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May 13, 2009

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

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17924
AIR PROTECTION BRANCH

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

Dear Ms. Prabhu:

On behalf of our client Power4Georgians, LLC (P4G) please find attached additional supplemental pages for the above referenced application. The attached additional supplemental pages include a new exhibit to the application (Exhibit F), which includes a $PM_{2.5}$ BACT analysis for the facility.

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.

Justin Fickas
Senior Engineer

Ken Hiltgen
Project Manager/Principal

Cc: C. Dean Alford, Allied

LIST OF EXHIBITS

3.13 Fine Particulate Review Requirements ($PM_{2.5}$)

In 1997 NAAQS were set for fine particulate. Fine particles or "$PM_{2.5}$" can aggravate heart and lung diseases and have been associated with premature death and a variety of serious health problems including heart attacks, chronic bronchitis and asthma attacks. This standard was set in addition to the PM_{10} NAAQS that was already existing. On September 8, 2005, the Environmental Protection Agency (EPA) issued a proposed rule implementing the 1997 fine particle ($PM_{2.5}$) national ambient air quality standards. On March 29, 2007, EPA issued a final rule defining requirements for state plans to clean the air in 39 areas where particle pollution levels do not meet national air quality standards. This rule addressed only those areas that which are not in attainment with the standard and listed no additional requirements for those areas which are currently in attainment with the standard. Therefore in this application we have reviewed and addressed control of emissions of PM_{10} which also includes the subcategory of $PM_{2.5}$. By doing this it is expected that controls specified for PM_{10} will also address required controls of $PM_{2.5}$.

On May 8, 2008 the USEPA issued final rules governing the implementation of the New Source Review (NSR) program for $PM_{2.5}$. The rule has established a direct $PM_{2.5}$ significant emission rate of 10 tpy. Emissions of direct $PM_{2.5}$, as well as precursor pollutants SO_2 and NOx, have been evaluated in the BACT evaluation in Section 4.3 of this application. A specific $PM_{2.5}$ BACT analysis is included in Exhibit F of this application.

3.14 Georgia State Requirements

The Georgia Rules For Air Quality Control, Chapter 391-3-1, have promulgated rules for emission limitations regarding visible emissions, fuel burning equipment, fugitive dust, and mercury emissions from new electric generating units. Georgia Rule 391-3-1-.02(ttt) requires application of BACT to Hg emissions from new coal-fired electric generation units installed after January 1, 2007 and that generate greater than 25 MW of electricity for sale. Therefore, the main boiler at Plant Washington will be subject to the Georgia Rule 391-3-1-.02(ttt). Additional emission limitation requirements under the Georgia Rules for Air Quality Control are less stringent than the application of BACT, or other applicable requirements such as New Source Performance Standards (NSPS) to the emission units present at Plant Washington. Plant Washington, where applicable, shall maintain compliance with all Georgia State Requirements.

EXHIBIT F ADDITIONAL $PM_{2.5}$ BACT ANALYSES

F.1 Introduction

Section 3.13 of the permit application discusses the background and regulatory policy regarding the control of $PM_{2.5}$. In that section we state that "we have reviewed and addressed control of emissions of PM_{10} which also includes the subcategory of $PM_{2.5}$. By doing this it is expected that controls specified for PM_{10} will also address required controls of $PM_{2.5}$." This approach is often referred to as the "surrogacy approach" (using PM10 as a surrogate to determine appropriate controls for $PM_{2.5}$). Even though our BACT analysis presented in Section 4 did generally follow that approach we included information where possible directly regarding $PM_{2.5}$. Recent EPA pronouncements have suggested that the surrogacy approach is not appropriate. To that end we have provided this section which takes a second look at BACT focusing on $PM_{2.5}$ to determine if additional controls could be added to reduce the smaller size particulate emissions even further.

On May 16, 2008 the EPA published in the Federal Register (73 Fed. Reg. 28321 5/16/08) regulations regarding $PM_{2.5}$ titled *Implementation of New Source Review (NSR) Program for Particulate Matter Less Than 2.5 Micrometers ($PM_{2.5}$)*. This rule finalized several NSR program requirements for sources that emit $PM_{2.5}$ and pollutants that contribute to $PM_{2.5}$. The rule discusses the three types of pollutants that contribute to $PM_{2.5}$. There is "direct $PM_{2.5}$" which is particulate emitted from the source in either solid particle form (called filterable) or vapors that can condense in the atmosphere as it moves downwind (called condensable). In addition, there is "secondary $PM_{2.5}$" which is particulate formed in the atmosphere when compounds emitted from source react to either form or cause to be formed particulate downwind. The rule established significant emission rates for direct $PM_{2.5}$ (in both filterable and condensable form) and "indirect" $PM_{2.5}$ or "precursors".

Table F-1 Facility Operations at the Facility Requiring a $PM_{2.5}$ BACT Review

Plant Washington
- Supercritical Pulverized Coal Boiler - Auxiliary Boiler - Cooling Towers - Material Handling - Diesel Engine Generator and Fire Water Pump

Prepared by: JDF 5/13/09
Checked by: KDH 5/13/09

Table F-2 $PM_{2.5}$ BACT Analysis Summary Table (Additional Controls)

Source	BACT	Proposed Emission Limit (lb/MMBtu)	Proposed Compliance Test Method
Supercritical Pulverized Coal (SCPC) Boiler	Work Practice to identify the most appropriate fabric for the baghouse that removes $PM_{2.5}$	0.01236 (Total) 0.00636 (Filterable)	EPA Method 201/201A (including OTM-27) for measurement of filterable $PM_{2.5}$, and OTM-28/CTM-39 for measurement of condensable $PM_{2.5}$
Auxiliary Boiler	Same Work Practice for PM_{10} Controls through selection of ultra low sulfur fuel	0.012 (Total)	Fuel Specification Eng. Controls
Cooling Towers	No Additional Controls	0.0005 percent drift Total Dissolved Solids (TDS) Limit 3300 mg/L	Vendor Data Quarterly TDS Testing
Material Handling	Work Practice to identify the most appropriate fabric for the baghouse that removes $PM_{2.5}$	See Section F.5	EPA Method 201/201A (including OTM-27) for measurement of filterable $PM_{2.5}$
Diesel Engine Generator and Fire Water Pump	See Section F.6	See Section F.6	See Section F.6

Prepared by: JDF 5/13/09
Checked by: KDH 5/13/09

F.2 Supercritical Pulverized Coal (SCPC) Boiler

This section contains the BACT analysis for $PM_{2.5}$ for the planned 850 MW net SCPC unit planned for use at the facility. A summary of the $PM_{2.5}$ BACT results for the SCPC boiler is in Table F-2.

F.2.1 BACT Demonstration for $PM_{2.5}$ Emissions from the Supercritical Pulverized Coal Boiler

The composition and amount of $PM_{2.5}$ emissions from a coal-fired boiler is a function of the type of coal used, firing configuration of the boiler, and emission controls in place on the unit. The source of "direct" $PM_{2.5}$ emissions from coal-fired boilers is a result of incombustible inert matter (ash) in the fuel and condensable organic substances and acid gases. Incombustible inert matter, or ash, will be in a "filterable" form, and can be collected through the same means as collection of larger particle size fractions of filterable PM (i.e. PM_{10}). Condensable $PM_{2.5}$ would not be captured on a filter at stack conditions but could condense in the atmosphere to form an aerosol. Condensables could include emissions of pollutants such as Sulfuric Acid Mist (SAM) and Volatile Organic Compounds (VOCs).

