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Ohio Environmental
Protection Agency
Southeast District

July 21, 2009

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**RE: Ohio EPA's Draft Administrative Modification to the Air Permit for the AMPGS with the Case-by-Case MACT Determination**

Dear Mike and Dean:

American Municipal Power-Ohio, Inc. ("AMP-Ohio") has developed the attachment to this letter to provide the Ohio Environmental Protection Agency ("Ohio EPA") additional information and data to respond to comments from the US EPA and others related to the draft Administrative Modification to the Permit-to-Install for the AMPGS to address the Section 112(g) case-by-case maximum achievable control technology ("MACT") determination. AMP-Ohio has carefully evaluated all of the comments submitted, and has provided significant substantive answers to confirm AMP-Ohio's case-by-case analysis. This response should be considered a supplement to the materials previously submitted by AMP-Ohio as part of the case-by-case Section 112(g) MACT process.

Please contact me if you have any questions concerning this letter or attachment.

Sincerely,

Randy Meyer
Director of Environmental Affairs

Attachment

cc: Bob Hodanbosi (w/attachment)
Misty Parsons (w/attachment)
Scott Kiesewetter (w/o attachment)

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## AMP'S SUPPLEMENT IN RESPONSE TO QUESTIONS CONCERNING THE SECTION 112(g) DETERMINATION FOR THE AMPGS

### Introduction

This introduction is provided by AMP to establish background for the response to the five questions posed by US EPA Region 5 as well as other comments submitted to Ohio EPA regarding the case-by-case Section 112(g) proposed Permit-to-Install (PTI) administrative modification for the AMPGS. AMP has carefully evaluated all comments submitted and has provided significant substantive answers herein related to AMP's case-by-case analysis. In addition, based on the comments, AMP has concluded that additional reductions may be "achievable" for AMPGS. As such, AMP has presented lower emission limits than have previously been established in the draft administrative action. This response should be considered a supplement to the materials already submitted by AMP as part of the case-by-case Section 112(g) MACT process.

The federal Clean Air Act Amendments of 1990 established the requirements for Maximum Achievable Control Technology (MACT) standards to limit emissions of hazardous air pollutants (HAPs) from existing and new major sources of HAPs emissions. Section 112(c) of the Clean Air Act requires US EPA to list source categories and subcategories for the adoption of MACT standards. Section 112(d) requires the Administrator of US EPA to adopt MACT standards for each category or subcategory of sources identified pursuant to Section 112(c) and authorizes the Administrator to "distinguish among classes, types, and sizes of sources within a category or subcategory in establishes such standards".

MACT standards promulgated by US EPA under Section 112(d) "*shall require the maximum degree of reduction in emissions of the hazardous air pollutants subject to this section...that the Administrator, taking into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements, determines is achievable*". Section 112(d)(3) goes on to direct that "*The maximum degree of emission reduction that is deemed achievable for new sources in a category or subcategory shall not be less stringent than the emission control that is achieved in practice by the best controlled similar source, as determined by the Administrator.*"

Electric utility generating units (EGU) were not included in the original source category list compiled by US EPA pursuant to Section 112(c).[1] This was due to the fact that Section 112(n) of the Clean Air Act required that the US EPA study HAP impacts from EGUs to determine if it was appropriate to list EGUs as a source category pursuant to

[1] The initial list of source categories was published in the Federal Register on July 16, 1992. At that time, US EPA stated "*...the Agency agrees that a study of hazards from electric utility steam generating units is required before regulating these units. Given this requirement, the Agency sees little benefit in listing these units unless this study demonstrates significant health hazards, warranting regulation. Hence, electric utility steam generating units, as defined in Section 112(a)(8), are not included on today's initial list of categories of major sources and area sources.*"

Section 112(c) and regulate HAP emissions from EGUs pursuant to Section 112(d). US EPA submitted a final study of HAP emissions from EGUs to Congress in February 1998.[2] In December 2000 US EPA published revisions to the source category list to include EGUs as a source category, with mercury (Hg) emissions identified as the pollutant.[3]

During 1999 and 2000, US EPA initiated a process known as the Information Collection Request (ICR) to acquire the information and data needed to develop proposed MACT standard for EGUs. US EPA obtained data concerning the various types of fuels used by utility boilers (the database compiled from this effort is identified as the ICR-2 database) and also obtained data concerning uncontrolled and controlled emissions of mercury from a large cross section of operating utility boilers (the database compiled from this effort is known as the ICR-3 database). These databases have been previously provided by AMP to Ohio EPA as part of the case-by-case MACT process.

US EPA considered all of the information obtained from the ICR process and developed a proposed MACT standard for EGUs as Part 63 Subpart UUUUU that was published in January 2004.[4] At the same time, US EPA also proposed an alternative for regulating mercury from coal-fired EGUs pursuant to the Section 111 New Source Performance Standard (NSPS) (this proposal is known as the Clean Air Mercury Rule or CAMR) and solicited comments regarding a proposal to remove EGUs from the Section 112(c) source category list. US EPA's proposed Section 112(d) MACT for EGUs included proposed subcategories based on rank of coal (e.g., bituminous, sub-bituminous, lignite, etc.) and the basic type of coal combustion process (e.g., pulverized coal, stoker, fluidized bed, etc.). The only HAP that US EPA proposed for regulation from coal-fired EGUs was mercury.

US EPA issued a supplemental notice of proposed rulemaking in March 2004 to propose the Section 111 NSPS provisions of the CAMR cap and trade rules.[5] In December 2004, US EPA published a notice of data availability and solicited additional comments concerning the proposed mercury emissions approach for EGUs.[6]

Following a review of the record of the proposed rulemaking, US EPA determined it was not appropriate or necessary to regulate EGUs under Section 112 and removed EGUs from the Section 112(c) source category list in March 2005.[7] The delisting decision was

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[2] The February 1998 mercury report to Congress is entitled "Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units – Final Report to Congress (RTC)".

[3] 65 FR 79825, December 20, 2000.

[4] 69 FR 4652, January 30, 2004.

[5] 69 FR 12398, March 16, 2004.

[6] 69 FR 69864, December 1, 2004.

[7] 70 FR 15994, March 29, 2005.

based on US EPA's determination that HAP emissions from coal-fired EGUs were effectively controlled by the control technologies required pursuant to other provisions of the Clean Air Act and US EPA regulations. US EPA determined, however, that mercury emissions should be limited and, as a result, finalized the Section 111 NSPS (CAMR) in May 2005.[8] Again, the only HAP that US EPA determined needed to be subject to regulation was mercury.

The final standards adopted by US EPA included the mercury limits for new coal-fired EGUs presented in Table 1.

**Table 1**
**Mercury Emission Limits**
**40 CFR Part 60 Subpart Da § 60.45a**

| Coal Rank (Fuel Type) | 40 CFR Part 60 Subpart Da § 60.45a Final Hg Emission Limitation Expressed in lb Hg/MWh |
|---|---|
| Bituminous | $21 \times 10^{-6}$ lb/MWh (1.94 lb/TBtu for the AMPGS) |
| Sub-bituminous w/wet-FGD | $42 \times 10^{-6}$ lb/MWh (3.88 lb/TBtu for the AMPGS) |
| Sub-bituminous w/dry-FGD | $78 \times 10^{-6}$ lb/MWh (7.21 lb/TBtu for the AMPGS) |
| Bituminous/Sub-bituminous Blend | The emission limitation is computed as a weighted average of the emissions rates authorized for the individual fuels (e.g., if 50% of the MWh output is derived from bituminous coals and 50% is derived from sub bituminous coals and wet-FGD is the control technology, the weighted average emission limit is $31.5 \times 10^{-6}$ lb/MWh). |

AMP submitted its PTI application and technical support materials for the AMPGS to the Ohio EPA in May 2006. At that time, EGUs were not a listed source category for MACT. And, in accordance with state and federal law and regulations, the AMPGS was exempt from the case-by-case Section 112(g) MACT requirements.

When the final PTI was issued for the AMPGS on February 7, 2008, the PTI included terms and conditions that required AMPGS to comply with the federal regulations that limited HAP emissions from EGUs that were in effect at that time (i.e., the mercury emission limits in the NSPS and the CAMR cap and trade program). The final PTI also included "state only" enforceable requirement that were significantly more stringent than the applicable federal requirements and limited mercury emissions from each of the two main boilers at the AMPGS to no more than 1.9 pounds per trillion British Thermal Units of heat input (lb/TBtu) and no more than 86 pounds per rolling 12-month period. The

[8] 70 FR 28606, May 18, 2005.

"state only" mercury limitations were established by the Director of Ohio EPA pursuant to Ohio Administrative Code (O.A.C.) rule 3745-31-05(C).

After the final PTI was issued for the AMPGS, the D.C. Circuit Court of Appeals issued a ruling in *New Jersey v. EPA*, 517 F.3d 574 (D.C. Circuit 2008) that had the effect of making EGUs a listed source category for MACT standards. Appeal of this decision was immediate and the matter was not determined with finality until February 24, 2009. Subsequent to this ruling but while the legal appeals were still pending, AMP prepared and submitted an analysis to define a case-by-case MACT. Ohio EPA had determined that Section 112(g) of the Clean Air Act and O.A.C. 3745-31-28 required that a temporary MACT standard be included in the permit for the AMPGS because it was a major source of HAP emissions that fell within a category of sources that are listed under Section 112(c), and US EPA had not yet adopted a MACT standard for EGUs pursuant to Section 112(d).

The case-by-case MACT limitations included in the PTI for the AMPGS will remain in effect until those limitations are replaced by the final Section 112(d) MACT standard adopted by US EPA. If the Section 112(d) MACT standard adopted by US EPA is more stringent than the case-by-case Section 112(g) MACT established in the permit issued by Ohio EPA, AMP must comply with the promulgated Section 112(d) standard as expeditiously as practicable, but not longer than 8 years after such standard is promulgated. If the Section 112(d) MACT standard adopted by US EPA for EGUs is less stringent than the level of control required by standards set by Ohio EPA, Ohio EPA has the discretion to determine whether or not to incorporate the less stringent terms of the promulgated standard in the operating permit for the AMPGS.

Thus, the case-by-case MACT determination made by Ohio EPA for the AMPGS will be a temporary standard that could remain in effect for only a short period of time after the facility commences operation (i.e., until such time that an EGU MACT is finalized).

## Basic Principles of Section 112(g) MACT Determinations

As explained in AMP's July 2008 submittal, O.A.C. rule 3745-31-28(E)[9] identifies five principals that are applicable to the case-by-case Section 112(g) MACT determination for the AMPGS:

(1) The case-by-case Section 112(g) MACT emission limitation or MACT requirements recommended by AMP and approved by the Director of Ohio EPA can not be less stringent than the emission control which is *achieved in practice by the best controlled similar source*, as determined by the Director of Ohio EPA. This can be described as the "MACT floor" analysis;

9 Ohio EPA rule 3745-31-28 is consistent with 40 CFR Part 63 §63.43 (which are the analogous federal rules), including the basic principles for case-by-case MACT determinations made by the Director of Ohio EPA. Ohio's NSR permitting program, including Chapter 31, was fully approved by EPA in January 2003 and became effective on March 10, 2003 (68 FR 2909).

(2) Based upon available information, the case-by-case Section 112(g) MACT emission limitation and control technology recommended by AMP and approved by the Ohio EPA Director must achieve *the maximum degree of reduction in emissions of HAPs which can be achieved by utilizing those control technologies that can be identified from the available information*, taking into consideration the costs of achieving such emission reduction and any non-air quality health and environmental impacts and energy requirements associated with the emission reduction. This can be described as the "beyond the floor" analysis;

(3) AMP may recommend specific design, equipment, work practice, or operational standards or a combination thereof, and the Director of Ohio EPA may approve such a standard if the Director of Ohio EPA specifically determines that it is not feasible to prescribe or enforce an emission limitation;

(4) *If the Administrator* of US EPA *has* either *proposed a relevant emission standard pursuant to section 112(d)* or section 112(h) of the Clean Air Act or adopted a presumptive MACT determination for the source category which includes the constructed or reconstructed major source, then *the case-by-case Section 112(g) MACT requirements* established by the Director of Ohio EPA *must consider those requirements*; and

(5) Any PTI issued for the AMPGS containing a MACT determination must include monitoring, testing, record keeping, and reporting requirements necessary to ensure initial and ongoing compliance with the MACT determination.

## Integration of 112(g) by Ohio EPA

Ohio EPA intends to integrate the case-by-case MACT for AMPGS into existing PTI 06-08138 via the air permitting program found at O.A.C. Chapter 3745-31. This action is consistent with 40 CFR 63.43(c)(2)(ii) which states: when an owner or operator is not required to obtain or revise a title V permit (or other permit issued pursuant to title V of the Act) before construction or reconstruction, the owner or operator shall either, at the discretion of the permitting authority: (i) Apply for and obtain a Notice of MACT Approval according to the procedures outlined in paragraphs (f) through (h) of this section; or (ii) Apply for a MACT determination under any other administrative procedures for preconstruction review and approval established by the permitting authority for a State or local jurisdiction which provide for public participation in the determination. As Ohio EPA knows, AMP applied for a case-by-case MACT determination for the AMPGS pursuant to O.A.C. rule 3745-31-28 and Ohio EPA provided for public participation in the form of both a public notice and comment period and a public hearing (held in Meigs County on June 2, 2009).

## Responses to Questions

**1. US EPA's first question/comment requested confirmation that the case-by-case Section 112(g) MACT analysis demonstrates the MACT limits for the AMPGS are at least as stringent as the best controlled similar source.**

### A. Factors Considered for the Identification of Similar Source

O.A.C. rule 3745-31-01(MMMMM) defines the term "similar source" to mean "...a stationary source or process that has comparable emissions and is structurally similar in design and capacity to a constructed or reconstructed major MACT source such that the source could be controlled using the same control technology." The same definition is found at 40 CFR Part 63 §63.41.

For purposes of determining a "similar source," the Clean Air Act and various court decisions acknowledge that MACT determinations can appropriately consider subcategories of a given source category. CAA Section 112(c-d). US EPA considered the definition of "similar source" in the development of the proposed EGU MACT as well as in the final NSPS for EGUs. In these rulemakings US EPA elected to sub-categorize EGUs on the basis of coal rank, the size of the facility and the plant type. US EPA has utilized subcategorizes in numerous other MACT standards as well. US EPA's proposed MACT is instructive in preparing a case-by-case Section 112(g) MACT analysis as it is US EPA's own proposal and demonstrates intent of US EPA regarding subcategorization.

