a VOC surrogate monitoring limit for organic HAPs.

The Relationship Between Control of VOC and NOx Emissions

A second point on this issue to discuss is the relationship between controls of VOC emissions and NOx emissions. In Section 4.3.4 of the BACT evaluation, it was discussed that boiler design parameters that tend to result in lower VOC emissions result in higher NOx emissions. When establishing emission limits for VOCs, consideration must be given to the impact a low limit of VOCs could have on NOx emissions since both limits will need to be achieved simultaneously for compliance. The ADEQ derived the VOC emission limit for the John W. Turk Jr. facility from five years of stack testing data from Hawthorn Station Unit 5. EPA Clean Air Markets program data was reviewed for 2002 to 2008 for Hawthorn Station Unit 5 to assess the NOx emissions from the facility. Table 1 lists the annual average NOx emissions from Hawthorn Unit 5 from 2002 to 2008.

Table 1: Annual Average NOx Emissions for Hawthorn Unit 5

Operational Year	NOx Annual Avg. Emission Rate (lb/MMBtu)
2002	0.104
2003	0.106
2004	0.085
2005	0.074
2006	0.072
2007	0.071
2008	0.076

Prepared by: JDF 5/22/09
Checked by: KDH 5/22/09

Data from Table 1 indicates that the annual average NOx emissions for Hawthorn Unit 5 are higher than the proposed NOx emission limit for Plant Washington of 0.05 lb/MMBtu on a 30-Day Rolling Avg. This information indicates that the operation of the Hawthorn Unit 5 boiler may be optimized for control of VOC (and CO) emissions.

Therefore, a review of information regarding Hawthorn Station Unit 5 has indicated that NOx emissions at the site are significantly higher than the proposed NOx emission limit for Plant Washington of 0.05 lb/MMBtu on a 30-day rolling average. Therefore, it is unknown if Hawthorn Unit 5 could achieve a comparable level of VOC emissions while operating at a lower NOx emission rate. Also, Hawthorn Unit 5 has a permitted NOx emission rate of 0.08 lb/MMBtu on a 30-day rolling average. Therefore, the Hawthorn Unit 5 VOC emissions testing data, and the limit derived from this data for the John W. Turk Jr. facility, may not be representative of a site achieving both a low level of VOC emissions and NOx emissions.

Reliability of Hawthorn Unit 5 Testing Data

A third point on this issue to discuss is the reliability of the VOC emissions testing on which the John W. Turk Jr. VOC emission limit was derived. The stack testing data used to derive the John W. Turk Jr. facility VOC limit (Hawthorn Unit 5 2002 to 2006) was obtained for review. Also, stack testing data for this source for 2007 and 2008 was obtained. Data for 2008 was comparable (0.00038 lb/MMBtu CY2008) to VOC emissions testing results for 2002 to 2006. However, VOC stack testing data for 2007 (0.001 lb/MMBtu) was higher than testing data for other years evaluated.

Table 2 lists the determined VOC emission rates (ppm and lb/MMBtu) from stack testing for 2002 through 2008 for Hawthorn Unit 5 and the date on which the testing occurred.

Table 2: VOC Testing Results at Hawthorn Unit 5 From 2002 to 2008

Test Date	Tested VOC Result (Avg. ppm)	Tested VOC Result (Avg. lb/MMBtu)
8/15/02	0.34	0.0005
4/15/03	0.13	0.0002
5/24/04	0.20	0.0003
5/3/05	0.35	0.0004
4/20/06	0.36	0.0005
4/5/07	0.70	0.001
4/3/08	0.25	0.00038

Prepared by: JDF 5/22/09
Checked by: KDH 5/22/09

A review of the stack testing data indicates that VOC emissions testing at Hawthorn Unit 5 was conducted utilizing USEPA Reference Method 25A – Total Hydrocarbons. The equipment utilized included a portable hydrocarbon analyzer, which was used for analysis of the total hydrocarbons in the duct flue gas. The analyzer utilizes the flame ionization method of detection, and continuously measures the concentration of hydrocarbons in a gas stream. Testing reports for 2002 to 2006, on which the VOC emission limit for the John W. Turk Jr. facility was based, indicated the same test method (USEPA Method 25A) and the same type of portable hydrocarbon analyzer (J.U.M. Model 3-100) were used.

Although Method 25A does not list a detection limit, it is generally accepted that VOC readings less than 1 ppm are not reliable. As indicated in Table 2, all of the tested results from 2002 to 2008 indicated results less than 1 ppm, with an average tested value as low as 0.13 ppm. This data is therefore unreliable, and cannot be relied upon to develop an emission standard.

Estimation of the Condensable Portion of Particulate Matter

A fourth and final point on this issue involves the estimation of the condensable portion of Particulate Matter (PM), and what constitutes the condensables which would be emitted. The main condensables that would be emitted from a coal fired boiler would include organic condensables (VOCs) and Sulfuric Acid Mist (SAM). The permitted emission limits for the John W. Turk Jr. facility are 0.025 lb/MMBtu total PM_{10}, and 0.012 lb/MMBtu filterable PM_{10}. This implies a condensable portion of 0.013 lb/MMBtu. The Sulfuric Acid Mist emission limit for the facility is 0.0042 lb/MMBtu, and the VOC limit is 0.00078 lb/MMBtu, totaling only approximately 0.005 lb/MMBtu. Incorporating the permitted emission limits for HCl and HF, which could be measured as condensables during stack testing, would only increase the total estimated condensables to 0.006 lb/MMBtu, still leaving a deficit of 0.007 lb/MMBtu of unknown condensables. If additional organic condensables are not present, then the derivation of the estimated condensable emissions is unknown, further drawing into question the low VOC emission limit derived for the facility.

VOC Limit Evaluation Summary

In summary, four main points were identified and discussed, drawing into question the applicability of the derived VOC emission limit for the John W. Turk Jr. facility to Plant Washington. Those four points included;

1. The method (MACT) used to derive the limit and the intended use of the limit (organic HAP surrogate).
2. The relationship between control of VOC and NOx emissions.
3. The reliability of the VOC testing data on which the John W. Turk Jr. facility was derived.
4. The method behind estimation of the condensable emissions from the John W. Turk Jr. facility.

The assessment of the above four points provides sufficient evidence that the emission limit for the John W. Turk Jr. facility should not be considered BACT for Plant Washington, and the Hawthorn Unit 5 data should not be used as a basis for estimation of a VOC BACT emission limit for Plant Washington.

If you have any questions, please contact me at (770) 421-3335 or Ken Hiltgen at (770) 421-3334.

Sincerely,
MACTEC ENGINEERING AND CONSULTING, INC.

Mary V. Rolader

Justin Fickas
Senior Engineer

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For Ken Hiltgen
with permission

Cc: C. Dean Alford, Allied