Sources of "indirect" $PM_{2.5}$ emissions, or secondarily formed $PM_{2.5}$ in the atmosphere from emissions of other pollutants, are referred to as precursors. The four primary precursors of $PM_{2.5}$ identified by the EPA in the May 16, 2008 Rule included Sulfur Dioxide (SO_2), Nitrogen Oxides (NOx), Volatile Organic Compounds (VOCs), and Ammonia. The Rule further specified that VOCs and Ammonia were not regulated as precursors unless the State demonstrated that they were significant contributors to formation of $PM_{2.5}$ for an area in the State

The following $PM_{2.5}$ BACT analysis will address the major constituents of $PM_{2.5}$, including "direct" filterable $PM_{2.5}$, "direct" condensable $PM_{2.5}$, and "indirect" precursor emissions. The analysis for the supercritical boiler will then conclude with Step 5 of the BACT analysis providing a summary of the results of the controls for the various constituents of $PM_{2.5}$ and proposing a $PM_{2.5}$ BACT emissions limit for the supercritical pulverized coal fired boiler.

Direct $PM_{2.5}$ Emissions

Filterable $PM_{2.5}$

Step 1 – Identify All Control Technologies

Control technologies identified for filterable PM_{10} in Section 4.3.1 would also be effective in control of filterable $PM_{2.5}$. Control technologies identified previously for control of filterable $PM_{2.5}$ would include the following;

Table F-3 $PM_{2.5}$ Filterable Control Technologies Identified in Section 4.3.1

Control Technology
Coal Selection
Coal Cleaning
Fabric Filter Baghouse
Dry ESP
Wet ESP
Venturi Scrubber
Centrifugal Separator (Cyclone)
Advanced Hybrid Particulate Collector
Agglomerator

Note: Control technologies listed above discussed in detail in Section 4.3.1.

Prepared by: JDF 5/13/09
Checked by: KDH 5/13/09

The control technologies identified in Table F-3 were discussed in detail in Section 4.3.1 of the application. In addition to the control technologies identified above, additional research was conducted as part of this assessment to identify additional control technologies which could be used in the control of filterable $PM_{2.5}$. Such additional control technologies identified included;

Table F-4 Additional $PM_{2.5}$ Filterable Control Technologies Identified In This Assessment

Control Technology
Coated Fabric or Membrane Fabric Filters
Electrostatic Fabric Filters
Membrane Wet ESP

Note: Control technologies listed above discussed in further detail below.

Prepared by: JDF 5/13/09
Checked by: KDH 5/13/09

The control technologies identified in Table F-4 are discussed in further detail below.

Coated Fabric or Membrane Filters

Intrinsically coated fabric filters refers to the manufactured type of filter bag used in a fabric filter baghouse. Intrinsically coated bags use fabric made of specially coated (e.g. Teflon®) fibers. These coatings both improve the durability of the bag and reduce the pore size between fibers, providing an improved capture efficiency for smaller particles such as $PM_{2.5}$.

Membrane fabric filters refers to the manufactured type of filter bag used in a fabric filter baghouse. Membrane bags have a coating applied to the surface of the bag as opposed to individual fibers, as is done in an intrinsically coated fabric filter bag. Coating of the surface of the bags provides for smaller pore sizes and higher control efficiencies for small particles. Coating of the surface of the bag leads to reduced filter cake formation on the surface of the bag, reducing the pressure drop across the baghouse system. The EPA Environmental Technology Verification (ETV) Program assesses the performance of technologies that have the potential to improve protection of human health and the environment. This program has evaluated the performance of baghouse filtration products (bag types) in emissions of fine particulate matter ($PM_{2.5}$). Types of baghouse filtration products evaluated include both membrane and non-membrane fabrics, including types such as micropore size scrim supported felt fabric, polyester needle felt with polytetrafluoroethylene membrane, etc.

Electrostatic Fabric Filters

An electrostatic fabric filter is a system similar to the Advanced Hybrid Particulate Collector discussed in Section 4.3.1, which is a hybrid of an Electrostatic Precipitator and a Fabric Filter Baghouse. The Electrostatic Fabric Filter Baghouse technology, licensed as the Max-9 Electrostatic Fabric Filter to GE, is a technology developed through a partnership of the EPA and Southern Research Institute (SRI). GE reports that the technology is recommended for use as a slipstream unit to augment an existing dust collector, a polishing unit behind an existing precipitator, baghouse, or scrubber, or as a stand alone replacement for an inefficient precipitator or multiclone.

Membrane Wet ESP

Wet ESP devices were already evaluated in Section 4.3.1. However, membrane wet ESPs operate in the same manner as traditional wet ESPs, but they use a membrane material as opposed to a steel plate as a collection surface. The membrane materials are corrosion resistant fibers, which conduct water based cleaning through capillary action between the fibers, thereby maintaining an even distribution of water. Pilot testing has indicated that a membrane wet ESP can be more effective than a standard steel plate wet ESP in collection of $PM_{2.5}$, acid aerosols, and mercury.

Step 2 – Eliminate Technically Infeasible Options

Control technologies identified for filterable PM_{10} in Section 4.3.1 would also be effective in control of filterable $PM_{2.5}$. Control technologies identified previously as being technically feasible for control of filterable $PM_{2.5}$ would include the following;

Table F-5 $PM_{2.5}$ Filterable Control Technologies Identified as Technically Feasible in Section 4.3.1

Control Technology
Coal Selection
Coal Cleaning
Fabric Filter Baghouse
Dry ESP
Wet ESP
Venturi Scrubber
Centrifugal Separator (Cyclone)
Agglomerator

Note: Technical feasibility of control technologies listed above discussed in detail in Section 4.3.1.

Prepared by: JDF 5/13/09
Checked by: KDH 5/13/09

The technical feasibility of the control technologies identified in Table F-5 were discussed in detail in Section 4.3.1 of the application. In addition to the control technologies identified above, additional research was conducted as part of this assessment to identify additional control technologies which could be used in the control of filterable $PM_{2.5}$. The technical feasibility of these control options identified in Step 1 above is discussed below.

Intrinsically Coated Fabric or Membrane Fabric Filters

Intrinsically coated fabric filter bags are commercially available and have been utilized on utility boiler systems. Therefore, use of intrinsically coated fabric filter bags is considered technically feasible in this analysis.

Electrostatic Fabric Filters

There is a limited full scale operational history for the GE Max 9 Electrostatic Fabric Filter Baghouse. A unit was installed on the Allegheny Energy Supply Company R. Paul Smith facility. This unit was installed to serve as an upgrade to the existing ESP system on Unit 4 at the facility. Although this type of unit has seen limited commercial operation, the use of Electrostatic Fabric Filter Baghouse technology is considered technically feasible for this analysis.

Membrane Wet ESP

Membrane wet ESP devices have been evaluated in pilot testing at First Energy's Bruce Mansfield Power Plant. No information was found indicating the full scale commercial operation of these units on utility boilers. However, due to the commercial use of these devices in other industries, use of a membrane Wet ESP is considered technically feasible for this analysis.

Step 3 – Rank Remaining Technically Feasible Control Options

In the BACT analysis for filterable PM_{10} (and consequently $PM_{2.5}$) in Section 4.3.1, the top ranked and remaining control options for control of filterable $PM_{2.5}$ were identified as fabric filter baghouses and ESPs (including WESPs), both providing the maximum degree of emissions reduction of $PM_{2.5}$ emissions from coal-fired units. The additional identified control technologies in Step 1 which were found technically feasible in Step 2 of this analysis will now be evaluated in Step 3.

Intrinsically Coated Fabric or Membrane Fabric Filters

Intrinsically coated fabric filter bags are comprised of coated fibers. This coating material improves the bag durability and reduces the pore size between fibers, thereby improving removal efficiency for smaller particles such as filterable $PM_{2.5}$. Filterable PM control efficiency for standard fabric filter bags is high (i.e. 99 to 99.9 percent). However, limited information is available on the improved removal efficiency that could be expected from coating of the filter bag fibers, and the expected removal efficiency for the smaller particle size fraction of $PM_{2.5}$. In practice it is assumed due to the smaller pore size between fibers in the filter bag that an improved efficiency over standard fabric filter bags would be expected.