That said, Ohio EPA has the ultimate latitude and decision-making authority to determine what constitutes a "similar source" for purposes of a case-by-case Section 112(g) MACT determination. In determining what constitutes a "similar source," Ohio EPA can look to guidance from determinations made by other permitting authorities, but Ohio EPA is not bound to follow any previous determination. As explained in previous submissions, Ohio EPA should consider the proposed EGU MACT as well as the final NSPS and CAMR rules; however, Ohio EPA is not bound by the proposal.[10] If Ohio EPA determines that case-specific factors are relevant to the MACT determination, Ohio EPA can consider those factors in defining the source category or subcategory that is similar.

The selection of subcategories for coal-fired EGUs can include an assessment of: (a) the type of fuel(s) that will be burned (e.g., bituminous, sub-bituminous, lignite, coal refuse, or a blend of multiple fuel types); (b) the basic design or type of combustion for the boiler (e.g., pulverized, stoker, cyclone, fluidized bed, etc.); and (c) the size of the boiler (typically expressed in terms of million Btu per hour (mmBtu/hr) heat input or megawatt (MW) power output). There are also interrelationships among these primary factors. In its subcategory consideration for EGUs, US EPA also identified geographic factors as being relevant to the definition of similar sources. Each of these categories is explained in more detail below.

[10] O.A.C. rule 3745-31-28(E)(4).

**Coal Rank and Geographic Considerations.** The characteristics of the fuel or fuel blend are important because the total uncontrolled rate of HAPs emissions will vary depending on the specific fuel(s) employed (e.g., mercury, chlorine, and fluoride content and form vary significantly). The United States Geological Survey (USGS) COALQUAL database indicates that sub-bituminous coals can have a mercury content ranging from 0.3 lb/TBtu to more than 120 lb/TBtu with a mean of 12.67 lb/TBtu with the upper limit nearly 15 lb/TBtu with a 95% confidence level. The same database indicates that bituminous coals can have a mercury content from 0.2 lb/TBtu to more than 220 lb/TBtu with a mean of 14.62 lb/TBtu with the upper limit nearly 16 lb/TBtu with a 95% confidence level. US EPA's statistical analysis of the mercury data obtained from the ICR concluded that the upper end of the range of mercury content was 9.1 lb/TBtu for sub-bituminous coals and 14.27 lb/TBtu for bituminous coals.

Fuel characteristics will also influence the effectiveness of control equipment performance (e.g., chlorine content has an impact on the oxidation of certain forms of mercury which enhance mercury removal with a wet FGD control system). The proposed EGU MACT addressed the importance fuel type/rank in great detail and was developed based on a consideration of different types of coal rank.[11] It should be noted that US EPA has determined that utilizing "fuel switching" to determine MACT is not a viable option because of the inherent variations that occur, design factors associated with certain coal ranks and regional disparities in markets.[12] While Ohio EPA is not bound by this analysis, it is a defensible and reasonable consideration and one which AMP used to determine similar sources; i.e., those utilizing a blend of both bituminous and sub-bituminous coals.

**Unit Design.** The basic design of the boiler will have substantial impact on the control of organic HAPs that are formed as a result of incomplete combustion of the fuel(s). Good combustion design is the basic control approach used to minimize emissions of both carbon monoxide (CO) and volatile organic compounds (VOC) from coal-fired boilers. The features that constitute good combustion design are different for different boiler types (e.g., stoker, pulverized coal, fluidized bed, etc.). In addition, the design features that minimize organic HAP emissions can increase the formation of nitrogen oxides ($NO_x$) emissions. As a result, the boiler design and operating parameters must be balanced to achieve both complete combustion and low $NO_x$ emissions.

Another important consideration related to sub-categorization based on boiler design relates to the ability to achieve complete combustion and the size and shape of particulate matter exhausted. For example, circulating fluidized bed combustors ("CFB")[13] and stoker boilers produce more particulate emissions (including unburned carbon) than pulverized coal boilers. This additional unburned carbon enhances the control of

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[11] 69 FR 4666.

[12] 69 FR 4669 and 69 FR 4678.

[13] See Addendum 1 for further information supporting the exclusion of CFB based on design considerations.

mercury in units equipped with fabric filters for particulate emission control. In developing the proposed EGU MACT, US EPA proposed limits for Integrated Gasification Combined Cycle ("IGCC") units that were distinct from pulverized coal ("PC") units, thus recognizing the fundamental design and combustion differences between the two.[14] Again, while Ohio EPA is not bound by US EPA sub-categorization method, AMP followed the sub-categorization methodology used in the Proposed EGU MACT to determine similar sources as those units utilizing PC technology.

**Unit Size.** The size of an individual boiler is also important to the establishment of appropriate sub-categories. The size of the unit influences the selection of the basic boiler design and also influences other important aspects of the boiler operation and the production of emissions. US EPA has recognized boiler size should be considered in segregating "industrial and commercial size" fuel combustion units from "electric utility size" units for the development of emission factors as well as setting emission limitations pursuant to the NSPS and MACT. The wide-range of EGU boilers sizes makes it appropriate to define EGU sub-categories based on size. As explained in prior submissions, AMP considered PC units at 400 MW and larger, with specific focus on units in the 400-600 MW range.

**Control Equipment Utilized.** As a final distinctive feature of determining what constitutes a similar source, AMP considered the suite of control equipment proposed for AMPGS. While AMP recognizes that control equipment may not be a direct correlation to determining the best controlled similar source (because operating units do not have the same equipment), it should, nonetheless, be considered. This position is consistent with the approach used by US EPA with respect to the EGU source category. Specifically, US EPA set limits and subcategorization for mercury based on the use of wet scrubbers versus dry scrubbers. Again, while Ohio EPA is not bound by this evaluation, AMP believes that consideration of specific and distinct controls is appropriate in determining case-by-case standards. Specifically, AMP has identified the following controls for AMPGS: Wet FGD Scrubber (Powerspan Packed Bed Ammonia), Wet ESP, Fabric Filter, Overfire Air and SCR. As Ohio EPA knows, AMP will be the first large-scale commercial installation of the Powerspan ammonia-based scrubber technology. As such, there is no comparable suite of control equipment operating or being proposed for commercial installation.

## B. Summary of AMP's Determination of the Subcategory of Similar Source

As explained in more detail below, the comparisons made by AMP included EGUs based on basic boiler design, capacity, and type of fuels employed (including geographic considerations) and control equipment utilized or proposed. The comparison units included pulverized coal-fired boilers with a maximum heat input ratings of between 4,000 – 8,000 mmBtu/hr (400 - 800 MW) that can burn eastern bituminous coals blended with sub-bituminous coals. This mix of coals implies the appropriate subcategory includes units that employ a high efficiency FGD scrubber to control sulfur dioxide ($SO_2$)

[14] 69 FR 4652 and 69 FR 4662-4663.

emissions (i.e., dry FGD units cannot control $SO_2$ emissions from the combustion of higher sulfur bituminous coals at a rate comparable to a wet-FGD scrubber).

## C. Achieved in Practice

The case-by-case Section 112(g) MACT limits proposed by Ohio EPA for the AMPGS are at least as stringent as those achieved in practice by the best controlled similar source.[15] Achieved in practice has been defined to be a limit that is continuously achievable under reasonable worst-case conditions. Thus, there must be a safety margin in setting limits to account for operational and monitoring variability. AMP has previously submitted ICR data compiled by US EPA, which remains the most comprehensively available data set relevant to this case-by-case MACT. While this data is informative, it cannot be used on its face to determine the best controlled similar source since the ICR data is only a snapshot of performance (i.e., stack test data over 2-3 days and/or three one-hour testing runs on specific fuels). This rationale has been explained in AMP's previous submittals, including its April 2009 submittal. Thus, the emission monitoring method (e.g., stack test or continuous emissions monitoring (CEM) and the averaging time (e.g., three-hour, 30-day or annual average) are extremely important to the evaluation of the achievability of a particular emission limitation or a comparison of rates from one source to another. Variability in coal quality, boiler operation and control device operation are all factors that influence variability of HAP emissions. The general reliability and accuracy of the measurement methods must also be considered.

**Coal Quality.** US EPA has long recognized that the constituents of coal that contribute to air contaminant emissions (e.g., sulfur content, ash content, and various HAP constituents including mercury, chlorine, and fluorides) vary significantly from one coal producing region to another. Variability also exists from one coal mine to another in a particular region and from one coal seam to another within a particular coal mining area. As AMP has maintained since its initial PTI application in 2006, there is no "best case" coal from a permitting perspective.

The issue of mercury variability is further complicated by the fact that mercury may be present in three different forms in a particular coal, elemental mercury, oxidized mercury and particulate bound mercury. The concentration (or weight percent) of each of these forms of mercury will also vary by coal seam. Much of the mercury in coal is vaporized to elemental mercury during combustion in a boiler. As the boiler flue gases cool, much of the mercury will be transformed to oxidized mercury (e.g., in the form of mercury chloride ($HgCl_2$), mercury oxide (HgO) and mercury sulfate ($HgSO_4$). Mercury oxidation is enhanced when chlorine is present in the fuel and further oxidation of mercury occurs when a coal-fired boiler is equipped with an SCR for $NO_x$ emission control (mercury is oxidized when the flue gas passes through the catalyst). The form that mercury is present in the flue gas impacts the performance of any particular control system (e.g., oxidized mercury is water and ammonia soluble and can be effectively controlled by a high efficiency FGD scrubber system and particle bound mercury can be effectively controlled by fabric filters). The specific performance of any air pollution

[15] O.A.C. rule 3745-31-28(E)(1).

control system (by % control efficiency) in reducing mercury emissions is difficult to predict, however, because the speciation of mercury in power plant flue gas can vary significantly depending on the dynamics of coal properties and combustion conditions.

**Boiler Operation.** Boiler operating variability will also influence emissions variability. Even base load units will experience variability in operating rate, variations in continuous soot blowing and variations in other intermittent maintenance procedures. These operating variables will change conditions in the flue gases that are directed to air pollution control equipment, including the exit gas flowrate, temperature and concentration and form of air contaminants. The results from a single 3-hour emission test or of several 3-hour tests do not fully account for how emissions and other flue gas parameters could change due to changes in the boiler operating variables. Results achieved during a short period term (or a series of short term) test(s) are not indicative of continuously measured, long term performance.

**Control Device Operation.** Modern pulverized coal-fired power plants control air contaminant emissions with a comprehensive system of controls including fuel selection and precision blending, design and operating features in the boiler (e.g., low-$NO_x$ burners, overfire air, good combustion practices, etc.) as well as multiple add-on control devices (e.g., SCR, wet or dry FGD, ESP or fabric filter, wet ESP, etc.) and the integrated design and operating features of the boiler. Moreover, the entire process is carefully controlled with modern neural net control devices that continuously adjust the individual processes to minimize heat rate and satisfy emission limit requirements. Nonetheless, there is variability in the performance of this complex system of air pollution controls that can influence actual emission rates from hour to hour.

**Methods of Measurement.** The concentrations of HAP emissions in boiler flue gases are substantially less than many of the criteria air pollutants. The mercury emission rates being established for new EGUs are approximately $1/10{,}000^{th}$ the emission rates being established as BACT for $PM_{10}$ (filterable) for the same units. While criteria pollutant performance testing and CEM instrumentation and laboratory methods have been refined with more than three decades of experience, the methods for measuring very small amounts of individual HAP pollutants are far less developed. The methods for mercury emissions testing and mercury CEM are still under development. The method employed in the testing performed to respond to the US EPA Information Collection Request (ICR) is known as the Ontario Hydro Method. The Ontario Hydro Method is a short term stack test (i.e., the average of three three-hour runs) conducted at a time known in advance such that boiler operation, pollution control equipment operations, fuel selection, etc. can be carefully controlled and maintained in top form for the duration of the test. Although mercury monitoring technology is not yet mature from a commercial perspective, modern coal-fired EGUs, such as the AMPGS, will be equipped with a mercury CEMS to continuously monitor and record mercury emissions through the entire range of actual conditions associated with fuel, boiler and control system variability.

The measurement of other non-mercury HAPs is complicated by many of the same factors, including very low concentrations in a high volume gas stream, limited experience with the instrumentation/test methods, etc. Emission testing has not been performed for the HAP pollutants that are present in the highest concentrations (e.g., HCl) with the frequency necessary to provide an adequate basis for determining what has been achieved in practice for various subcategories of EGUs. Emission tests for the HAP pollutants that are present in lower concentrations (e.g., toluene, formaldehyde, etc.) have been performed only on a very small number of sources.

**Consideration of Variability.** All of the above factors must be considered as variables when identifying the "best controlled similar source" for the MACT floor. US EPA attempted this prior to publishing the proposed MACT for EGUs in January 2004. US EPA determined that the stack test data collected in the ICR were insufficient to estimate the "worst case" emissions from the best performing facilities. As a result, US EPA performed a statistical evaluation of the mercury emissions data collected from the ICR to determine the "worst case" mercury emissions from the "best controlled similar source". US EPA acknowledged, however, that there were other valid approaches to assessing variability in mercury emissions, including the approach used by the US DOE. DOE's approach differed from US EPA's in that it assumed an EGU could use a coal not previously burned at the unit and alternative coals of the same rank with higher HAP concentrations constitute worst case conditions at the best performing units. DOE's analysis found that an appropriate MACT floor emission rate for mercury was 2.6 lb/TBtu for bituminous coal and 5.4 lb/TBtu for sub-bituminous coal.

US EPA established mercury emission limits in the NSPS adopted on May 18, 2005 by re-examining the ICR data. US EPA used the ICR data because it "*...is the only test data for a large number of Utility Units employing a variety of control technologies currently available to the Agency and because there is very limited permit data for new or projected facilities from which to determine existing Hg emission limits. (The EPA has historically relied on permit data in establishing NSPS limits because it believes that such limits reasonably reflect the actual performance of the unit.)*"

## D. Differing Approaches Used in Case-by-Case Analyses to Determine the Best Controlled Similar Source (MACT Floor)

Case-by-case Section 112(g) assessments submitted by utilities to state air agencies for coal-fired EGUs have evaluated the "best controlled similar source" using various approaches. As should be expected, state air agencies have exercised their discretion and accepted different approaches when issuing construction permits for EGUs.

Table 2, which has been previously submitted to Ohio EPA by AMP, presents the case-by-case Section 112(g) determinations for mercury for several facilities that were issued permits between December 20, 2000 (i.e., the date that EGUs were added to the Section 112(c) category list) and March 29, 2005 (the date that EGUs were removed from the Section 112(c) list) that reflect the differences in approaches to defining the "best controlled similar source" and the MACT floor for mercury.

| Table 2<br>Case-by-Case Section 112(g) MACT Determinations for EGUs<br>During the Period<br>December 20, 2000 through March 29, 2005 | | |
|---|---|---|
| **Company** | **Permit Date** | **Section 112 (g) Mercury Emission Limit(s)** |
| Tucson Electric Power Company Springerville Units 3 and 4 (Sub-bituminous) | April 29, 2002 | 6.9 lb/TBtu |
| MidAmerican Energy Company Council Bluff Energy Center No. 4 Boiler (Sub-bituminous) | June 17, 2003 | 1.7 lb/TBtu |
| Santee Cooper Cross Generating Station Units 3 and 4 (Bituminous) | February 5, 2004 | 3.6 lb/TBtu |
| Longview Power, LLC (Bituminous) | March 2, 2004 | 2.38 lbTBtu (0.0638 TPY) |
| Thoroughbred Generating Company, LLC Units 1 and 2 (Bituminous) | October 29, 2004 Revised on: February 17, 2005 May 10, 2006 | 2.12 lb/TBtu |

More recently, electric utility applicants have attempted to define the best controlled similar source based on statistical evaluations of the ICR data for EGUs as well as a comparison of other case-by-case Section 112(g) permit determinations for EGUs the applicant determined were similar sources. In addition to different approaches for defining "similar source", there is no single methodology that has been used to define the "best controlled similar source".

Recent permit applications include case-by-case Section 112(g) studies illustrate the use of different approaches for defining the "best controlled similar source" to define the MACT floor for mercury emissions and the acceptance of those approaches by different state permitting agencies. Examples include the case-by-case Section 112(g) studies for the following facilities:

**Santee Cooper Pee Dee.** The June 2008 permit application for the Santee Cooper Pee Dee facility (subcategorized coal, eastern bituminous) included a modified statistical analysis of the ICR data base and concluded the "best controlled similar source" was the Dominion Electric Clover Power Station Unit 2 (eastern bituminous coal only) with a "worst case" mercury emission rate of 1.06 lb/TBtu. The Pee Dee analysis concluded that additional control beyond the MACT floor was not warranted (i.e., was not cost-effective).

**Duke Energy Cliffside.** The July 2008 Section 112(g) analysis submitted by Duke Energy for Cliffside Unit 6 (subcategorized coal, eastern bituminous) concluded the "best controlled similar source" was Santee Cooper Cross Unit 3 with an emission rate of 0.036 lb/GW-hr (4.04 lb/TBtu). The analysis submitted by Duke reports the actual emission rate at the Dominion Electric Clover Power Station Unit 2 is 0.294 lb/GW-hr (31.6 lb/TBtu) rather than the 1.06 lb/TBtu projected in the Pee Dee analysis for the same unit. Duke goes on to state that US EPA has determined that 14.3 lb/TBtu represents the reasonable maximum value of uncontrolled mercury emissions for bituminous coal. And, with the expected 90% control efficiency Duke anticipates that Cliffside Unit 6 will achieve a "beyond the MACT floor" mercury emission rate of 0.014 lb/GW-hr (1.4 lb/TBtu). (Note: Duke subsequently demonstrated that Cliffside Unit 6 was not a major source of HAP emissions. The North Carolina Department of Environment and Natural Resources issued a permit for Cliffside on March 13, 2009 that established a mercury emission limit for Unit 6 of 0.019 lb/GW-hr (1.94 lb/TBtu) as a "state only" requirement).

**Consumers Energy Karn/Weadock.** The December 2008 (4th Revision) Section 112(g) analysis submitted by the Consumers Energy Company (subcategorized coal, PRB) conformed with the requirements in MDEQ Op. Memo No. 15 which establishes a three-step analysis for determining MACT in Michigan. Step 1 is to describe the proposed control technology and air quality control system, and the emission reductions that can be achieved by each. Step 2 is to identify the emission limit achieved in practice by the "best controlled similar source" (i.e., the MACT floor). Step 3 consists of an assessment of alternative technologies to define the maximum reduction in HAPs that can be achieved taking into consideration cost and non-air quality health and environmental impacts and energy requirements. Consumers does not include a statistical analysis to project the "worst case" emission rate based on variability of actual test results. Consumers concluded that the MACT floor is 0.0133 lb/GW-hr (1.5 lb/TBtu for a purely western coal project).

**Different Approaches with Different Results.** Three recent case-by-case Section 112(g) MACT studies, two of which are summarized above, have determined the actual emissions rate achieved by the Dominion Electric Clover Power Station Unit 2. Each study used a different approach and reached different conclusions. Santee Cooper concluded that Clover Unit 2 had a "worst case" emission rate of 1.06 lb/TBtu. Duke concluded that Clover Unit 2 had a "worst case" emission rate of 31.6 lb/TBtu (0.294 lb/GW-hr). And, Old Dominion Electric Cooperative[16] concluded that Clover Unit 2 had a "worst case" emission rate of 1.593 lb/TBtu. It is apparent from the different conclusions regarding Clover Unit 2 that ***alternative methodologies for evaluating the variability of the limited mercury emissions data currently available can lead to different conclusions regarding likely long term performance. Thus, their examples demonstrate the true case-by-case nature of each MACT determination.***

[16] A case-by-case MACT was submitted in February 2009 for Old Dominion Electric Cooperative's proposed Cypress Creek Power Station Project in Virginia (Central Appalachian bituminous coal).

## E. Different Methodologies Employed in Section 112(g) Analyses (Both Floor and Beyond the Floor)

The case-by-case Section 112(g) analyses for EGUs reviewed by AMP develop the MACT floor analysis for mercury using one of three methodologies:

**Method 1**: This methodology uses the mercury emission limits established based on case-by-case Section 112(g) determinations made for other similar EGU sources. This approach relies on US EPA's proposed EGU MACT and the final NSPS adopted by US EPA for defining the MACT floor. This approach also makes the assumption that the emission rates in construction permits are limits that have not been achieved in practice and represent beyond the floor requirements. The case-by-case Section 112(g) analyses for the Oak Grove Steam Electric Station (Luminant) and the AEP-SWEPCO Turk facility are examples of this approach.

**Method 2**: This methodology identifies the "worst case" mercury content of the fuel(s) that are expected to be employed and define a MACT rate of mercury control to calculate the appropriate MACT floor. The beyond the MACT floor analysis for facilities that used this method typically considered the cost-effectiveness of achieving additional mercury control. The Consumers Energy analysis for the Karn-Weadock Generating Station is an example of this method being employed to establish a MACT floor for mercury emissions.

**Method 3**: This methodology employs a statistical analysis of the coal usage data in the ICR2 database and the mercury stack test results in the ICR3 database for similar sources that reflects variability in the coals employed and process variability to derive an "achieved emission rate" that represents the MACT floor for the source category. The Santee Cooper analysis for the Pee Dee facility and the ODEC analysis for the Cypress Creek Power Plant are examples of a statistical analysis being employed to establish the MACT floor for mercury emissions.

## F. AMP's Approach

AMP's approach to the case-by-case Section 112(g) analysis for the AMPGS considered several factors, including those listed above, to establish the "best controlled similar source", what has been achieved (i.e., the floor) and then what is achievable (i.e., beyond the floor) to determine if it was appropriate for the Ohio EPA to define any HAP emission limitations that were more stringent than the floor. As part of this analysis, the following items were also considered along with the available information identified:

- The range of fuels that could be burned at the AMPGS (a blend of western sub-bituminous and eastern bituminous coals, including Central Appalachian and Ohio);
- The HAP emission rates that are likely to be "achieved" at the AMPGS on a continuous basis for the life of the facility with a high degree of confidence given

the overall air pollution control system for the facility (Good Combustion Practices, Over Fire Air, Low-$NO_x$ burners, Selective Catalytic Reduction (SCR), an ammonia-based wet flue gas desulfurization (FGD) scrubber, fabric filter and a wet electrostatic precipitator (ESP) (O.A.C. 3745-31-28(E)(2));

- A comparison of the HAP emissions rates proposed for the AMPGS versus the HAP limits for new EGUs adopted by US EPA in 2005 (this also included a comparison with the EGU MACT proposed by US EPA in January 2004);

- A comparison of the HAP emission limits established based on case-by-case MACT evaluations performed for other coal-fired EGUs (O.A.C. 3745-31-28(E)(2)); and

- Consideration of the use of additional control technology (e.g., activated carbon injection) given the costs and expected benefits in terms of additional emission reduction potential (O.A.C. 3745-31-28(E)(2)).

- AMP also consulted with its specific technical experts to determine what limits were achievable at AMPGS (O.A.C. 3745-31-28(E)(2).

To confirm the floor analysis, AMP also performed a statistical analysis of USEPA's ICR-2 and ICR-3 databases to derive an "achieved emission rate" that represents the MACT floor for the AMPGS based on variability in mercury content of the types of fuels that will be employed (i.e., bituminous and sub-bituminous) and the variability in equipment operations for the similar sources included in the ICR databases.

**Statistical Evaluation of the MACT Floor**

The statistical analysis employed by AMP utilizes the basic methodology identified by the US EPA in the January 2004 EGU MACT proposal with refinements developed by the US Department of Energy (US DOE) which are also cited in US EPA's proposed MACT. The statistical evaluation performed by AMP identifies similar sources for which mercury stack tests have been performed and then examines emission variability to identify the emissions that are likely to result from the use of the worst (i.e., highest mercury content) reasonably available coal supply.

Table 3 lists the five facilities that are similar to the AMPGS (in terms of PC boiler design, bituminous/sub-bituminous coal blends, and boiler size) for which mercury emission stack test data are available from the ICR-3 database compiled by US EPA for the January 2004 EGU MACT proposal. The plants are listed in descending order of the controlled mercury emission rate (i.e., "out the stack") during the test period expressed in pounds of mercury per trillion Btu of heat input (lb Hg/TBtu). The data in the ICR-3 database includes the plant name, the specific unit tested, the uncontrolled mercury emission rate for the unit (i.e., "out the boiler"), the air pollution control system for the unit and the controlled mercury emission rate. The estimated control efficiency present in this table was calculated by the following formula: Control Efficiency = CE = (1 – controlled rate/uncontrolled rate).

| Table 3<br>ICR-3 Data for Mercury Emission Tests for Plants Burning Both Bituminous/Sub-bituminous Coals | | | | | |
|---|---|---|---|---|---|
| **Plant name** | **Unit** | **Uncontrolled Mercury Emission Rate (lb Hg/TBtu)** | **Control System** | **Controlled Mercury Emission Rate w/o Statistical Analysis (lb Hg/TBtu)** | **Calculated Mercury Control Efficiency (%)** |
| Shawnee Fossil Plant | 3 | 3.3073 | Baghouse | 1.0507 | 68.23% |
| Meramec | 4 | 6.6269 | ESP - CS | 1.7255 | 73.96% |
| St Clair Power Plant | 4 | 4.8819 | ESP - CS | 3.9076 | 19.96% |
| Clifty Creek | 6 | 10.4083 | ESP - HS | 6.8745 | 33.95% |
| GRDA | 2 | 8.6306 | ESP – CS & SDA | 8.6918 | -0.71% |

Each of the facilities/units identified in the above table was a candidate for defining the MACT floor for mercury as the "best controlled similar source" to AMPGS based on the ICR data set. Note: Although Meramec and GRDA are identified as bituminous/sub-bituminous in the ICR-3 database, other summary reports indicate that Meramec only combusted bituminous coal during the test period and that GRDA only burned sub-bituminous coal during the test period. On this basis, AMP believes that both of these units should be excluded from the analysis of the "best controlled similar source". In addition, GRDA's testing data appears to be flawed since the controlled rate is actually higher than the uncontrolled rate.

The US DOE's variability analysis used the US EPA ICR-2 database for coal deliveries to calculate the average mercury content of coals used at each of the power plants included in the database. This included utility plants that used exclusively sub-bituminous coal, utility plants that used exclusively bituminous coal, utility plants that used exclusively lignite, utility plants that used waste coals, utility plants that used petroleum coke, and utility plants that burned a blend of fuels including blends of sub-bituminous and bituminous coals.

The analysis developed by AMP identified the utility plants that burned blends of sub-bituminous and bituminous coals to use for the variability analysis because that fuel blend was similar to the fuel blend to be employed at the AMPGS.[17] AMP calculated the weighted average mercury content for all coal deliveries in the ICR-2 database for each plant that burned both bituminous and sub-bituminous coals.

[17] AMP excluded utility plants that burned less than 5% of either subbituminous or bituminous coal from the list.

The utility plants for which coal quality data were extracted from the ICR-2 database are identified in Table 4. The plants are listed in Table 4 in order from the lowest to the highest weighted average mercury content. This table also includes the statistical approach employed by AMP to identify the coal that is the worst case coal that could reasonably been employed in the five facilities that were identified as candidates for defining the MACT floor for the sub-bituminous/bituminous subcategory.