Membrane fabric filter bags utilize a coating on the surface of the bag (i.e. Teflon®). This coating reduces the pore size between fibers, thereby improving removal efficiency for smaller particles such as $PM_{2.5}$. However, while improved removal for $PM_{2.5}$ occurs, the coating in the membrane reduces the buildup of filter cake on the surface of the bag, thereby reducing the pressure drop across the baghouse system. This reduces power requirements but the presence of a significant filter cake on the surface of the bags in the fabric filter baghouse is needed for sorbent injection systems upstream of the fabric filter baghouse (i.e. activated carbon injection) for reduction of mercury and sulfuric acid mist emissions. Without a filter cake present on the surface of the bag, the control effectiveness of the proposed control options for both mercury and sulfuric acid mist could be negatively impacted. EPA has conducted numerous tests on fabrics for filters and have found that as a whole, the membrane (coated) fabric types performed better and achieved greater filterable $PM_{2.5}$ removal during verification testing than the non-membrane (coated) fabrics. Discussions with a baghouse filtration vendor also confirmed that coated fabric filter bag types would have improved performance over non-coated fabric filter bag types. Therefore, membrane fabric filter bags and intrinsically coated filter bags will be considered further in this analysis.

Electrostatic Fabric Filters

According to vendor information for the GE Max 9 Electrostatic Fabric Filter Baghouse, the system operates at a pressure drop about 25% of a normal fabric filter baghouse, allowing the system to operate at an air-to-cloth ratio higher than a conventional fabric filter. The system can therefore treat a significant gas volume with a small footprint at high efficiency. Vendor information for the GE Max 9 unit indicates that the control efficiency for PM could be as high as 99.999%, with an 80-90% reduction in sub-micron particulate matter emissions.

There is a limited full scale operational history for the GE Max 9 Electrostatic Fabric Filter Baghouse. A unit was installed on the Allegheny Energy Supply Company R. Paul Smith facility. This unit was installed to serve as an upgrade to the existing ESP system on Unit 4 at the facility. Installation of the unit was not considered a major modification, and no BACT analysis was conducted for installation of the unit. A literature search could not locate any $PM_{2.5}$ testing data to demonstrate the operational performance of the GE Max 9 unit installed at the R. Paul Smith facility.

Due to the lack of available data regarding the performance of the operational performance of these units in relation to $PM_{2.5}$ emissions reductions, ranking of this system is difficult. Vendor information for the system indicates that the systems were designed as polishing units and not intended as a stand alone system. An assessment of a similar control technology in Section 4.3.1, the Advanced Hybrid Particulate Collector, indicated that those systems were still being evaluated, and were not yet commercially available. A demonstration project of the Advanced Hybrid Particulate Collector indicated difficulties in meeting project objectives.

Due to the lack of available data regarding the effectiveness of the Max 9 Electrostatic Fabric Filter Baghouse in control of filterable $PM_{2.5}$ emissions, these units will no longer be considered in this analysis.

Membrane Wet ESP

Membrane wet ESP devices have been evaluated in pilot testing at First Energy's Bruce Mansfield Power Plant. No information was found indicating the full scale commercial operation of these units on utility boilers. A technical report on the performance of the membrane wet ESP during pilot testing indicated performance of the unit only marginally better than a wet ESP unit (96% vs. 93% for $PM_{2.5}$). However, performance data regarding the $PM_{2.5}$ collection efficiency of these units is limited. The main advantages of these systems are indicated as higher corrosion resistance when compared to metal plate wet ESPs, reduced maintenance requirements when compared to metal plate wet ESPs, and cost savings from using membrane material as opposed to metal plates. Since the limited operational effectiveness of these units indicates an expected control efficiency of $PM_{2.5}$ comparable to that of a standard wet ESP unit, it is assumed that these units will have similar control efficiencies for $PM_{2.5}$ as standard metal plate type wet ESPs.

Step 4 – Evaluate Remaining Control Technologies

The top control technologies identified in Section 4.3.1. included fabric filter baghouses and ESPs (including WESPs). The chosen BACT technology was Fabric Filter Baghouse. Additional top control technologies identified in Steps 1 thru 3 of this analysis includes use of intrinsically coated fabric and membrane filter bags (as part of a fabric filter baghouse system). No energy, economic, or environmental impacts would preclude use of this control technology for control of filterable $PM_{2.5}$ emissions.

Direct $PM_{2.5}$ Emissions

Condensable $PM_{2.5}$

Condensable $PM_{2.5}$ emissions will be a result of organic condensables (VOCs), acid gases (i.e. sulfuric acid mist), as well as reaction products within the exhaust gas stream (i.e. ammonia and sulfate forming ammonium sulfate). The formation of ammonium compounds through exhaust gas stream reactions will largely be a function of the ammonia slip from the Selective Catalytic Reduction (SCR) system, which will be minimized through proper operation of the SCR system.

Control technologies identified for condensable PM were addressed in the BACT control technology evaluations for VOC and sulfuric acid mist in Section 4.3.4 and Section 4.3.7 of the application. Those technologies identified for control of VOC and sulfuric acid mist would also be effective control technologies for the control of condensable $PM_{2.5}$. No additional control technologies were found for evaluation of condensable $PM_{2.5}$ as part of this updated assessment.

Evaluation of control technologies for the control of VOC emissions in Section 4.3.4 indicated combustion controls as the top control option. Evaluation of control technologies for the control of sulfuric acid mist emissions in Section 4.3.7 indicated use of sorbent injection and use of a wet ESP as the top control options. Coal cleaning and coal selection are already an integral part of other BACT analyses (i.e. SO_2) within the application. Therefore, the most effective controls for control of condensable $PM_{2.5}$ would include use of combustion controls, sorbent injection, and use of a wet ESP.

As discussed in Section 4.3.4, no energy, environmental, or economic impacts would preclude use of combustion controls on the supercritical pulverized coal fired boiler. The energy, economic, and environmental impacts of use of sorbent injection and wet ESP for control of sulfuric acid mist emissions were evaluated in Section 4.3.7. The results of this analysis found that use of a wet ESP for control of sulfuric acid mist emissions, and consequently condensable $PM_{2.5}$ emissions, would be economically infeasible. The analysis found that BACT for sulfuric acid mist emissions was use of sorbent injection in conjunction with use of a wet scrubber (co-benefit). Therefore, BACT for control of condensable $PM_{2.5}$ emissions would be use of combustion controls, sorbent injection, and use of a wet scrubber. The Sulfuric Acid Mist BACT emission limit has been determined to be 0.004 lb/MMBtu, and the VOC BACT emission limit has been determined to be 0.003 lb/MMBtu.

Indirect $PM_{2.5}$ Emissions (Precursors)

Indirect $PM_{2.5}$ is $PM_{2.5}$ formed in the atmosphere from emissions of other pollutants that react and form particles or aerosols that analyze as $PM_{2.5}$. These other pollutants are referred to as precursors. The four primary precursors of $PM_{2.5}$ identified by the EPA in the May 16, 2008 Rule included Sulfur Dioxide (SO_2), Nitrogen Oxides (NOx), Volatile Organic Compounds (VOCs), and Ammonia. Although EPA recognized ammonia as a compound that could form indirect $PM_{2.5}$, they also recognized that elimination of ammonia would potentially form even more hazardous $PM_{2.5}$. Considering this fact and the fact that ammonia is prevalent in the atmosphere from biogenic sources EPA concluded that generally ammonia need not be evaluated in developing requirements to control $PM_{2.5}$. Similarly, EPA has determined that not enough is known about VOC's role in the formation of $PM_{2.5}$ to require controls of that pollutant. Also, higher molecular weight VOC would condense and fall in the category of condensable particulate, which is direct particulate and therefore regulated.

The remaining precursors SO_2,and NOx were evaluated through the BACT process in Section 4.3 of the application. In those sections a complete technology assessment was provided that determined which control technology would best reduce emissions of these two pollutants.

NOx plays a role in both the formation of ozone and the formation of $PM_{2.5}$. Typically the control of this pollutant is predominantly associated more with the control of ozone formation rather than $PM_{2.5}$. That is because the chemical reactions that form nitrates, particularly ammonium nitrate (that comprises $PM_{2.5}$), unlike sulfates, are reversible reactions. Therefore the net result NOx has less of an impact on fine particulate formation than SO_2. BACT for NOx emissions was determined to be the installation of an SCR unit in conjunction with low NOx burners and overfire air.

In the SCR unit ammonia is reacted with the exhaust gas in the presence of a catalyst to form nitrogen and water vapor. These control units have been installed in approximately 17% of the utility boilers that exist nationwide and they have demonstrated their effectiveness in reducing NOx. Typically these types of units have only been required to operate during the ozone season but we are proposing to require the unit to operate year round. The Plant Washington control method does not solely rely on SCR's to reduce NOx. The type of burners installed on the unit will be a low NOx burners with overfire air which minimizes the amount of NOx that has to be treated in the SCR. Considerable evidence demonstrates that lowering the inlet concentration to the SCR lowers the NOx removal efficiency. Overall, however, the amount of NOx is minimized in the planned configuration. The proposed BACT limit for NOx is 0.05 lb/MMBtu on a 30 day average basis. This limit is the lowest permitted level for similar boilers and for the shortest time period for this emission level. By setting this level the amount of indirect $PM_{2.5}$ created from NOx is also minimized.

SO_2 plays a similar role in the formation of $PM_{2.5}$ as NOx. The SO_2 emitted into the atmosphere is oxidized in the atmosphere in the presence of condensed water vapor (clouds) to form sulfate containing aerosols. Ammonia in the atmosphere that occurs both naturally and from man-made sources reacts with the sulfate ions to form ammonium sulfate particulate. This particulate then agglomerates with other particles in the atmosphere to form filterable $PM_{2.5}$. Control of SO_2 emissions therefore controls a portion of $PM_{2.5}$.

Section 4.3.5 provides in detail a BACT analysis for SO_2. In that section a review of control technologies is assessed to determine the most effective means of reducing SO_2. Typical controls for similar types of boilers have been dry scrubbers in the past. However in our research we found that wet scrubbing technology to be superior in removing SO_2, so that is the proposed control technology. An evaluation was made to determine what the best performance that can be expected from a wet scrubber for removal of SO_2. Removal efficiencies were calculated for existing scrubbers by reviewing CEM data provided by EPA's Clean Air Markets Program, and comparing those emissions to reported sulfur content of the coal being burned documented in the FERC database.

Using this data an SO_2 removal efficiency was determined for each of the reported units. Then, a BACT removal efficiency was determined from those units by evaluating the best performers. In this manner BACT was determined to be 0.052 lb/MMBtu on a 12 month rolling average basis and 0.069 lb/MMBtu on a 30-day rolling average basis. BACT is also being proposed as a minimum removal efficiency of 97.5% removal. By controlling SO_2 in this manner reduces the potential for $PM_{2.5}$ formation downwind of the facility.

Step 5 – Selection of BACT

RBLC and Literature Review

A review of information on the RBLC database for $PM_{2.5}$ emissions found only 19 facilities which had established $PM_{2.5}$ BACT or LAER emission limits. Table F-6 provides a listing of those for coal fired boilers. None of these units were pulverized coal utility boilers. Three of these units were Circulating Fluidized Bed (CFB) boilers, with two units at the Virginia Electric and Power Company Virginia City Hybrid Energy Center and one unit at the Northern Michigan University Ripley Heating Plant. The Northern Michigan CFB unit is a 185 MMBtu/hr wood and coal fired unit with an indicated a filterable $PM_{2.5}$ BACT limit of 0.03 lb/MMBtu. However, a footnote for this site indicates that the $PM_{2.5}$ BACT limit was established through use of the PM_{10} surrogacy approach per the 1997 EPA memorandum. Therefore, this limit is not an effective basis of comparison to Plant Washington.

The Virginia City CFB boiler units are 3132 MMBtu/hr units indicated as using coal and coal refuse. The RBLC listing indicates a filterable $PM_{2.5}$ BACT emission limit of 0.012 lb/MMBtu. However, these same sources also list a filterable PM_{10} BACT emission limit of 0.012 lb/MMBtu. Although not indicated in the RBLC database listing, the Virginia DEQ was contacted and the Virginia DEQ noted that the RBLC database incorrectly noted that the limits were filterable (they are total, both filterable and condensable).

With a lack of information regarding proposed $PM_{2.5}$ BACT emission limits, a literature review was conducted to determine other sources which may have undergone a $PM_{2.5}$ BACT analysis. Only one such site was located, the Southern Montana Electric Highwood Generating Station in Montana. This proposed site is a 250 MW coal fired facility near Great Falls, Montana using a Circulating Fluidized Bed (CFB) boiler. The original application for the site addressed $PM_{2.5}$ BACT through the PM_{10} surrogacy approach. However, through a permit appeal process the Montana Board of Environmental Review issued a decision requiring the applicant to prepare a $PM_{2.5}$ BACT analysis. The applicant prepared a $PM_{2.5}$ BACT analysis, proposing at one point a $PM_{2.5}$ BACT emission limit of 0.02 lb/MMBtu, comprising a filterable $PM_{2.5}$ portion of 0.012 lb/MMBtu, and a condensable $PM_{2.5}$ portion of 0.008 lb/MMBtu. However, when the Montana DEQ issued the revised permit for the site, a numerical $PM_{2.5}$ emission limit was not included in the permit. The permit specified control equipment and a future permit modification to establish a numeric emission limit once a reference method is finalized by the EPA. The overall CFB boiler control strategy included limestone injection into the boiler, Selective Non-Catalytic Reduction (SNCR), Hydrated Ash Re-injection (HAR), Activated Carbon Injection, Intrinsically Coated Fabric Filter Baghouse, and an enhanced dry scrubber with hydrated lime injection.

<u>$PM_{2.5}$ Emissions Estimate</u>

$PM_{2.5}$ emissions for the Plant Washington facility main supercritical boiler were estimated using the proposed PM_{10} BACT emission limits and the estimated condensable portion of PM_{10}. The proposed PM_{10} BACT limit is 0.012 lb/MMBtu filterable PM_{10} (termed filterable PM due to the CEM compliance method), and 0.018 lb/MMBtu total PM_{10}. This would infer a condensable PM_{10} value of 0.006 lb/MMBtu as an engineering estimate. Since all condensable PM is presumed to be less than 2.5 microns in size, based on EPA documentation, the condensable $PM_{2.5}$ emissions would therefore be approximately 0.006 lb/MMBtu. Please note that this differs from the sum of the proposed VOC BACT emission limit (0.003 lb/MMBtu) and the proposed sulfuric acid mist BACT emission limit (0.004 lb/MMBtu) of 0.007 lb/MMBtu, since it is presumed that not all VOC emissions will be considered "condensable" $PM_{2.5}$ and a fraction will permeate as vapor phase VOC, later potentially taking part in secondary atmospheric reactions to form $PM_{2.5}$ as a precursor.

The filterable $PM_{2.5}$ emissions were estimated from the proposed PM_{10} filterable BACT emission limit of 0.012 lb/MMBtu, and particle size distribution data from AP-42, Table 1.1-6 for coal combustion and utilization of a baghouse. This data indicates that the filterable $PM_{2.5}$ portion of PM would be 53%. The filterable PM (instead of PM_{10}) value is evaluated since the proposed compliance monitoring method for Plant Washington for PM is use of PM CEMS, which measures filterable PM. Using this estimate of 53% (applied to 0.012 lb/MMBtu) provides an estimate of 0.00636 lb/MMBtu filterable $PM_{2.5}$. Using an estimate of 0.00636 lb/MMBtu for filterable $PM_{2.5}$, and an estimate of 0.006 lb/MMBtu for condensable $PM_{2.5}$, provides an emission estimate of 0.01236 lb/MMBtu for total $PM_{2.5}$.