**Table 4**
**ICR-2 Data for Mercury in Coal Deliveries for Plants Receiving Both Bituminous and Sub-bituminous Coals**

| Plant Name | Weighted Average Mercury Content of Coal Deliveries (lb/TBtu) | Rank | % of Total |
|---|---|---|---|
| Coleto Creek | 3.12 | 1 | 0.021 |
| Sibley | 3.59 | 2 | 0.043 |
| Mt. Poso Cogeneration Plant | 3.59 | 3 | 0.064 |
| Victor J. Daniel | 3.62 | 4 | 0.085 |
| Alma | 3.63 | 5 | 0.106 |
| Irvington | 3.78 | 6 | 0.128 |
| James River Power Station | 4.25 | 7 | 0.149 |
| Shawnee Fossil Plant | 4.27 | 8 | 0.170 |
| St Clair Power Plant | 4.34 | 9 | 0.191 |
| Baldwin | 4.51 | 10 | 0.213 |
| Michigan City | 4.52 | 11 | 0.234 |
| Coffeen | 4.66 | 12 | 0.255 |
| Dean H. Mitchell | 4.86 | 13 | 0.277 |
| La Cygne | 4.98 | 14 | 0.298 |
| Polk Power | 5.08 | 15 | 0.319 |
| Milton L. Kapp | 5.13 | 16 | 0.340 |
| Genoa | 5.28 | 17 | 0.362 |
| River Rouge Power Plant | 5.42 | 18 | 0.383 |
| Scherer | 5.44 | 19 | 0.404 |
| Meramec | 5.44 | 20 | 0.426 |
| South Oak Creek | 5.46 | 21 | 0.447 |
| R.M. Schahfer | 5.49 | 22 | 0.468 |
| Boardman | 5.52 | 23 | 0.489 |
| Harrington Station | 5.65 | 24 | 0.511 |
| Cholla | 5.66 | 25 | 0.532 |
| Tecumseh | 5.67 | 26 | 0.553 |
| Sioux | 5.70 | 27 | 0.574 |
| Monroe Power Plant | 5.83 | 28 | 0.596 |
| Lawrence | 5.92 | 29 | 0.617 |
| Trenton Channel Power Plant | 6.12 | 30 | 0.638 |
| J.C. Weadock | 6.18 | 31 | 0.660 |
| Big Bend | 6.57 | 32 | 0.681 |
| B.C. Cobb | 6.66 | 33 | 0.702 |

| Table 4<br>ICR-2 Data for Mercury in Coal Deliveries for Plants Receiving Both Bituminous and Sub-bituminous Coals | | | |
|---|---|---|---|
| **Plant Name** | **Weighted Average Mercury Content of Coal Deliveries (lb/TBtu)** | **Rank** | **% of Total** |
| F.J. Gannon | 6.68 | 34 | 0.723 |
| J.H. Campbell | 6.86 | 35 | 0.745 |
| Clifty Creek | 6.91 | 36 | 0.766 |
| Tanners Creek | 6.94 | 37 | 0.787 |
| J.R. Whiting | 6.97 | 38 | 0.809 |
| Dan E. Karn | 7.41 | 39 | 0.830 |
| Springerville | 7.50 | 40 | 0.851 |
| Eckert Station | 7.89 | 41 | 0.872 |
| Miller | 8.55 | 42 | 0.894 |
| Jack Watson | 9.24 | 43 | 0.915 |
| Kincaid Generation L.L.C. | 9.57 | 44 | 0.936 |
| Avon Lake | 11.06 | 45 | 0.957 |
| Will County | 12.21 | 46 | 0.979 |
| "AES Shady Point, Inc." | 23.49 | 47 | 1.000 |

The evaluation of the 47 facilities in the ICR-2 database that employed a blend of bituminous coal and sub-bituminous coal identified the Avon Lake facility (located in Lorain County Ohio) as the facility with the worst reasonable blend of coals at the 95.7$^{th}$ percentile.

**Results of the AMP Statistical Analysis**

AMP employed the algorithms utilized by US EPA to assess variability as follows:

$$E = [10^6 \times Hg_{conc} \times (1 - Fr)]/[H]$$

Where:

$E$ = Projected Hg emission rate (lb/TBtu)
$Hg_{conc}$ = mercury concentration (ppm) in the coal used at the Avon Lake facility from the ICR-2 database
$Fr = 1 - ∃$
$∃ = 1$ – Hg Control Efficiency (from the ICR-3 test for the specific plant)
$H$ = the heat content (Btu/lb) of the coal used at Avon Lake from the ICR-2 database

The projected mercury emissions rates that reflect the use of the worst case coal that could reasonably been employed by the AMPGS are presented in the Table 5.

| Table 5<br>Projected Mercury Emission Rates from Coals that Could be Reasonably Employed from Plants Using Bituminous and Sub-bituminous Coals | | | | | | |
|---|---|---|---|---|---|---|
| **Plant** | **Weighted Average Heat Input (Btu/lb)** | **Weighted Average Hg Content (ppm)** | **Beta (1 – CE)** | **Fr** | **Projected Mercury Emission Rate = E (lb/TBtu)** | **ICR-3 Test (lb/TBtu)** |
| Shawnee | 13,482 | 0.15 | 0.3177 | 0.682309 | 3.51 | 1.05 |
| St. Clair | 13,482 | 0.15 | 0.8004 | 0.199574 | 8.85 | 3.91 |
| Clifty Creek | 13,482 | 0.15 | 0.6605 | 0.339518 | 7.30 | 6.87 |
| Meremec | 13,482 | 0.15 | 0.2604 | 0.739622 | 2.88 | 1.73 |
| GRDA | 13,482 | 0.15 | 1.0071 | -0.007091 | 11.14 | 8.69 |

The conclusion from the statistical analysis presented in the above calculations and table is that the projected mercury emission rate for the Meremec facility of 2.88 lb/TBtu is the MACT floor for units that are in the bituminous/sub-bituminous coal rank subcategory. The statistical analysis demonstrates that the "best controlled similar source" for mercury emissions is Meremec at 2.88 lb/TBtu followed by Shawnee at 3.51 lb/TBtu. Again, as explained above, Meremec can also reasonably be excluded since the facility only burned bituminous coal during testing. However, for purposes of establishing the floor, AMP has included Meremec.

## G. MACT Floor Conclusion

Based on each of the analyses that AMP considered, including a statistical analysis comparable to that used by USEPA and DOE, AMP concluded that the mercury emission rate of 1.9 lb/TBtu in the original PTI issued by the Ohio EPA for the AMPGS was lower than the floor for PC units utilizing a blend of eastern bituminous and western sub-bituminous coals.[18] AMP then moved to the beyond the floor analysis to determine whether or not any additional reductions could be "achievable" for the AMPGS.

## H. Beyond the Floor Analysis

As set by the current PTI, AMPGS will employ the following control technologies that will control mercury and HAPs: good combustion, selective catalytic reduction, fabric filter, wet flue gas desulfurization scrubber and wet electrostatic precipitator. As part of the Best Available Technology (BAT) analysis for the AMPGS, Ohio EPA has already determined that this array of control equipment will achieve high mercury (and other HAP) reductions.

[18] The PTI for AMPGS is unique in that AMP and Ohio EPA had already evaluated mercury and set limits despite the absence of any MACT requirement to do so. Other recently permitted projects did not perform any such prior analysis.

In evaluating whether or not AMPGS could achieve any beyond the floor control, AMP evaluated each of the sources identified as "available information" in O.A.C. rule 3745-31-01(N). Specifically, AMP evaluated the following sources of information:

- O.A.C. rule 3745-31-01(N)(1) & (2) - The proposed EGU MACT and Clean Air Mercury Rule, along with accompanying US EPA data and background related materials (including the ICR database). This material has been previously provided to Ohio EPA and also accompanies this submittal and can be found at:

  http://www.epa.gov/ttn/atw/combust/utiltox/icrdata.xls ;
  http://www.epa.gov/ttn/atw/combust/utiltox/winter_hg_data.xls ;
  http://www.epa.gov/ttn/atw/combust/utiltox/spring_hg_data.xls ;
  http://www.epa.gov/ttn/atw/combust/utiltox/summer_hg_data.xls ; and
  http://www.epa.gov/ttn/atw/combust/utiltox/autumn_hg_data.xls

- O.A.C. 3745-31-01(N)(3) - Data from the Control Technology Center (which no longer exists under that name and appears to have been combined with US EPA's RACT/BACT/LAER Clearinghouse) at:

  http://neet.rti.org/

- O.A.C. 3745-31-01(N)(4) - Data from the Aerometric Informational Retrieval System, including information in the MACT database. This information does not include updated information, but can be viewed by Ohio EPA at:

  http://www.epa.gov/compliance/data/systems/air/afssystem.html

- O.A.C. rule 3745-31-01(N)(5) & (6) - Case-by-case MACT permits. These permits have been previously provided to Ohio EPA;

- O.A.C. rule 3745-31-01(N)(5) & (6) - US EPA's Section 112(g) Clearinghouse at:

  http://www.epa.gov/ttn/atw/112g/112gmact/112gmact.html

- O.A.C. rule 3745-31-01(N)(5) & (6) AP-42 Emission factors for HAPS from coal-fired EGU boilers at:

  http://www.epa.gov/ttn/chief/ap42/ch01/index.html

- O.A.C 3745-31-01(N)(5) & (6) - Various state mercury rules at:

  http://www.4cleanair.org/Documents/StateTable.pdf ; and
  http://www.4cleanair.org/FinalMercuryModelRule-111405.pdf

AMP spent significant time reviewing air permits and case-by-case MACT analyses for projects that are either proposed or in construction, but not yet in operation. While the permits for these facilities are helpful from an evaluation perspective, since the facilities are not yet operating, there is no conclusion regarding the achievability of the permitted emission limits. As a summary, AMP reviewed and has previously provided Ohio EPA with the following permits: MidAmerican Energy Company CBEC #4; Santee Cooper Cross #3 & #4; Longview Power, LLC; Wisconsin Public Service Corporation Weston #4; Thoroughbred Generating Station Units #1 & #2; Prairie State Generating Company, LLC; Louisville Gas & Electric Trimble Unit #2; Kansas City Power and Light Iatan #1 and #2; Western Farmers Electric Cooperative Hugo #2; Longleaf Energy Associates, LLC Units #1 & #2; American Electric Power Turk and Duke Cliffside Unit #6. In its analysis, AMP has identified the distinctions and similarities of these projects to AMPGS for purposes of the beyond the floor analysis. This dialog was on-going with Ohio EPA through the MACT process and has been summarized in electronic mails and submittals by and between AMP and Ohio EPA.

In accordance with O.A.C. rule 3745-31-28(E)(2), the case-by-case Section 112(g) MACT emission limits should reflect the "maximum degree of reduction" of HAPs which can be "achieved" by utilizing control technologies identified in the "available information" considering the (1) costs of achieving the reductions; (2) any non-air quality health/environmental impacts and (3) energy requirements. Achievability is a case-by-case determination based on what is achievable under the most adverse recurring conditions that could be reasonably expected (contemplating the variety of fuel blends utilized).

There is no clear standard for determining cost-effectiveness for beyond-the-floor control. In other MACT categories, US EPA has determined that as low as $4,500/lb reduced as deemed cost-prohibitive.[19] Thus, Ohio EPA makes a case-by-case determination regarding the increased costs for additional reductions. The second consideration focuses solely on the non-air quality impacts resulting from the by-products of the control technology. The third consideration is the energy needs that result from any additional control technology that will result in additional reductions.

AMP identified two potential control technologies for consideration in the beyond the floor analysis: (1) The Powerspan ammonia-based scrubber; and (2) Sorbent Injection (Activated Carbon Injection or ACI).

**Powerspan.** AMP intends to move forward with the installation and use of Powerspan's ammonia-based scrubber technology (packed column ammonia scrubber) at the AMPGS. However, to date, there are no long-term or comprehensive data from full scale operation to demonstrate the potential mercury reductions achievable with the use of the Powerspan technology. The oxidized mercury removal rate of this technology was 85% in the 50 MW slipstream test at the FirstEnergy Burger facility. And, Powerspan contemplates oxidized mercury removal efficiencies between 80-90%. Therefore, AMP anticipates that Powerspan may yield superior mercury control. That said, the mercury emission limit established by the case-by-case Section 112(g) process must identify mercury emission limitations that are achievable 100% of the time under all operating conditions.

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[19] 64 FR 52863.

The beyond the floor mercury emission rate proposed by AMP is consistent with that requirement.

**Sorbent Injection/ACI.** Sorbent injection with activated carbon (ACI) is being utilized on sub-bituminous coal fired boilers and/or boilers that utilize an ESP for particulate emissions control. AMP evaluated the use of ACI during its case-by-case MACT analysis. Specifically, R.W. Beck prepared an analysis of the potential additional reductions available with ACI and other associated factors. Refer to Attachment C of AMP's April 7, 2009 submittal. R.W. Beck determined that the cost to remove mercury could be as low as $54,000 per pound or as high as $106,000 per pound (based on a conservative base mercury removal of 80% and assuming that the use of ACI would achieve approximately 90% mercury removal, resulting in a 10% additional reduction delta). Even the lower cost per ton is far higher than the $35,000 per pound that US EPA proposed as a "safety valve" cost ceiling in the CAMR cap and trade provisions. The actual additional removal efficiency associated with the use of ACI may be much less than 10% because it is possible the use of ACI would simply transfer where mercury is collected (i.e., from the wet-FGD to the fabric filter) with little, if any, additional reduction being achieved. Thus, AMP has determined the addition of ACI to the overall control system at the AMPGS would not be cost-effective.

As explained in the R.W. Beck document, the cost and environmental impact associated with properly disposing fly ash that is contaminated with activated carbon/mercury must also be considered. The introduction of activated carbon into the fly ash can be a significant impediment to the use of the fly ash as an ingredient in cement manufacturing. The disposal of high carbon fly ash can add additional costs to operation as well as increasing the amount of waste material that must be disposed rather than re-used.

## I. Beyond the Floor MACT Conclusion for Mercury

After careful consideration of all of the information and data accumulated by AMP, consideration of questions posed by Ohio EPA and US EPA and a review of the comments provided during the public comment period concerning the proposed administrative change of the PTI for the two main boilers, AMP has determined the appropriate mercury limit for the AMPGS is the 12-month rolling average of no more than 1.9 lb/TBtu specified in the draft administrative modification issued by Ohio EPA. Although other recent power plant permits include mercury emission limitations that are less than 1.9 lb/TBtu, none of those facilities will be operated with the range of coal supplies[20] or control equipment configuration that will be utilized at the AMPGS.

AMP has also determined that the control system required by PTI 06-08138 for use at the AMPGS is both the best possible control system (including Good Combustion Practices, Over Fire Air, Low-$NO_x$ burners, Selective Catalytic Reduction, an ammonia-based wet flue gas desulfurization scrubber, fabric filter and a wet electrostatic precipitator) for reducing mercury emissions but also demonstrates AMP's commitment to seek beyond-the-floor, innovative control equipment (Powerspan) that has yet to be demonstrated at

[20] See addendum 1 for additional information regarding coal supplies.

commercial scale. The lack of significant long-term data makes it difficult for AMP to precisely identify the mercury removal rates "achievable" with the use of the Powerspan technology. Nonetheless, the expected reduction in mercury emissions necessary to meet the 1.9 lb/TBtu case-by-case Section 112(g) MACT emission rate is greater than 90% for the highest mercury content coals that can be reasonably expected to be delivered to the facility.