<u>$PM_{2.5}$ Compliance Test Methods</u>

Compliance test methods for evaluating emissions of $PM_{2.5}$, both filterable and condensable, are still in development. Such test methods include condensable test methods OTM-28 and CTM-39, and OTM-27 for filterable $PM_{2.5}$ (adding the $PM_{2.5}$ cyclone method to 201 and 201A). OTM-28 (revised Method 202) has been proposed and is currently in the comment period, and will be undergoing field tests by EPA in the next couple of months depending on approval of the test plan and QA plan. CTM-39 is scheduled for additional field testing later this year, depending on site availability. A proposal for this test method could be posted in the Federal Register early next year.

Also, test methods OTM-28 and CTM-39 are for "dry" stacks (no water droplets present). Therefore, these test methods would not be applicable while sampling in a "wet" stack, as would be present following a wet scrubber as at Plant Washington. EPA is in the initial stages of developing a "wet" PM method for $PM_{2.5}$ and condensable PM, and has not yet conducted initial feasibility tests. These "wet" test methods will be proposed at an unknown time in the future. Therefore, in the absence of sampling the exhaust gas for $PM_{2.5}$ ahead of the Plant Washington wet scrubber, the test methods that Plant Washington would utilize for measurement of $PM_{2.5}$ at the stack are unknown.

Proposed BACT

As determined through the assessments discussed above, BACT for control of filterable $PM_{2.5}$ is determined as use of a fabric filter baghouse, BACT for control of condensable $PM_{2.5}$ is determined as use of combustion controls, sorbent injection, and a wet scrubber, and BACT for control of $PM_{2.5}$ precursor emissions is use of combustion controls, Selective Catalytic Reduction (SCR) in conjunction with low NOx burners and Overfire Air, and use of a wet scrubber. By maintaining compliance with the VOC and Sulfuric Acid Mist BACT emission limits, emissions of condensable $PM_{2.5}$ will be effectively controlled. Also, through compliance with the SO_2 and NOx BACT emission limits for the facility, indirect $PM_{2.5}$ emissions (precursors) will also be effectively controlled.

There are operational issues of concern regarding the use of coated filter bags because of a potential loss of filter cake and how that may impact collection of other pollutants. However this fact needs to be weighed with the performance of other removal techniques that will be employed for control of these pollutants. **Therefore, the proposed $PM_{2.5}$ BACT is a work practice to evaluate coated bags for removal of $PM_{2.5}$ as they become available in the future.** At this time the improved performance of these type of bags cannot be quantified so the proposed $PM_{2.5}$ BACT emission limit for the main boiler for Plant Washington is based on the limited information provided in AP-42 regarding the percentage of $PM_{2.5}$ in the total filterable portion (i.e. 0.01236 lb/MMBtu, total filterable and condensable on a 3-hr. average basis, and a filterable $PM_{2.5}$ BACT emission limit of 0.00636 lb/MMBtu on a 3-hr. average basis).

Although there is no reference method available for measurement of $PM_{2.5}$ emissions, at this time compliance would be proposed to be demonstrated through use of EPA Method 201/201A (including OTM-27) for measurement of filterable $PM_{2.5}$, and OTM-28/CTM-39 for measurement of condensable $PM_{2.5}$. Since development of measurement of $PM_{2.5}$ from a "wet" stack is still under development, any future proposed testing protocol for the main boiler for $PM_{2.5}$ emissions (following construction of the site) would address and justify use of any promulgated reference methods in the interim period between permit issuance and construction/operation of the source.

Table F-6 RBLC Permit Listings for $PM_{2.5}$ for Coal Fired Boilers

Facility Name	Facility State	Permit Number	Permit Date	Process Name	Fuel	Capacity (MMBtu/hr)	Control Description	Emission Limit	
Virginia Electric and Power Company Virginia City Hybrid Center	VA	11526	6/30/08	2 Circulating Fluidized Bed Boilers	Coal and Coal Refuse	3132	Good Combustion Practices and Baghouse	0.012 (Total)[1]	lb/MMBtu
Northern Michigan University Ripley Heating Plant	MI	60-07	5/12/08	CFB Boiler	Wood and Coal	185	Cyclone Plus Fabric Filter	0.03 (Filterable)[2]	lb/MMBtu
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Waste Heat Boilers (6)	Pulverized Coal	60	Lime Spray Dryer and Baghouse	21.48 (Filterable)[3]	lb/hr
								0.0127 (Filterable)[3]	gr/dscf
								0.036 (Filterable)[3]	lb/MMBtu

[1] Emission limit for Total $PM_{2.5}$ is the same as the emission limit for total PM_{10}. A provision is present to allow an increase of the total PM_{10} limit up to 0.03 lb/MMBtu based on stack testing results for the filterable and condensable fractions. There is no provision for increasing the total $PM_{2.5}$ limit. Emission limit is a 3-hr average.

[2] Emission limit for filterable $PM_{2.5}$ is the same as the emission limit for filterable PM_{10}. Notation indicated; *PM-2.5 IS ESTABLISHED USING PM-10 AS A SURROGATE PER USEPA MEMORANDUM FROM JOHN S. SEITZ, DIRECTOR OAQPS TO REGIONAL AIR DIRECTORS, "INTERIM IMPLEMENTATION OF NEW SOURCE REVIEW REQUIREMENTS FOR PM2.5" (OCT. 23, 1997)*. Compliance method is stack testing and COMS.

[3] Emission limit basis is indicated as LAER. Notation indicated; *THE STACK EMISSIONS FROM EACH ROTARY HEARTH FURNACE AND ITS DEDICATED BOILER (EACH OF 6 STACKS) SHALL NOT EXCEED 86.80 TONS PM10/YR AS A ROLLING 12-MONTH SUMMATION. POUND PER HOUR EMISSIONS ARE FOR EACH ROTARY HEARTH FURNACE AND ITS DEDICATED BOILER (EACH OF 6 STACKS). PM10 IS USED AS A SURROGATE FOR PM2.5. FACILITY IS NON-ATTAINMENT FOR PM2.5 AND PSD FOR PM AND PM10.* Emission limit of 0.036 lb/MMBtu indicated as 3-hr average.

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Checked by: KDH 5/13/09

F.3 Auxiliary Boiler

This section contains the BACT analysis for $PM_{2.5}$ for the 240-MMBtu/hr auxiliary boiler unit planned for use at the facility. The composition and amount of $PM_{2.5}$ emissions from the auxiliary boiler would be a function of the fuel type used (i.e. fuel oil), firing configuration of the boiler, and emission controls in place on the unit. The source of "direct" $PM_{2.5}$ emissions from the auxiliary boiler would be a result of incomplete combustion of the fuel and condensable organic substances and acid gases. Incombustible inert matter, or ash, will be in a "filterable" form, and can be controlled through the same means as collection of larger particle size fractions of filterable PM (i.e. PM_{10}). Condensable $PM_{2.5}$ would not be captured on a filter at stack conditions but could condense in the atmosphere to form an aerosol. Condensables could include emissions of pollutants such as Sulfuric Acid Mist (SAM) and Volatile Organic Compounds (VOCs). These indicated pollutants were evaluated for the auxiliary boiler through the BACT process in Section 4.4 of the application. Sources of "indirect" $PM_{2.5}$ emissions are SO_2, NOx, and VOCs which were evaluated for the auxiliary boiler through the BACT process in Section 4.4 of the application. The auxiliary boiler would not be expected to be a significant source of ammonia emissions.

The following $PM_{2.5}$ BACT analysis will first conduct Steps 1 through 4 of the BACT analysis for the major constituents of $PM_{2.5}$, including "direct" filterable $PM_{2.5}$, "direct" condensable $PM_{2.5}$, and "indirect" precursor emissions. The analysis for the auxiliary boiler will then conclude with Step 5 of the BACT analysis providing a summary of the results of the controls for the various constituents of $PM_{2.5}$ and proposing a $PM_{2.5}$ BACT emissions limit for the auxiliary boiler.

F.3.1 BACT Demonstration for Particulate Matter ($PM_{2.5}$) Emissions from the Auxiliary Boiler

$PM_{2.5}$ emissions can be affected by the grade of fuel oil fired in a boiler. PM emissions from oil-fired boilers primarily consist of particles resulting from the incomplete combustion of the oil, and are not correlated to the ash or sulfur content of the oil. Combustion of lighter distillate oil results in lower PM formation than combustion of heavier residual oils.

Direct $PM_{2.5}$ Emissions

Filterable $PM_{2.5}$

Step 1 – Identify All Control Technologies

Control technologies identified for filterable PM_{10} in Section 4.4.1 would also be effective in control of filterable $PM_{2.5}$. Control technologies identified previously for control of filterable $PM_{2.5}$ would include the following;

Table F-7 $PM_{2.5}$ Filterable Control Technologies Identified in Section 4.3.1

Control Technology
Fuel Selection
Fabric Filter Baghouse
Dry ESP
Wet ESP

Note: Control technologies listed above discussed in detail in Section 4.4.1.

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Checked by: KDH 5/13/09

The control technologies identified in Table F-7 were discussed in detail in Section 4.4.1 of the application. Additional technologies were identified Section F.2 for the main facility supercritical pulverized coal fired boiler. These technologies included primarily modified systems (different types of fabric filter bags, membrane wet ESPs, etc.) along with similar technologies as were evaluated previously (fabric filter baghouse/ESP hybrid devices). These technologies are incorporated by reference into this assessment.

Step 2 – Eliminate Technically Infeasible Options

Control technologies identified for filterable PM_{10} in Section 4.4.1 would also be effective in control of filterable $PM_{2.5}$. Control technologies identified previously as being technically feasible for control of filterable $PM_{2.5}$ would include the following;

Table F-8 $PM_{2.5}$ Filterable Control Technologies Identified as Technically Feasible in Section 4.4.1

Control Technology
Fuel Selection
Fabric Filter Baghouse
Dry ESP
Wet ESP

Note: Technical feasibility of control technologies listed above discussed in detail in Section 4.4.1.

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The technical feasibility of the control technologies identified in Table F-8 were discussed in detail in Section 4.4.1 of the application.

Step 3 – Rank Remaining Technically Feasible Control Options

In the BACT analysis for filterable PM_{10} (and consequently $PM_{2.5}$) in Section 4.4.1, Step 3 was conducted. As discussed in Section 4.4.1, the combination of the low duty cycle (10 percent), in conjunction with the placement and configuration of auxiliary boilers, has generally eliminated consideration of add-on control devices. Since the primary purpose of the auxiliary boiler is for startup and shutdown of the main boiler, the operational schedule of the unit has generally precluded the use of add-on control systems. However, fabric filter baghouse and ESP systems (both wet and dry) would be the most effective control options.

Step 4 – Evaluate Remaining Control Technologies

Due to the limited operational hours of the unit, and the corresponding low level of emissions, add-on controls would not be economical for this unit, with costs greater than $100,000/ton. Assuming the unit operates a maximum of 876 hrs/yr, the annualized cost of a baghouse for the unit would be approximately $144,000 (based on EPA cost estimation software), and annual emissions from the unit would be approximately 1.2 tons/yr (see Exhibit A). This provides a $/ton cost of approximately $120,000/ton.

Fuel selection, including use of ultra low sulfur distillate fuel oil (if commercially available) would be considered BACT for filterable $PM_{2.5}$. If ultra low sulfur fuel is not available the facility will utilize low sulfur fuel.

Direct $PM_{2.5}$ Emissions

Condensable $PM_{2.5}$

Condensable $PM_{2.5}$ emissions will be a result of organic condensables (VOCs), acid gases (i.e. sulfuric acid mist), as well as any reaction products within the exhaust gas stream.

Step 1 – Identify All Control Technologies

Control technologies identified for condensable PM were addressed in the BACT control technology evaluations for the auxiliary boiler for VOC and sulfuric acid mist in Section 4.4.4 and Section 4.4.6 of the application. Those technologies identified for control of VOC and sulfuric acid mist would also be effective control technologies for the control of condensable $PM_{2.5}$. Control technologies identified previously for control of condensable $PM_{2.5}$ would include the following;

Table F-9 $PM_{2.5}$ Condensable Control Technologies Identified in Sections 4.4.4 and 4.4.6

Control Technology
Combustion Controls
Add-on Controls (i.e. afterburners, dry scrubber)
Fuel Selection

Note: Control technologies listed above discussed in detail in Section 4.4.4 and 4.4.6.

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Control technologies identified in Table F-9 are discussed in detail in Section 4.4.4 and 4.4.6 of the application. No additional control technologies were found for evaluation of condensable $PM_{2.5}$ as part of this updated assessment.

Step 2 – Eliminate Technically Infeasible Options

Control technologies for control of condensable $PM_{2.5}$ would be the same as those control technologies identified for control of VOCs and sulfuric acid mist in Section 4.4.4 and Section 4.4.6 of the application. These control technologies which were identified previously as being technically feasible would include the following;

Table F-10 $PM_{2.5}$ Condensable Control Technologies Identified as Technically Feasible in Section 4.4.4 and 4.4.6

Control Technology
Combustion Controls
Add-on Controls (i.e. afterburners, dry scrubber)
Fuel Selection

Note: Technical feasibility of control technologies listed above discussed in detail in Section 4.4.4 and 4.4.6.

Prepared by: JDF 5/13/09
Checked by: KDH 5/13/09

The technical feasibility of the control technologies identified in Table F-10 were discussed in detail in Sections 4.4.4 and 4.4.6 of the application. No additional control technologies were found to be technically feasible for control of condensable $PM_{2.5}$ as part of this updated assessment.

Step 3 – Rank Remaining Technically Feasible Control Options

The combination of the low duty cycle (10 percent), in conjunction with the placement and configuration of auxiliary boilers, has generally eliminated consideration of add-on control devices. Since the primary purpose of the auxiliary boiler is for startup and shutdown of the main boiler, the operational schedule of the unit has generally precluded the use of add-on control systems. Use of combustion controls and fuel selection would be the top ranked control options for control of condensable $PM_{2.5}$.

Step 4 – Evaluate Remaining Control Technologies

No energy, environmental, or economic impacts associated with the use of combustion controls or fuel selection would preclude their use as BACT for the auxiliary boiler. Therefore, BACT for condensable $PM_{2.5}$ for the auxiliary boiler would be use of combustion controls and fuel selection, utilizing ultra low sulfur fuel (if commercially available). If ultra low sulfur fuel is not available, the facility will utilize low sulfur fuel.

Precursor $PM_{2.5}$ Emissions

The four primary precursors of $PM_{2.5}$ identified by the EPA in the May 16, 2008 Rule included Sulfur Dioxide (SO_2), Nitrogen Oxides (NOx), Volatile Organic Compounds (VOCs), and Ammonia. The Rule further specified that VOCs and Ammonia were not regulated as precursors unless the State demonstrated that they were significant contributors to formation of $PM_{2.5}$ for an area in the State. Significant emissions of ammonia would not be expected from the auxiliary boiler.

A BACT analysis for the $PM_{2.5}$ precursors NOx, VOC, and SO_2 was conducted in Sections 4.4.2, 4.4.4, and 4.4.5 of the application. Although VOC was evaluated above as a portion of "direct" condensable $PM_{2.5}$, organics emitted from the supercritical pulverized coal boiler could also conceivably be emitted in a vapor phase form and undergo secondary atmospheric reactions to form $PM_{2.5}$.

Step 1 Through Step 4 of the NOx, SO_2, and VOC Analyses

The BACT analyses in Section 4.4.2, 4.4.4, and 4.4.5 determined that use of low NOx burners and flue gas recirculation were BACT for control of NOx emissions for the auxiliary boiler, that combustion controls were BACT for control of VOC emissions from the auxiliary boiler, and use of ultra low sulfur fuel (if commercially available) was BACT for control of SO_2 emissions from the auxiliary boiler. Through implementation of these control technologies, and the proposed BACT emission limits for NOx, SO_2, and VOC, the emission of $PM_{2.5}$ precursors from the auxiliary boiler at Plant Washington will be minimized to the degree of reduction required through application of BACT.