2. **US EPA's second question/comment requested that the case-by-case Section 112(g) MACT analysis for the AMPGS consider the mercury MACT determinations for the Presque Isle, Cliffside, Turk and Consumers Energy permits.**

   A. **Presque Isle (Wisconsin Electric Company, Marquette, Michigan).** The information compiled by AMP for this facility indicates that the Wisconsin Electric Power Company (We Energies) is working in conjunction with the US DOE, EPRI, Wheelabrator and others to install and test the use of the TOXECON process to control mercury and other air pollutants from three approximately 90 MW units. The information on the DOE web site indicates that these boilers burn low-sulfur, Powder River Basin (PRB) sub-bituminous coal. In addition, the description of the project states the TOXECON control technology "has application at power plants burning coals with hot side ESP's (18GW), and plants burning western, sub-bituminous coals with cold side ESP's (68GW)."

      In January 2009, We Energies submitted a report to the Michigan Public Service Commission that describes the use of the TOXECON technology as a "Voluntary Company Action" associated with research regarding mercury emissions from its coal-fired electric generating units. The report states "Testing of sorbents for capturing mercury commenced in February, 2006 and testing is scheduled to continue through the first quarter of 2009."

      AMP believes any mercury emissions data that are currently available for the Presque Isle plant project should not be considered "achieved in practice" and are not applicable to the development of a MACT floor or beyond the floor analysis for the AMPGS given that: (a) the use of the TOXECON technology at Presque Isle is a research and development project involving relatively small units that are not similar in size to the AMPGS (i.e., 90 MW versus 480 MW); (b) final test results from the R&D are not yet available, (c) the project involves units that burn a different range of fuels (i.e., exclusively PRB sub-bituminous coal versus a blend of fuels that includes various sub-bituminous and bituminous coals); and (d) the purpose of the Presque Isle project is to demonstrate the use of the TOXECON technology with the use of ESPs for particulate matter control (particulate matter emissions from the AMPGS will be controlled with a fabric filter).

   B. **Cliffside Power Plant Unit 6 (Duke Energy Corporation, plant located on the Cleveland/Rutherford County line in North Carolina).** The Cliffside Power Plant (Cliffside) Unit 6 is an 800 MW unit with a design heat input rating of 7,850 mmBtu/hr. Although Duke Energy Corporation (Duke) submitted a Section 112(g) application for Cliffside Unit 6 to the State of North Carolina, a final Section 112(g) permit has not been issued for this unit. Duke's current position is that installation of Cliffside Unit 6 will not cause an increase in HAP emissions large enough to trigger the Section 112(g) requirements for the modification of an existing major source (i.e., the emissions of each HAP will be less than 10 tons per year and the emissions of all HAPs combined will be less than 25 tons per year). Nonetheless, Duke has submitted information to the State of North Carolina to support a MACT limit for mercury emissions of no more than 0.014 lb/GWh (equivalent to 1.43 lb/TBtu) for Unit 6. This proposed emission limitation was based on Duke's analysis of mercury variability in the range of fuels that may be burned in Unit 6 (i.e., Northern Appalachian, Central Application, Illinois Basin, Pennsylvania and Ohio), the expected mercury removal efficiency of the Unit 6 air pollution control system (i.e., SCR, spray dry absorbers, fabric filters and wet FGD), Duke's evaluation of the variability of mercury in the fuels and the performance of the control equipment, and Duke's appraisal that a stack test be used to verify compliance with the mercury emission limitation rather than continuous emissions monitoring (i.e., Duke states that the proposed emission rate would be higher if HG CEM was specified as the compliance method).

The State of North Carolina issued a final Title V permit revision for the Cliffside Power Plant on March 13, 2009 to include provisions that authorize the construction and authorization of Unit 6. That permit treats Unit 6 as a minor source of HAP emission that is not subject to the Section 112(g) case-by-case MACT requirements. The final Title V revision (Section 2.1 Paragraph J. on pages 38 through 52) specifies the requirements for Unit 6. The permit requires that Unit 6 meet the 40 CFR Part 60 Subpart Da emission limits for mercury. The permit also includes a *state-only* requirement that the mercury emissions from Unit 6 not exceed 0.019 lb/GWh gross energy output (equivalent to 1.94 lb/TBtu).

While AMP does not believe that Duke's Cliffside Unit 6 is similar to the AMPGS (due to the differences in coals that will be utilized at the AMPGS and the potentially greater mercury variability and different control equipment), the proposed beyond the floor mercury emission rate for the AMPGS of 1.9 lb/TBtu compares favorably with the emission rate of 1.94 lb/TBtu in the permit for Cliffside Unit 6.

C. **John W. Turk, Jr. (American Electric Power-Southwest Electric Power Company, Fulton, Arkansas).** The John W. Turk, Jr. Power Plant (Turk) is a 600 MW unit that will burn only sub-bituminous coal. The State of Arkansas issued a final air permit to authorize the construction and operation of Turk on November 5, 2008. The final permit includes a case-by-case Section 112(g) determination that limits mercury emissions to no more than 1.7 lb/TBtu on a 12-month average basis.

AMP believes that the Turk facility is not similar to the AMPGS in that it will employ 100% sub-bituminous coal (versus the range of fuels for the AMPGS that include sub-bituminous and bituminous coals from a variety of coal seams in the eastern US) and the fact that Turk will employ a dry scrubber. That said, the 1.9 lb/TBtu emission rate for AMPGS compares favorably with the mercury emission limit set for Turk, especially given the wider range of coals that will be utilized at the AMPGS and the potentially greater mercury variability.

D. **Consumers Energy Karn-Weadock Generating Station (Hampton Township, Michigan).** The Consumers Energy Karn-Weadock Generating Station (Consumers) proposes to install a 930 MW unit with a heat input rating of 8,190 mmBtu/hr designed to burn 100% sub-bituminous PRB coal. The plant will also have the ability to blend up to 50% bituminous coal (as limited by heat input) with sub-bituminous coal.

The case-by-case MACT Section 112(g) analysis for Consumers proposed a mercury emission limit of 0.0079 lb Hg/GWh (0.89 lb Hg/TBtu) as MACT "based on the select fuels that Consumers has chosen". However, the Consumers proposal is tempered by the following statements:

> "While Consumers believes this limit is achievable, this case-by-case MACT analysis found a great deal of uncertainty with respect to the measurement and control of mercury emissions from electric generating units. Even the NACAA list of state mercury rules reflects that almost every state allows the option for an alternate emission limit or additional time if the state limit is not met." (Page 41)
>
> "The uncertainties...lead Consumers to propose that an optimization study be included in the mercury MACT decision...If the optimization study indicates that the ASCPC unit cannot achieve the 0.0079 lb/GWh, the limits established as MACT may need to be revised to reflect the levels that can be achieved..." (Page 42)
>
> "...the ability to demonstrate compliance with the proposed emission limit will depend on the measurement method used and the expected outlet mercury concentrations. Mercury CEMS have been proposed for compliance determination rather than discrete stack testing...the performance of Hg CEMS makes the results subject to significant uncertainty at low concentrations..." (Page 42)

The Section 112(g) analysis submitted by Consumers estimates the upper confidence level for mercury content in both sub-bituminous coals (i.e., 14.98 lb/TBtu) and bituminous coals (15.72 lb/TBtu). And, Consumers acknowledges the overall control system for the new unit may not achieve greater than a 90% level of mercury control. As a result, Consumers requested that an optimization study be performed after the new unit has been in operation that would allow an upward adjustment in the allowed mercury emission limitation. If no more than 90% mercury control is achieved, the actual mercury emission from Consumers could be more than 1.5 lb/TBtu (assuming the worst case mercury content for sub-bituminous PRB coal).

The draft air permit issued by the MDEQ to Consumers on February 26, 2009 includes the 0.0079 lb/GW-hr mercury emission rate proposed by Consumers. This permit is not yet final.

AMP believes Consumers is not similar to the AMPGS because it is designed to burn 100% sub-bituminous PRB coal with the mere possibility of burning up to 50% eastern bituminous coal (as limited by heat input) with sub-bituminous coal. Although the MACT limit proposed by Consumers is more stringent than the limit for the AMPGS, AMP believes the wider range of coals that will be utilized at the AMPGS and the potentially greater mercury variability supports a MACT determination consistent with the limit in the permit for the AMPGS. In addition, the Consumers proposal allows for an optimization study to increase emissions upward in the event that the proposed levels cannot be achieved.

While none of the above facilities is "similar" to the AMPGS, information from these permits and applications was considered during the Section 112(g) analysis for the AMPGS. Information regarding the control technologies considered and the degree of HAP emission control that these facilities believe can be achieved from the alternative technologies was evaluated as part of the beyond the floor analysis for the AMPGS. However, given the clear distinctions between AMPGS and these other projects, AMP did not believe any of them represent what is "achievable" for AMPGS.

## Summary of Analysis for Non-Mercury HAPs

In addition to mercury, US EPA has also raised questions regarding non-mercury HAPs. As explained in detail above, US EPA concluded as part of its EGU rulemaking that controlling non-mercury HAPs via a MACT standard was not necessary or appropriate. Therefore, Ohio EPA has the discretion to determine whether or not any HAPs beyond mercury need be included in the case-by-case MACT determination for AMPGS.

That said, AMP proposed in the July 2008 case-by-case Section 112(g) MACT study that emission limits be set for other non-mercury HAPs, including: (a) volatile organic compounds (VOC) (as a surrogate for all organic HAPs); (b) $PM_{10}$ (filterable) (as a surrogate for all metal HAPs); and (c) hydrogen chloride (HCl) (as a surrogate for all acid gas HAPs).[21] The appropriateness of the use of surrogates has been presented by AMP in previous submissions and AMP provided additional information regarding the HAPs that would be controlled by this surrogate approach in an April 2009 response to questions

[21] "Clean Air Act Section 112(g) Hazardous Air Pollutant (HAP) Maximum Achievable Control Technology (MACT) Analysis for the American Municipal Power Generating Station", July 2008.

from Ohio EPA.[22] The response to US EPA's Question 6 below summarizes the information provided by AMP to support the surrogate approach.

Ohio EPA's draft administrative modification includes case-by-case MACT emission limits for the following pollutants: (a) hydrogen fluoride (HF); (b) HCl as a surrogate for inorganic/acid gas HAPs; (c) the use of the $PM_{10}$ as a surrogate for metal HAPs; (d) the use of sulfur dioxide ($SO_2$) as a monitoring surrogate for inorganic HAPs; and (e) carbon monoxide (CO) and VOC as surrogates for organic/acid gas HAPs.

Similar to mercury, AMP performed an analysis to establish both the "MACT floor" and a "beyond-the-floor" analysis for the surrogate pollutants identified in the July 2008 submission to Ohio EPA (i.e., VOC, $PM_{10}$ (filterable) and HCl). Originally, AMP did not propose the use of $SO_2$ as a monitoring surrogate for inorganic HAPs nor did AMP propose a specific MACT limit for HF. However, since Ohio EPA determined that additional limits were appropriate, AMP has provided additional information and data for each of these pollutants in response to US EPA's questions.

## <u>HCl and HF</u>

3. **US EPA's third question/comment requested that the case-by-case Section 112(g) MACT analysis for the AMPGS consider the HF and/or HCl MACT determinations for the AEP/SWEPCO Turk, the Consumers Energy and the Springerville permits.**

   The issues associated with variability in fuels, equipment operation and monitoring, etc. presented as a preface to the comparisons of mercury emission rates are also pertinent to comparisons of HF and HCl emission rates. Although the control systems are not specifically designed to control HF and HCl emissions, the same BACT control systems that limit emissions of $SO_2$ and sulfuric acid mist ($H_2SO_4$) will limit emissions of other acid gases included HF and HCl. At the AMPGS, these include the wet-FGD and wet-ESP components of the overall control system

   HF and HCl emissions are dictated by the fluoride and chlorine content of the fuels as well as the efficiency of the overall control equipment in removing these acid gases. Specifically, based on the USGS COALQUAL, chlorine content can range from approximately 100 ppm to 860 ppm, with significant standard deviation associated with each (i.e. significant disparity among coals, even coals within the same rank). Although fluoride content does not have the same wide range of variability, the variability is significant. There are no HF-specific or HCl-specific control systems employed on large pulverized coal fired power plant boilers.

[22] AMP's April 2009 submission contained emissions estimates for individual HAPs based on AP-42 factors and engineering estimates. See, Attachment B to the April 2009 submittal. Further, the array of control equipment proposed for AMPGS will control all HAPs, even those that are emitted at de minimis levels.

## MACT Floor for HF and HCl

No existing EGU has monitoring equipment capable of measuring HCl and HF on a continuous basis. Therefore, compliance with HF and HCl emission limitations is demonstrated with a limited three-hour stack test. Historically, HF and HCl emission tests may have been required only once per permit cycle or even less frequently, if required at all. There are limited actual test reports available for these contaminants which severely handicaps an assessment of the variability of results demonstrated by the testing. AMP has attempted to review recent testing data from EGUs (both western and eastern coal units) for floor purposes, but has concluded the testing too limited to provide an adequate basis for development of the floor. As such, there is no demonstrated achieved MACT "floor" for HCl or HF based on testing due to the limited information.

## Beyond the Floor Analysis for HF and HCl

As a next step AMP evaluated permit limits for EGUs that are in operation as set forth in Table 6. Note, however, that these facilities lack comprehensive testing data, so the permit limits are a source point for what may be achievable.

**Table 6**
**Case-by-Case MACT Determinations for**
**Hydrogen Fluoride (HF) and Hydrogen Chloride (HCl)**

| Plant (permit date) | HF Permit Limit | HCl Permit Limit |
|---|---|---|
| Tucson Electric-Springerville 3 (sub-bituminous) (4/29/02) | 0.00044 lb/mmBtu | No limit in permit. |
| MidAmerican Walter Scott (sub-bituminous) (6/17/03) | 0.0009 lb/mmBtu | 0.0029 lb/mmBtu |
| Santee Cooper Cross Units 3 & 4 (bituminous) (2/5/04) | 0.0003 lb/mmBtu | 0.0024 lb/mmBtu |
| Weston Unit 4 (sub-bituminous) (10/19/04) | 0.000217 lb/mmBtu | 0.0021 lb/mmBtu (calculated based on 10.94 lb/hr) |

None of the facilities identified in Table 6 utilize a blend of bituminous and sub-bituminous coals; thus, they cannot serve as a viable basis for what is achievable at AMPGS.

AMP next consulted the same sources of information identified in the mercury summary above to determine what, if any, additional reductions might be achievable. In doing so, AMP confirmed that overall air pollution control system for the AMPGS (i.e., a wet FGD, fabric filter and a wet ESP) provide the highest level of control based on the facility's fundamental design requirements, including fuel flexibility.[23] AMP then reviewed recently issued permits for EGUs not yet in operation. These permits and a summary of emission limits were previously provided to Ohio EPA as part of AMP's response to questions from Ohio EPA in April 2009.