Step 5 – Selection of BACT

RBLC and Literature Review

A review of information on the RBLC database for $PM_{2.5}$ emissions found only 19 facilities which had established $PM_{2.5}$ BACT or LAER emission limits. Several of these units were identified as auxiliary boilers, or small industrial type boilers. All but one of these boilers utilized natural gas as fuel. The auxiliary boiler for the Virginia Electric and Power Company Virginia City Hybrid Energy Center is the only oil fired unit and Table F-11 provides the information from the database and a total $PM_{2.5}$ emission rate of 0.024 lb/MMBtu was proposed.

With a lack of information regarding proposed $PM_{2.5}$ BACT emission limits, a literature review was conducted to determine other similar sources which may have undergone a $PM_{2.5}$ BACT analysis. No such information was found during the literature review.

$PM_{2.5}$ Emissions Estimate

$PM_{2.5}$ emissions for the Plant Washington facility auxiliary boiler were estimated using the proposed PM_{10} BACT emission limits and the estimated condensable portion of PM_{10}. The proposed PM_{10} BACT limit is 0.014 lb/MMBtu filterable PM_{10}, and 0.024 lb/MMBtu total PM_{10}. This would infer a condensable PM_{10} value of 0.01 lb/MMBtu as an engineering estimate. As all condensable PM is presumed to be less than 2.5 microns in size, based on EPA documentation, this would infer that the condensable $PM_{2.5}$ emissions would be approximately 0.01 lb/MMBtu.

The filterable $PM_{2.5}$ emissions were estimated from the proposed PM_{10} filterable BACT emission limit of 0.014 lb/MMBtu, and particle size distribution data from AP-42, Table 1.3-6 for distillate oil combustion (uncontrolled). This data indicates that the filterable $PM_{2.5}$ portion of PM would be 12%. Using this estimate of 12% (applied to 0.014 lb/MMBtu) provides an estimate of 0.00168 lb/MMBtu filterable $PM_{2.5}$. Using an estimate of 0.00168 lb/MMBtu for filterable $PM_{2.5}$, and an estimate of 0.01 lb/MMBtu for condensable $PM_{2.5}$, provides an emission estimate of approximately 0.012 lb/MMBtu for total $PM_{2.5}$.

$PM_{2.5}$ Compliance Test Methods

As discussed above for the main facility supercritical pulverized coal boiler, compliance test methods for evaluating emissions of $PM_{2.5}$, both filterable and condensable, are still in development. At this time, the proposed compliance methods for filterable and condensable $PM_{2.5}$ for the auxiliary boiler would include fuel specification and engineering controls (combustion controls).

Proposed BACT

As determined through the assessments discussed above, BACT for the auxiliary boiler for control of filterable $PM_{2.5}$ is determined as fuel selection (ultra low sulfur fuel), **BACT for control of condensable $PM_{2.5}$ is determined as use of fuel selection (ultra low sulfur fuel) and combustion controls, and BACT for control of $PM_{2.5}$ precursor emissions is use of combustion controls and fuel selection (ultra low sulfur fuel.** The proposed $PM_{2.5}$ BACT emission limit for the auxiliary boiler for Plant Washington is 0.012 lb/MMBtu (total filterable and condensable), Compliance will be demonstrated through use of fuel specification and engineering controls.

Table F-11 RBLC Permit Listings for $PM_{2.5}$ for Auxiliary Boiler Units

Facility Name	Facility State	Permit Number	Permit Date	Process Name	Fuel	Capacity (MMBtu/hr)	Control Description	Emission Limit	
Virginia Electric and Power Company Virginia City Hybrid Center	VA	11526	6/30/08	Auxiliary Boiler	Distillate Oil	190	No Controls Feasible	0.024 (Total)[1]	lb/MMBtu

[1] Emission limit for Total $PM_{2.5}$ is the same as the emission limit for total PM_{10}. Limit was derived through the surrogacy approach. No other boilers found in RBLC database listings having $PM_{2.5}$ emission limits and utilizing fuel oil.

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Checked by: KDH 5/13/09

F.4 Cooling Towers

The cooling tower will be a multi-celled, back-to-back-style tower. The purpose of the cooling tower is to reduce the heat released by the condensed steam from the steam turbine. The cooling tower will comprise 34 cells using drift eliminators for the reduction of drift, or the amount of water from the cooling tower carried into the ambient air in liquid form (emission points S-2 through S-35). Mineral matter in the water droplets released in the drift is considered PM emissions. A small portion (< 1%) of the PM emissions from the cooling towers is estimated to be $PM_{2.5}$ emissions. A BACT analysis for PM emissions from the cooling towers is included in Section 4.6.1 of the application.

F.4.1 BACT Demonstration for $PM_{2.5}$ Emissions from the Cooling Towers

Particulate emissions will be generated from the wet cooling towers in the form of drift. Drift is formed when droplets of water are entrained in the exhaust gas stream passing through the cooling tower. As the water in the droplets evaporates, the solids in the water become particulate matter. A portion of the particulate matter generated from the cooling tower would be in the form of $PM_{2.5}$. Emissions of $PM_{2.5}$ from the cooling towers would be assumed to be filterable in nature, with no condensable $PM_{2.5}$ emissions occurring (or precursor emissions).

The only control method available for wet cooling towers is drift eliminators. The design of the drift eliminators dictates their control efficiency. The efficiencies range from 0.05 to 0.0005 percent (gallons of drift per gallons of cooling water). The use of drift eliminators would effectively control $PM_{2.5}$ emissions as well as emissions of PM_{10}.

A review of the RBLC database was conducted to determine if there were any indicated listings of $PM_{2.5}$ BACT emission limits for cooling towers. Several facilities were found in the RBLC database review and is presented in Table F-12. Of these facilities, all but one listed use of drift eliminators with a drift rate of 0.0005 percent as BACT for $PM_{2.5}$ emissions from the cooling towers. One site indicated numeric PM and $PM_{2.5}$ emission limits. However, the values for both PM and $PM_{2.5}$ were identical, and it was indicated that the $PM_{2.5}$ limit was a LAER limit, and likely derived through the surrogacy approach.

The proposed BACT for the cooling towers for $PM_{2.5}$ is the use of ultra-high-efficiency drift eliminators with an efficiency of 0.0005 percent. The proposed method of compliance for $PM_{2.5}$ for the drift eliminators is use of a manufacturer's guarantee and analysis of the quality of the total dissolved solids (TDS) in the cooling tower makeup water, limited to 3,300 mg/L. This drift limit is consistent with BACT evaluations for $PM_{2.5}$ as found in the RBLC database.

Table F-12 RBLC Permit Listings for $PM_{2.5}$ for Cooling Tower Units

Facility Name	Facility State	Permit Number	Permit Date	Process Name	Throughput	Throughput Unit	Control Description	Emissions Limit	Emissions Limit Unit
ConocoPhillips Company Billings Refinery	MT	2619-24	11/19/08	Cooling Water Tower	10000	gal/min	High Efficiency Drift Eliminators	0.0005[1]	% Total Liquid Drift (Filterable)
Competitive Power Ventures, Inc.	MD	CPCN Case No. 9129	11/12/08	Cooling Tower	Not Indicated	---	High Efficiency Drift Eliminators	0.0005[2]	% Drift Loss (Filterable)
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Cooling Towers (12)	1440000	gal/hr	Drift Eliminators	3.42	lb/hr

[1] Emission limit for Filterable $PM_{2.5}$ is the same as the emission limit for Filterable PM_{10}.
[2] Emission limit for Filterable $PM_{2.5}$ is the same as the emission limit for Filterable PM_{10}. Emission limit basis is indicated as LAER.
[3] Emission limit for Filterable $PM_{2.5}$ is the same as the emission limit for Filterable PM. Emission limit basis is indicated as LAER. Notation indicates that emission limit is for all 12 cooling towers combined.