**Response to US EPA's Question**

USEPA raised a question concerning the MACT limits in the permits for Turk, Springerville and Consumers Energy that are summarized in Table 7.

**Table 7**
**MACT Emissions Limits for HF and HCl in the Permits for Turk, Consumers Energy and Springerville**

| Plant (permit date) | HF | HCl |
|---|---|---|
| Springerville Unit 3 and Unit 4 (sub-bituminous) (4/29/02) | 0.00044 lb/mmBtu | NA |
| AEP/SWEPCO Turk (sub-bituminous) (11/5/08) | 0.0002 lb/mmBtu | 0.0006 lb/mmBtu |
| Consumers Energy (bituminous/sub-bituminous) (draft permit 2/26/09) | 0.00017 lb/mmBtu | 0.0023 lb/mmBtu |

A key distinction between the AMPGS and these three facilities is the fact that Turk, Consumers Energy and Springerville are designed to use 100% PRB coal (Note: While the documents for Consumers Energy state that it could also employ a blend that utilizes up to 50% eastern bituminous coal, it has been designed as a PRB coal project.). None of these sources will utilize the blend of coals that will be employed at the AMPGS. Thus, Turk, Consumers Energy and Springerville are not similar to the AMPGS and a direct comparison with the HF and HCl emission rates for these facilities is not relevant to a case-by-case Section 112(g) MACT determination for the AMPGS.

The use of wet FGD, fabric filter and a wet ESP at the AMPGS represent a MACT control system for these two pollutants. Based on USEPA's questions, AMP has re-evaluated the limits presented in Ohio EPA's draft administrative modification and determined that, based on its additional consideration of recently issued permits, AMP is proposing a new, lower case-by-case Section 112(g) MACT limit for HCl of 0.004 lb/mmBtu.

[23] In fact, the proposed EGU MACT does not even contemplate the use of a wet ESP: however, AMP believes the addition of the wet ESP (which is included in the PTI issued for the AMPGS as a BACT control for $H_2SO_4$) will provide the co-benefit of additional control of HF and HCl. A dry FGD system is not feasible at AMPGS because it would require fundamental design changes and would reduce the efficiency of the scrubber to control $SO_2$ while utilizing eastern coal blends.

AMP is proposing a new, lower case-by-case Section 112(g) MACT limit for HF of 0.0004 lb/mmBtu. While AMP notes that Consumers Energy has proposed a lower limit, that permit remains in draft form and AMP has determined, based on discussions with project engineers, that such a low limit is not achievable (i.e., met on a continuous basis throughout the life of the plant) on a long-term basis with the blend of coals that will be utilized at the AMPGS.

**<u>Non Mercury Metal HAPs</u>**

4. **US EPA's fourth question/comment requested that the case-by-case Section 112(g) MACT analysis for the AMPGS consider the non-mercury metal HAPs ($PM_{10}$ as a surrogate) MACT determinations for the AEP/SWEPCO Turk and Consumers Energy permits.**

All of the non-mercury metal HAPs emitted by EGUs are present in coals in very small amounts. US EPA has determined on several occasions that the emissions of these metal HAPs from coal-fired power plants are de minimis and that HAP pollutant-specific emission limits are not warranted. The metal HAP emissions are effectively controlled by the components of the overall air pollution control system that are designed to control particulate emissions (i.e., the wet-FGD, wet-ESP and fabric filter). This combination of control systems will control all particulate emissions to a very high efficiency. Because of this, AMP has proposed that the allowable $PM_{10}$ emission rate be a surrogate for all metal HAP emissions for the proposed case-by-case Section 112(g) MACT.

**MACT Floor for $PM_{10}$ (Surrogate for Metal HAPs)**

EGUs currently in operation demonstrate compliance with $PM_{10}$ emission limits via stack testing. Due to the limited nature of the testing and the lack of general information regarding testing parameters (including control equipment, types of coal utilized during testing and fuel combustion techniques) the use of past stack testing data does not provide a sound technical basis for the establishment of achieved in practice. AMP evaluated the permit limits for EGUs that are in operation as set forth in Table 8. Thus, the permitted $PM_{10}$ emission rates for these units are representative of the lowest emission rates achieved.

**Table 8**
**Permit Limits for $PM_{10}$ from Operating EGUs**

| Plant (permit date) | $PM_{10}$ Emission Rate (filterable) |
|---|---|
| Santee Cooper Cross (2/15/04) | 0.018 lb/mmBtu |
| Clover (1/1/08) | 0.018 lb/mmBtu |

From a permit perspective for operating units, the best controlled sources for $PM_{10}$ have emission limits of no more than 0.018 lb/mmBtu (filterable), which is higher than the current limit in the AMPGS PTI of 0.015 lb/mmBtu.

**Beyond the Floor Analysis for $PM_{10}$ (Surrogate for Metal HAPs)**

AMP confirmed there are no EGUs that have proposed to use an overall air pollution control system that will provide a superior level of $PM_{10}$ emissions control to the system proposed for the AMPGS (i.e., a wet-FGD, a fabric filter and a wet ESP). AMP has also reviewed recently issued permits for EGUs not yet in operation. These permits and a summary of emission limits were previously provided to Ohio EPA in the BACT analysis for the AMPGS and/or in the case-by-case Section 112(g) MACT submissions. In addition, AMP has evaluated additional permits that were issued subsequent to AMP's case-by-case MACT submittal to Ohio EPA, these permits include Turk and Santee Cooper Pee Dee. A summary of these limits is presented in Table 9.

**Table 9**
**Permit Limits for $PM_{10}$ from Permitted EGUs that are Not Yet Operating**

| Plant (permit date) | $PM_{10}$ Emission Rate (filterable) |
|---|---|
| Elm Road Generating Facility (1/14/04) | 0.018 lb/mmBtu |
| Longview (3/2/04) | 0.018 lb/mmBtu and 110 lb/hr |
| Thoroughbred (10/29/04) | 0.018 lb/mmBtu |
| Prairie State (4/28/05) | 0.015 lb/mmBtu |
| Longleaf (5/14/07) | 0.012 lb/mmBtu |
| Santee Cooper Pee Dee (12/16/08) | 0.012 lb/mmBtu |
| Cliffside Unit 6 (3/13/09) | 0.012 lb/mmBtu |

**Response to US EPA's Question**

USEPA raised a question concerning the $PM_{10}$ MACT limits in the permits for Turk, and Consumers Energy that are summarized in Table 10.

| Table 10<br>MACT Emissions Limits for $PM_{10}$ in the Permits for<br>Turk and Consumers Energy | | |
|---|---|---|
| **Plant (permit date)** | **$PM_{10}$ (filterable)** | **$PM_{10}$ (total)** |
| AEP/SWEPCO Turk (11/5/08) | 0.012 lb/mmBtu | 0.025 lb/mmBtu |
| Consumers Energy Karn-Weadock (draft permit 2/26/09) | NA | 0.024 lb/mmBtu |

The $PM_{10}$ (filterable) emission rate and the $PM_{10}$ (total = filterable + condensable) emission rate for the AMPGS are not significantly different than the rates for Turk and Consumers Energy. Note that the draft Consumers Energy permit does not include a $PM_{10}$ filterable emission rate and the $PM_{10}$ total emission rate in the draft permit is not defined as a surrogate for other metal HAPs. In addition, only filterable $PM_{10}$ is used as the metal HAP surrogate for AMPGS by Ohio EPA (the condensable portion does not represent metal HAPs). It is also important to note that, as discussed above, these proposed EGUs are each distinct from AMPGS in that the proposed fuels used at each plant is different from the proposed fuel blends to be utilized at AMPGS.

AMP believes that the $PM_{10}$ emission rates in the permit for the AMPGS represent MACT and are beyond the established MACT floor of 0.018 lb/mmBtu. In addition, AMP also believes the use of wet FGD, fabric filter and wet ESP at the AMPGS represents a MACT control system for metal HAPs. Nonetheless, after careful consideration of all of the information and data accumulated by AMP, consideration of questions posed by Ohio EPA and US EPA and a review of the comments provided during the public comment period concerning the proposed administrative change of the PTI for the two main boilers, AMP has determined the it can lower its initial case-by-case MACT limit for $PM_{10}$ (filterable) to 0.012 lb/mmBtu as a 3-hour average. After consulting with project engineers, AMP has confirmed that the limit is the lowest rate achievable for AMP utilizing the Powerspan equipment and the coal blends to be utilized by AMPGS.

## <u>Organic HAPs</u>

5. **US EPA's fifth question/comment requested that the case-by-case Section 112(g) MACT analysis for the AMPGS consider the organic HAPs (VOC as a surrogate) MACT determinations for the AEP/SWEPCO Turk and Consumers Energy permits.**

Organic HAPs are emitted by EGUs as the result of incomplete combustion of fuel. Once again, US EPA has determined on several occasions that the emissions of these trace amounts of organic HAPs from coal-fired power plants are de minimis and that HAP pollutant-specific emission limits are not warranted. The organic

HAP emissions are effectively minimized by proper burner design and good combustion design. This includes proper air to fuel ratios and a boiler design that provides the necessary temperature, residence time and mixing conditions.

Optimizing complete combustion to minimize CO, VOC and organic HAP emissions must balance the control of those pollutants with the production of nitrogen oxide ($NO_x$) emissions. Sometimes efforts to reduce CO/VOC/Organic HAPs can increase $NO_x$ (e.g., increasing combustion temperatures) and sometimes efforts to decrease $NO_x$ (e.g., reducing temperatures) can cause less efficient combustion. This complex combustion ratio must be considered when getting emission rates.

There are no add-on air pollution control systems currently employed by EGUs for controlling CO/VOC/Organic HAPs. The add-on systems typically employed to control these emissions from other source categories (i.e., thermal oxidizers and catalytic oxidizers) are not feasible for EGUs.

**MACT Floor for CO (Surrogate for Organic HAPs)**

The case-by-case Section 112(g) analysis submitted by AMP proposed that the BACT limit for VOC emissions of 0.0037 lb/mmBtu be used as a surrogate for organic HAP emissions. The draft administrative modification issued by Ohio EPA referenced VOC as a surrogate for organic HAPs and referenced CO as an additional surrogate for organic HAPs. AMP believes that CO is a more effective surrogate than VOC if a Continuous Emission Monitoring (CEM) system is employed to demonstrate continuous compliance with the 3-hour average emission limit.

To support the use of a CO emission limit as a surrogate for organic HAP emissions, AMP evaluated the most stringent CO emission limits in permits issued for PCs that are in operation as set forth in Table 11. The permitted CO emission rates for these units are representative of the lowest emission rates achieved.

**Table 11**
**EGU Permit Limits for CO from Operating EGUs**

| Plant (permit date) | CO Emission Rate | Averaging Time | Compliance Method |
|---|---|---|---|
| Santee Cooper Cross (2/15/04) | 0.16 lb/mmBtu | 3-hr | Annual Stack Test |
| Clover (Title V permit 1/1/08) | 0.10 lb/mmBtu | 3-hr | Stack Test (if required) |

Note that compliance with the CO emission limits for both the Clover and Santee Cooper Cross facilities are based on a periodic stack test. The current Title V operating permit for the Clover facility does not specify that even a single CO emission test be performed during the five year term for that permit. The BACT emission limit for CO in the permit for the AMPGS is 0.154 lb/mmBtu. The use of CEM to demonstrate compliance with the CO limit for the AMPGS as a surrogate for organic HAPs would make it substantially more rigorous than the emission limit for the Santee Cooper Cross facility. AMP believes this limit is equivalent to if not more stringent than the CO emission rate in the permit for the Clover facility where the permit does not require a stack test even once during the five-year permit period.

**Beyond the Floor Analysis for CO (Surrogate for Organic HAPs)**

As discussed above, there are no available technologies to control CO emissions from PC facilities and no additional technology for AMP to evaluate for the control of CO as a surrogate for organic HAPs. Thus, AMP reviewed recently issued permits for EGUs not yet in operation to provide a basis for the beyond the floor determination. These permits and a summary of emission limits were previously provided to Ohio EPA in the BACT analysis for the AMPGS and/or in the case-by-case Section 112(g) MACT submissions. A summary of these limits is presented in Table 12.

**Table 12**
**EGU Permit Limits for CO from Permitted EGUs that are Not Yet Operating**

| Plant (permit date) | CO Emission Rate | Averaging Time | Compliance Method |
|---|---|---|---|
| Elm Road Generating Facility (1/14/04) | 0.12 lb/mmBtu | 24-hr rolling | CEM |
| Longview (3/2/04) | 0.11 lb/mmBtu | 3-hr rolling | CEM |
| Thoroughbred (10/29/04) | 0.10 lb/mmBtu | 30-day rolling | CEM |
| Prairie State (4/28/05) | 0.12 lb/mmBtu | 24-hr block | CEM |
| Longleaf Energy (5/14/07) | 0.15 lb/mmBtu<br>0.30 lb/mmBtu | 30-day rolling<br>1-hr | CEM |
| Santee Cooper Pee Dee (12/16/08) | 0.15 lb/mmBtu | 3-hr and 30-day rolling | CEM |
| Cliffside Unit 6 (3/13/09) | 0.120 lb/mmBtu | 6-hr | Annual Stack Test |
| Consumers Energy Karn-Weadock (draft permit 2/26/09) | 0.125 lb/mmBtu | 24-hr rolling | CEM |

The CO emission rates presented in Table 12 that are based on averaging times greater than 3-hours are not as stringent as the 3-hour average rate of 0.154 lb/mmBtu for the AMPGS. The Santee Cooper Pee Dee 3-hour average rate of 0.15 lb/mmBtu is equivalent to the rate for the AMPGS. Longview is the only permit with a 3-hour average CO emission rate that is less than the rate defined as

BACT for the AMPGS. AMP believes, after consultation with project technical experts, that the Longview limit cannot be achieved on a continuous basis at AMPGS and, therefore, cannot be used as the basis for the MACT for AMPGS.

The CO emission rate of 0.154 lb/mmBtu on a 3-hour average basis with CEM for compliance verification is an appropriate surrogate for organic HAP emissions in the case-by-case Section 112(g) analysis for the AMPGS. Any further reduction in the CO emission rate is likely to cause an increase in $NO_x$ emissions that could have significantly greater adverse impact on air quality.

**Response to US EPA's Question**

USEPA raised a question concerning the VOC MACT limits in the permits for Turk, and Consumers Energy that are summarized in Table 13.

**Table 13**
**MACT Emissions Limits for VOC in the Permits for Turk and Consumers Energy**

| Plant (permit date) | VOC Emission Rate |
|---|---|
| AEP/SWEPCO Turk (11/5/08) | 0.00078 lb/mmBtu |
| Consumers Energy (draft permit 2/26/09)) | 0.00340 lb/mmBtu |

The VOC emission rate for the AMPGS is not significantly different than the rate for Consumers Energy. The VOC emission rate for Turk is significantly less than that contained in the draft permit for Consumers Energy. It is important to note, however, that the organic HAP surrogate VOC emission rate for Turk presented in Table 13 was set at a level significantly lower than the BACT rate set in the same permit for VOC of 0.0036 lb/mmBtu. The MACT limit for VOC from the Turk facility was set on the basis of a statistical evaluation of five emission tests for Hawthorn Unit 5 (Missouri). Both Hawthorn and Turk are 100% sub-bituminous facilities that are not similar to the AMPGS and, therefore, neither facility should be considered for setting any case-by-case Section 112(g) MACT emission limit for the AMPGS.

AMP believes the VOC emission rate in the permit for the AMPGS represent BACT and is consistent with the best controlled similar source for the purpose of the case-by-case Section 112(g) MACT analysis. Regardless, AMP is now proposing that the CO emission rate of 0.154 lb/mmBtu on a 3-hour average basis with CEM for compliance verification be approved as an appropriate surrogate for organic HAP emissions in the case-by-case Section 112(g) analysis for the AMPGS. Both CO and VOC are products of the combustion process and there is no add-on air pollution control technology that is feasible to employ. The optimization of fuel combustion in the boilers at the AMPGS will minimize CO and organic HAP emissions. None of the other permits issued for EGUs that have used a surrogate for organic HAPs have specified a surrogate limit for both CO and VOC. As such, AMP believes that the use of one surrogate, CO, is appropriate.

After careful consideration of all of the information and data accumulated by AMP, consideration of questions posed by Ohio EPA and US EPA and a review of the comments provided during the public comment period concerning the proposed administrative change of the PTI for the two main boilers, AMP has determined the appropriate case-by-case MACT limit for organic HAPs is CO at 0.154 lb/mmBtu on a 3-hour average basis with CEM for compliance verification.

6. **US EPA's sixth question/comment requested that the case-by-case Section 112(g) MACT analysis for the AMPGS show the correlation of the surrogates for different HAPs and explain how the surrogates include all HAPs that are not specifically limited.**

**AMP's Use of "Surrogates"**

"Surrogate" is a term that refers to using one pollutant as a proxy or surrogate for one or more other pollutants. Use of surrogates for MACT development has been determined to be appropriate by US EPA and is appropriate in this instance.[24]

As explained in the Section 112(g) application submitted by AMP in July 2008, AMP proposed that $PM_{10}$ emission limits be used as a surrogate for metal HAPs, since metal HAPs are invariably present in $PM_{10}$ and will be captured by the control equipment utilized for particulate control. VOC emission limits were proposed as a surrogate for organic HAPs since organic HAPs are invariably present in VOC and good combustion will control the emission of both. HCl emission limits will be used as a surrogate for inorganic/acid gas HAPs since acid gases are invariably present and the same control devices can be utilized. Similarly, Ohio EPA retained the use of $PM_{10}$ as the surrogate for MACT for metal HAPs. In addition, the draft permit issued by Ohio EPA identified the BACT limits for both CO and VOC as surrogates for the MACT limit for organic HAPs (on the basis of required good combustion practices). The draft administrative revision issued by Ohio EPA included HCl as a surrogate for inorganic/acid gas HAPs, and added the use of the $SO_2$ monitoring as the surrogate MACT limit for inorganic/acid gas HAPs since the scrubber utilized will also capture inorganic/acid gas HAPs.

The use of surrogates in the manner proposed by AMP for the AMPGS is consistent with the case-by-case Section 112(g) MACT determinations in the permits for numerous EGUs including those identified in Table 14 as examples over the past 5-7 years.

[24] See, generally, D.C. Circuit Court of Appeals, *National Lime v. EPA*.

| Table 14<br>Surrogate Limits in Case-by-Case MACT Determinations for EGUs | | |
|---|---|---|
| **Plant (permit date)** | **MACT Limit(s)** | **Surrogate For** |
| Mid-American CBEC 4 (6/17/03) | PM | Metal HAP |
| | CO | Organic HAPs |
| Thoroughbred Generating Company, LLC (10/29/04) | VOC | Organic HAPs |
| AEP/SWEPCO Turk (11/5/08) | VOC | Organic HAPs |
| | $PM_{10}$ (filterable) | Metal HAPs |
| | $PM_{10}$ (total) | Metal HAPs |
| Consumers Energy (draft permit 2/26/09) | VOC | Organic HAPs |

**$SO_2$ as a Monitoring Surrogate**

AMP originally proposed that a case-by-case Section 112(g) MACT emission limit be established for HCl as a surrogate for all inorganic/acid gas HAPs. Compliance with the HCl surrogate emission rate would be demonstrated by periodic emission testing with the first test scheduled no later than 180 days after a unit at the AMPGS commenced operation.

AMP believes Ohio EPA included $SO_2$ as an additional monitoring parameter for inorganic acid gas HAP emissions because the same BACT control systems that effectively control $SO_2$ emissions will also control HCl, HF and other inorganic acid HAPs consistent with the case-by-case Section 112(g) MACT. The use of the $SO_2$ CEM system as a monitoring surrogate provides for a continuous demonstration that the control system that will also control inorganic acid HAPs is operating properly. Thus, the use of the $SO_2$ surrogate in this instance was for the purpose of continuous monitoring rather than to define an emission rate that is reflective of MACT for acid gas HAPs.

**<u>Summary</u>**

AMP hopes that this information further assists Ohio EPA. To that end, if Ohio EPA or USEPA have additional questions, please feel free to contact us.

Addendum 1: Additional Explanation of Information Evaluated/Considered by AMP

Addendum 2: Requirements in O.A.C. Rule 3745-21-28(D)(1)

Addendum 3: HAP Emission Estimates

## Addendum 1
## Additional Explanation of Information Evaluated/Considered by AMP

### 1. Evaluation of State Mercury Rules:

As part of AMP's beyond-the-floor evaluation for mercury, AMP considered proposed state mercury rules. Specifically, some states have developed and promulgated state-specific mercury rules that are more stringent than existing federal law. These rules are state-specific and many of them have only recently been promulgated. As such, the resulting application of those rules is yet to be seen (i.e., are the requirements achievable under the worst case foreseeable operating conditions). A link to the state summaries has been provided to Ohio EPA (http://www.4cleanair.org/Documents/StateTable.pdf). As additional distinguishing characteristics, many of the proposed state rules have escape clauses (i.e., if a source/facility cannot meet an established limit, there is a mechanism by which to avoid the limit) and many of the rules allow for averaging over multiple units (or even with other units in the same state) which are less stringent than unit-specific limits. For instance, Connecticut, which has the most stringent mercury limit allows a facility to modify the state requirement if it unachievable. Similarly, Massachusetts allows for averaging emissions across multiple units (i.e., the mercury limits are not unit specific) and New Jersey allows for suspension of applicability until at least 2012.

AMP also closely evaluated state rules proposed/promulgated for Region 5 states since the utilization of similar coals in those areas is the most closely aligned to Ohio. Of these states, Illinois, Minnesota and Wisconsin have the most stringent requirements. However, the most restrictive implementation of the rules do not trigger until the future: Illinois (90% in 2012), Minnesota (90% by 2014) and Wisconsin (75% by 2015). In addition, the coals used in Minnesota and Wisconsin are not similar to the coals employed by facilities located in the eastern Ohio Valley. As such, it is impossible, to date, to determine the achievability of those limits with coals that could be employed at the AMPGS on a long-term basis under worst case foreseeable conditions. In addition, the limits are based on percent removal, not a specific emission rate as is the case with AMPGS. Therefore, direct application of those rules to AMPGS under the umbrella of a case-by-case MACT is not appropriate. That said, the level of mercury removal anticipated from the AMPGS will be consistent with the level of control required by these state rules.

### 2. Role of Coals/AMPGS Control Equipment

As Ohio EPA knows, AMPGS has been designed with a significant array of control equipment that is designed to control to best available control technology limits, even given the need of AMP to utilize a range of coal blends. The overall air pollution control system for the AMPGS includes an SCR, an ammonia-based wet-FGD (solely western sub-bituminous coal projects tend to utilize dry-FGD systems), a fabric filter/baghouse and a wet ESP (solely eastern bituminous coal projects do not typically include the wet ESP). The AMPGS control system also meets or surpasses the control equipment proposed by new, yet-to-be-built EGU sources since AMP has designed for best controls on eastern and western coals. Likewise, this control equipment is MACT-level control for all HAPs that can be emitted from eastern and western coals (due to the use of both a wet-FGD system and the use of a wet-ESP). Thus, AMPGS has been designed specifically to utilize the variety of bituminous and sub-bituminous coals needed for fuel flexibility.

As AMP explained in its 2006 PTI application, AMP is a non-profit wholesale power supply and service provider owned by its member municipal electric systems. AMP's core purpose is to provide cost-effective, reliable power supply to member communities. Unlike many investor-owned utilities, AMP does not have a fleet of electric power generation resources. In fact, to date, AMP is purchasing the vast majority of its power needs from the market. AMPGS was conceived and developed to allow AMP to have less dependence on the ever-increasingly volatile power market, and to have a reliable, cost-effective and stable baseload generating station. Given that AMPGS will be AMP's flagship facility and its primary future generation asset, AMP must develop AMPGS to maximize coal fuel flexibility to address the issues set forth below. Given the fundamental project design criteria, AMP included control equipment that would offer the best and maximum control of emissions under a range of fuels. These controls meet MACT (and BACT) control levels.

Transportation of fuels to AMPGS is a fundamental consideration and of utmost importance to AMP. The availability of fuels is critical for AMPGS because AMP does not have a network of baseload generation resources that could be utilized in the event that fuel supply to AMPGS is disrupted. For instance, it would be an unacceptable risk for AMPGS to be developed as a solely western sub-bituminous/PRB project given the existing rail bottlenecks and limited cross-region railway infrastructure as well as the rail to barge transloading facilities necessary to transload coal for delivery to AMPGS. Reliance solely on barging of those coals is not possible, and barging costs have risen significantly due to price increases in the scrap steel industry and the retirement of existing barges. Additionally, lack of funding for lock improvements has been identified as a problem. Reliance on western sub-bituminous coals is further complicated by the loss of Btu and spontaneous combustion issues related to long transit times. In addition, the transportation of those fuels escalates the overall costs of power generation according to a recent study performed by AMP's coal consultant. The use of only Western coals will also result in fundamental and significant plant design changes and will add safety concerns due to the combustibility of the coals.

Within the range of eastern coals, there are several different subcategories of fuels including Ohio, Western Pennsylvania, Central Appalachia compliance coal and Central Appalachia medium sulfur coal. Demand for the Central Appalachia coals has increased and has been at an all-time high in 2008-2009. See, for example, testimony of Duke Energy's Director of Coal Procurement: www.dms.psc.sc.gov/6B49E628-991A-2A08-C06AD5456F2C5165.pdf (Central Appalachia coals are at an all-time high. The market increased from $40 per ton in 2007 to $120-150 per ton in 2008 based on global demand. However, high market prices for this coal have not lead to increased production (i.e., mining) due to increased permitting times, costs to develop coal reserves and uncertainty). Interestingly, Duke, a company with significant baseload resources, takes the same coal procurement position as AMP: it is critical to be able to purchase coal from a wide range of sources due to the variability over time of coal pricing. In addition, AMP has always contemplated the AMPGS is a facility capable of utilizing blends that include local Ohio coals, which have the lowest delivered cost and supports the Ohio economy. Therefore, costs and supply reliability were fundamental considerations in AMP's AMPGS design.

In preparing the case-by-case MACT assessment, as with the original PTI application, AMP considered fuel flexibility as a fundamental design element for AMPGS. Thus, as part of the statistical analysis, as well as the floor/beyond the floor evaluations, AMP presented information and data that consider both eastern and western fuels as blends. Even given this consideration, AMP has proposed figures that represent the very best edge of achievable for blended coal projects. For example, AMP's proposed mercury limit, 1.9 lb/TBtu requires approximately a 90% control of mercury (based on the average fuel usage being the 95% mercury-content fuel from the eastern regions in the ICR-2 database).

## 3. <u>Elimination of CFB as a Similar Source Category</u>

There are several fundamental differences between the design/structure and operation of CFB power plants and PC power plants. These include:

### A. Design/Structural Differences:

***The basic approach to combustion***. In a CFB, crushed coal is fed into the bottom of a bed of dense particulate material (mostly inert material and limestone) which is suspended, or fluidized, by the upward flow of combustion air, also provided from below. The fluid bed is maintained at approximately 1500° – 1600° F, which is hot enough to ignite the coal, and the heat released by combustion maintains the bed temperature. In a PC boiler, coal is fed into the boiler with preheated air through arrays of burners in the furnace walls or corners, usually at multiple elevations within the boiler. As EPA stated in the preamble to its 2004 Utility MACT, "CFB units employ a fundamentally different process for combusting coal from that employed by conventional-, stoker-, or cyclone-fired boilers."

***Additional hardware***. The CFB design includes a cyclonic device to separate large particles, which contain unburned carbon, from flue gases leaving the unit. PC systems do not recycle particles leaving the boiler.

***Coal processing***. In a CFB, coal crushed to about one-quarter inch diameter in a PC unit, coal is pulverized down to the fineness of talcum powder. Maintenance of the suspended bed requires additional parasitic power for the CFB design, as more powerful forced draft fans are needed than those used with PC units.

***Overall size***. Most CFB systems are smaller than 300 MW in capacity, with only 4 units in the U.S. exceeding that capacity.

**B. Operational differences:**

The fundamental design differences in CFB units, versus PC boilers such as the proposed AMPGS, lead to different operating characteristics. These include:

***Operating temperature.*** CFB units operate at a uniform temperature between 1500° and 1600° F, much lower than PC units for which the temperature varies within the boiler and is normally above 2500° F at the burners. Temperature has been demonstrated to be an important factor in mercury speciation (whether the mercury exists in particulate, oxidized, or elemental form).