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Checked by: KDH 5/13/09

F.5 Material Handling Systems

Particulate emissions will be generated from material handling systems. In particular, emissions will result from handling systems for coal, limestone, and ash. Section 4.7 of the application addressed BACT for PM emissions from material handling sources. That evaluation would also effectively serve as a BACT evaluation for $PM_{2.5}$ emissions. Emissions of $PM_{2.5}$ from material handling sources would be in a filterable $PM_{2.5}$ only, with no expected emissions of condensable $PM_{2.5}$ (or precursor emissions).

This section addresses material handling (point source) emissions. BACT for PM Emissions from other material handling operations (i.e. coal pile fugitive emissions) was addressed in Section 4.7 of the application. The control strategies indicated for control of fugitive emissions (i.e. water sprays, surfactants, etc.) would also be effective in the control of $PM_{2.5}$ emissions. No information was found regarding more effective control of fugitive $PM_{2.5}$ emissions through use of different crusting agents, watering techniques, etc.

Step 1 – Step 4

BACT for PM for material handling point sources of emissions was determined to be use of a fabric filter baghouse (or cartridge type dust collector for small silo/airflow sources). No economic, energy, or environmental impacts would preclude use of this technology for control of PM for material handling (point source) emissions. Use of these control technologies would also be determined to be BACT for filterable $PM_{2.5}$ emissions.

Step 5 – Selection of BACT

A review of information for the RBLC database found limited data entries for material handling point sources for $PM_{2.5}$ emissions which is presented in Table F-16. All the entries are for the same source (a steel mill) and are listed as LAER. The $PM_{2.5}$ concentration for all of the units is 0.0022 gr/ft^3. Presumably this was derived from the reported proportions of $PM_{2.5}$ in these waste streams which generally is much lower for this industry.

$PM_{2.5}$ emission estimates for material handling point source emissions were evaluated based on information provided in AP-42. The $PM_{2.5}$ size distribution of for ash handling sources while utilizing a baghouse (53%) was determined from AP-42, Table 1.1-6. The $PM_{2.5}$ size distribution for lime/limestone handling sources (27%) was determined from AP-42, Table 11.17-7. The $PM_{2.5}$ size distribution for coal material handling point sources (16%) was determined from AP-42, Appendix B.1, Section 11.10. The following Table F-13 indicates the estimated $PM_{2.5}$ emissions from facility material handling (point) sources.

Table F-13 $PM_{2.5}$ Emission Estimates For Material Handling (Point) Sources

Source	Stack ID	$PM_{2.5}$ Emissions (lb/hr)
Crusher House Dust Collector	S40	0.16
Tripper Deck	S41	0.12
Limestone Preparation Building Silo	S42	5.79E-02
Fly Ash Filter Separator (Fly Ash Mechanical Exhausters)	S43	0.05
Fly Ash Silo	S37	0.03
Mercury Sorbent Silo	S38	1.61E-02
SO_3 Sorbent Silo	S36	1.61E-02
Pre-Treatment Soda Ash Silo	S44	8.04E-03
Pre-Treatment Hydrated Lime Silo	S39	2.17E-03
PRB Stackout (Insertable Dust Collector)	S46	1.03E-02
Illinois No. 6 Stackout (Insertable Dust Collector)	S47	1.03E-02
Limestone Stackout (Insertable Dust Collector)	S48	1.74E-02

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In our BACT investigation for the main boiler we found that some fabrics are more effective than others in removing $PM_{2.5}$. In these applications a lack of build up of filter cake (the only detriment to coated bags) is not a concern. **So BACT for filterable $PM_{2.5}$ for material handling (point) sources at Plant Washington is determined to be the use of a fabric filter baghouse (or cartridge type dust collector) as appropriate and the work practice to identify appropriate filter bag types to minimize $PM_{2.5}$ emissions.** $PM_{2.5}$ BACT emission limits are proposed as those lb/hr estimated emission values from Table F-12 above. Although there is no reference method available for measurement of $PM_{2.5}$ emissions, at this time compliance would be proposed to be demonstrated through use of EPA Method 201/201A (including OTM-27) for measurement of filterable $PM_{2.5}$.

Table F-16 RBLC Permit Listings for $PM_{2.5}$ for Material Handling Sources

Facility Name	Facility State	Permit Number	Permit Date	Process Name	Throughput	Throughput Unit	Control Description	Emissions Limit	Emissions Limit Unit
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Coal Grinding (6)	396.84	T/H	Baghouse	1.4[1] (Filterable)	lb/hr
								0.0022[1] (Filterable)	gr/dscf
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Iron Ore Grinding (6)	992.00	T/H	Baghouse with 2 Cyclones	1.04[1] (Filterable)	lb/hr
								0.0022[1] (Filterable)	gr/dscf
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Scrap, Coal, Iron Ore Barge Unloading	8250647.00	T/YR	Use of Enclosures, Minimizing Drop Height, Venting Transfer Points to a Baghouse	0.93[2] (Filterable)	lb/hr
								0.0022[2] (Filterable)	gr/dscf
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Coal and Iron Ore Unloading and Conveying To Storage (3)	Not Indicated	---	Use of Enclosures and a Baghouse	0.93[2] (Filterable)	lb/hr
								0.0022[2] (Filterable)	gr/dscf
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Conveyors, Hoppers, Screens, to Rotary Hearth Furnace	227.00	T/H	Baghouse	1.40[2] (Filterable)	lb/hr
								0.0022[2] (Filterable)	gr/dscf
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Alloy, Flux, Carbon, Limestone, Coke Handling (2)	227.00	T/H	Use of Enclosures and a Baghouse	1.40[2] (Filterable)	lb/hr
								0.0022[2] (Filterable)	gr/dscf
New Steel International, Inc. Haverhill	OH	07-00587	5/6/08	Direct Reduced Iron Material Handling	227.00	T/H	Building Enclosure, Enclosures, Baghouse	0.47[2]	lb/hr

[1] Emission limit for Filterable $PM_{2.5}$ is the same as the emission limit for Total PM. Basis for $PM_{2.5}$ emission limits indicated as LAER. Notation indicates; *LIMITS FOR EACH INDIVIDUAL BAGHOUSE. PM10 IS USED AS A SURROGATE FOR PM2.5. FACILITY IS NON-ATTAINMENT FOR PM2.5 AND PSD FOR PM AND PM10*

[2] Emission limit for Filterable $PM_{2.5}$ is the same as the emission limit for Total PM. Basis for $PM_{2.5}$ emission limits indicated as LAER.

Table F-17 RBLC Permit Listings for $PM_{2.5}$ for Material Handling Sources Cont.

Facility Name	Facility State	Permit Number	Permit Date	Process Name	Throughput	Throughput Unit	Control Description	Emissions Limit	Emissions Limit Unit
Atofina Petrochemicals Inc.	TX	07-00587	11/5/01	(2) Powder Masterbatch Weight Bin Vent Filter	Not Indicated	---	None Indicated	0.03 (Filterable)	lb/hr
Arkansas Steel Associates	AR	35-AOP-R3	1/5/01	Slag Processing	Not Indicated	---	Water Application to Control Fugitive Emissions	2.9	lb/hr

Prepared by: JDF 5/13/09
Checked by: KDH 5/13/09

F.6 Diesel Engine Generator and Fire Water Pump

A BACT assessment for the diesel engine generator and the Fire Water Pump is included in Section 4.5 of the application. These engines will operate only during emergencies and/or maintenance cycles. The facility plans to limit operating hours of these engines to 500 hours per year for each engine. Typical maintenance operations range from 4 to 8 hours per month.

Emissions of $PM_{2.5}$ from these sources will be effectively controlled through purchase of engines that achieve the emission standards set by the Clean Air Nonroad Diesel Regulations. BACT for $PM_{2.5}$ emissions would be the same as determined for other criteria pollutant emissions for these sources, use of ultra low sulfur fuel (if commercially available).