***Ash characteristics.*** The larger coal particle sizes for CFBs tend to result in larger ash particles. Additionally, the lower CFB temperatures tend to result in higher unburned carbon content in the ash, typically about 2% for CFB versus about 0.5% for PC. These lower temperatures are below the ash fusion temperature, so the ash in a CFB boiler does not melt or vaporize, resulting in an ash that has a much greater specific surface area.

***Residence times.*** CFB gases stay within the boiler area about twice as long as combustion gases remain within a comparable capacity PC boiler. In addition, coal particles (which are retained within the fluid bed until their weight diminishes via combustion), remain much longer.

## Addendum 2
## Requirements in O.A.C. Rule 3745-31-28(D)(1)[25]

| Paragraph | Requirement | Required Information/Data |
|---|---|---|
| (D)(1)(a) | The name and address of the major MACT source. | American Municipal Power Generating Station (AMPGS).<br><br>Site Location:<br>Letart Falls, Ohio (along Route 124, south of Plants Road and north of Cemetery Road)<br><br>AMP Mailing Address:<br>Attn: Randy Meyer<br>2600 Airport Drive<br>Columbus, Ohio 43219 |
| (D)(1)(b) | A brief description of the major MACT sources and an identification of the listed source category from Section 112(c). | B001 – max. 5,191 mmBtu/hr pulverized coal-fired boiler; and<br>B002 – max. 5,191 mmBtu/hr pulverized coal-fired boiler.<br><br>The Section 122(c) category for emissions units B001 and B002 is coal-fired electric utility steam generating units; pulverized coal technology with bituminous/sub-bituminous coal as the primary fuel. |
| (D)(1)(c) | The expected date that construction of the major MACT sources will commence. | B001 – 2009 est.<br>B002 – 2009 est. |
| (D)(1)(d) | The expected date that construction of the major MACT sources will be completed. | B001 – 2014 est.<br>B002 – 2014 est. |
| (D)(1)(e) | The anticipated date of start-up of the major MACT sources. | B001 – 2014 est.<br>B002 – 2014 est. |
| (D)(1)(f) | The HAPs to be emitted by the major MACT source(s) and the estimated full emission rate for each HAP. | HAP emission estimates are included in the attached response Addendum 3. |
| (D)(1)(g) | The federally enforceable emission limitations applicable to the major MACT sources. | B001 and B002 (each unit):<br>- 40 CFR Part 60, Subpart Da<br>- OAC rules 3745-31-10 through 20 (PSD BACT)<br>- OAC Chapter 3745-14 ($NO_x$ Budget)<br>- OAC Chapter 3745-109 (CAIR)<br>- OAC Chapter 3745-103 (Acid Rain) |

[25] This information has previously been provided to Ohio EPA, but has been updated in this response.

| Paragraph | Requirement | Required Information/Data |
|---|---|---|
| (D)(1)(h) | The maximum and expected utilization of capacity of the major MACT sources. | Maximum Possible Utilization:<br>B001 and B002 – operating at 100% capacity factor 5,191 mmBtu/hr for 8,760 hrs/yr.<br><br>Expected Utilization:<br>B001 and B002 – operating at between 90-100% capacity factor as base load units.<br><br>Uncontrolled HAPs Emissions:<br>Refer to Addendum 3. |
| (D)(1)(i) | The controlled annual emissions (tons/yr or TPY) at the maximum and expected utilization of capacity[(1)] | Refer to Addendum 3 for emissions data for each boiler.<br><br>The annual emissions at the expected utilization are reduced proportionately. |
| (D)(1)(j) | The recommended emission limitation for the major MACT sources consistent with paragraph (E) of OAC rule 3745-31-28.<br><br>Note: This summary includes control equipment utilized for each recommended MACT emission limit to address (D)(1)(l). Details of the control equipment have been provided as part of the original PTI application; however, additional information can be provided upon request. | B001 and B002 (each unit):<br><br>CO (surrogate for organic HAPs)<br>0.154 lb/mmBtu (3-hr average) based on CEM;<br>Good combustion practice<br><br>$PM_{10}$ filterable (surrogate for metal HAPs)<br>0.012 lb/mmBtu (3-hr average) based on stack test;<br>Pulse jet fabric filter with leak detectors, wet scrubber, wet ESP<br><br>$SO_2$ (monitoring surrogate for acid gas HAPs)<br>CEM demonstration of compliance with BACT limits;<br>Wet-FGD<br><br>HF<br>0.0004 lb/mmBtu (3-hr average) based on stack test;<br>Wet-FGD and Wet-ESP<br><br>HCl<br>0.004 lb/mmBtu (3-hr average) based on stack test;<br>West-FGD and Wet-ESP<br><br>Mercury<br>No more than 1.9 lb/trillion Btu heat input as a 12-month rolling average;<br>SCR, Pulse Jet Fabric Filter, Wet-FGD, Wet ESP |

| Paragraph | Requirement | Required Information/Data |
|---|---|---|
| (D)(1)(k) | Any other relevant information required by 40 CFR Part 63, Subpart A | The requirements of 40 CFR Part 63, Subpart A are set forth above in the context of O.A.C. 3745-31-28(D). |
| (D)(1)(1) | Control technology selected | See (D)(1)(j) above and Addendum 3. |
| (D)(1)(m) | Supporting documentation of alternative controls | This requirement has been addressed in the "beyond the floor" analysis set forth herein and in prior AMP submittals. |

Notes:

(1) This analysis assumes that both boilers could operate at the maximum capacity for the entire year. If the actual utilization of each boiler is less than 100%, HAP emissions will be less than the maximum annual emission rates presented in the PTI application and the 112(g) analysis. For example, the maximum annual uncontrolled acetaldehyde emission rate at a 100% capacity factor is 0.79 tons per boiler (refer to Table 3-2). If the actual annual average capacity factor is 75%, the estimated uncontrolled acetaldehyde emissions would be 75% of the emission rate at the 100% capacity factor (e.g., acetaldehyde emissions at a 75% capacity factor = 75% x 0.79 tons = 0.59 tons).

## Addendum 3
## HAP Emission Estimates

| Table 1<br>Emissions Estimates for HAPs with Proposed Section 112(g) MACT Limitations<br>Boilers B001 and B002 | | |
|---|---|---|
| **Parameter** | **Maximum** | **Notes** |
| Heat Input Rating (MMBtu/hr) | 5,191 | Engineering Estimate |
| Coal Usage Rate (tons/hr) | 317 | Maximum Requirement for Lowest Btu Coal Supply |
| **$SO_2$ 30-Day Rolling Average (Monitoring Surrogate for Acid Gas HAPs) (based on CEM)** | | |
| CEM demonstration of compliance with BACT limits | | |
| **$PM_{10}$ 3-Hr Average (Filterable Only) (Surrogate for non-mercury Metal HAPs) (based on stack test)** | | |
| $PM_{10}$-lbs/MMBtu | 0.012 | Engineering Estimate |
| $PM_{10}$-lbs/hr | 62 | Calculated as maximum lb/MMBtu x Max Heat Input |
| $PM_{10}$-tons/yr | 273 | Calculated as lb/hr x 8,760 hours/yr x 1 ton/2,000 lbs |
| Estimated Fabric Filter Control Efficiency | 99.5+% | Engineering Estimate (varies based on ash content of fuel blend) |
| **CO 3-Hour Average (Surrogate for Organic HAPs) (based on CEM)** | | |
| CO-lbs/MMBtu | 0.154 | Engineering Estimate |
| CO-lbs/hr | 799 | Calculated as maximum lb/MMBtu x Max Heat Input |
| CO-tons/yr | 3,501 | Calculated as lb/hr x 8,760 hours/yr x 1 ton/2,000 lbs |
| Estimated Efficiency of Good Combustion Practices | NA | Inherent to boiler design and operation |
| **Mercury 12-Month Rolling Average (based on CEM)** | | |
| Hg-lbs/TBtu | 1.9 | Engineering Estimate |
| Hg-lbs/hr | 0.0099 | Engineering Estimate |
| Hg-lbs/yr | 86 | Calculated as lb/hr x 8,760 hours/yr |
| Estimated SCR/Wet-FGD/Fabric Filter/Wet-ESP Control Efficiency | 90+% | Engineering Estimate |
| **HF 3-Hour Average (based on stack test)** | | |
| HF-lbs/MMBtu | 0.0004 | Engineering Estimate |
| HF-lbs/hr | 2.1 | Calculated as maximum lb/MMBtu x Max Heat Input |
| HF-tons/yr | 9.09 | Calculated as lb/hr x 8,760 hours/yr x 1 ton/2,000 lbs |

| Table 1<br>Emissions Estimates for HAPs with Proposed Section 112(g) MACT Limitations<br>Boilers B001 and B002 | | |
|---|---|---|
| **Parameter** | **Maximum** | **Notes** |
| Estimated Wet-FGD/Wet-ESP Control Efficiency | 97+% | Engineering Estimate |
| **HCl 3-Hour Average (based on stack test)** | | |
| HCl-lbs/MMBtu | 0.004 | Engineering Estimate |
| HCl-lbs/hr | 20.8 | Calculated as maximum lb/MMBtu x Max Heat Input |
| HCl-tons/yr | 90.95 | Calculated as lb/hr x 8,760 hours/yr x 1 ton/2,000 lbs |
| Estimated Wet-FGD/Wet-ESP Control Efficiency | 97+% | Engineering Estimate |

| Table 2<br>Estimated Controlled Emissions for HAPs without Section 112(g) MACT Limitations<br>Boilers B001 and B002 | | | | | |
|---|---|---|---|---|---|
| HAP | Emission Factor (lb/ton) | AP-42 Reference | Maximum Hourly Emissions at 100% Load (lb/hr)[(1)] | Maximum Annual Emissions at 100% Load (lb/yr) | (ton/yr) |
| Cyanide (organic HAP) | 0.002500000 | Table 1.1-14 | 0.793 | 6,942 | 3.5 |
| Selenium (metal HAP) | 0.001300000 | Table 1.1-18 | 0.412 | 3,610 | 1.8 |
| Benzene (organic HAP) | 0.001300000 | Table 1.1-14 | 0.412 | 3,610 | 1.8 |
| Benzyl chloride (organic HAP) | 0.000700000 | Table 1.1-14 | 0.222 | 1,944 | 1.0 |
| Isophorone (organic HAP) | 0.000580000 | Table 1.1-14 | 0.184 | 1,611 | 0.8 |
| Acetaldehyde (organic HAP) | 0.000570000 | Table 1.1-14 | 0.181 | 1,583 | 0.8 |
| Methyl chloride (organic HAP) | 0.000530000 | Table 1.1-14 | 0.168 | 1,472 | 0.7 |
| Manganese (metal HAP) | 0.000490000 | Table 1.1-18 | 0.155 | 1,361 | 0.7 |
| Arsenic (metal HAP) | 0.000410000 | Table 1.1-18 | 0.130 | 1,139 | 0.6 |
| Methyl ethyl ketone (organic HAP) | 0.000390000 | Table 1.1-14 | 0.124 | 1,083 | 0.5 |
| Propionaldehyde (organic HAP) | 0.000380000 | Table 1.1-14 | 0.120 | 1,055 | 0.5 |
| Acrolein (organic HAP) | 0.000290000 | Table 1.1-14 | 0.092 | 805 | 0.4 |
| Methylene chloride (organic HAP) | 0.000290000 | Table 1.1-14 | 0.092 | 805 | 0.4 |
| Nickel (metal HAP) | 0.000280000 | Table 1.1-18 | 0.089 | 778 | 0.4 |
| Chromium (metal HAP) | 0.000260000 | Table 1.1-18 | 0.082 | 722 | 0.4 |
| Formaldehyde (organic HAP) | 0.000240000 | Table 1.1-14 | 0.076 | 666 | 0.3 |
| Toluene (organic HAP) | 0.000240000 | Table 1.1-14 | 0.076 | 666 | 0.3 |
| Methyl hydrazine (organic HAP) | 0.000170000 | Table 1.1-14 | 0.054 | 472 | 0.2 |
| Methyl bromide (organic HAP) | 0.000160000 | Table 1.1-14 | 0.051 | 444 | 0.2 |
| Carbon disulfide (organic HAP) | 0.000130000 | Table 1.1-14 | 0.041 | 361 | 0.2 |
| Cobalt (metal HAP) | 0.000100000 | Table 1.1-18 | 0.032 | 278 | 0.1 |
| Ethyl benzene (organic HAP) | 0.000094000 | Table 1.1-14 | 0.030 | 261 | 0.1 |
| Chromium (VI) (metal HAP) | 0.000079000 | Table 1.1-18 | 0.025 | 219 | 0.1 |
| Bis(2-ethylhexyl)phthalate(DEHP) (organic HAP) | 0.000073000 | Table 1.1-14 | 0.023 | 203 | 0.1 |
| Hexane (organic HAP) | 0.000067000 | Table 1.1-14 | 0.021 | 186 | 0.1 |
| Chloroform (organic HAP) | 0.000059000 | Table 1.1-14 | 0.019 | 164 | 0.1 |
| Cadmium (metal HAP) | 0.000051000 | Table 1.1-18 | 0.016 | 142 | 0.1 |
| Dimethyl sulfate (organic HAP) | 0.000048000 | Table 1.1-14 | 0.015 | 133 | 0.1 |
| Tetrachloroethylene (organic HAP) | 0.000043000 | Table 1.1-14 | 0.014 | 119 | 0.1 |
| Ethyl chloride (organic HAP) | 0.000042000 | Table 1.1-14 | 0.013 | 117 | 0.1 |
| Ethylene dichloride (organic HAP) | 0.000040000 | Table 1.1-14 | 0.013 | 111 | 0.1 |
| Bromoform (organic HAP) | 0.000039000 | Table 1.1-14 | 0.012 | 108 | 0.1 |

| Table 2<br>**Estimated Controlled Emissions for HAPs without Section 112(g) MACT Limitations**<br>**Boilers B001 and B002** | | | | | |
|---|---|---|---|---|---|
| **HAP** | **Emission Factor (lb/ton)** | **AP-42 Reference** | **Maximum Hourly Emissions at 100% Load (lb/hr)[(1)]** | **Maximum Annual Emissions at 100% Load** | |
| | | | | **(lb/yr)** | **(ton/yr)** |
| Xylenes (organic HAP) | 0.000037000 | Table 1.1-14 | 0.012 | 103 | 0.1 |
| Methyl tert butyl ether (organic HAP) | 0.000035000 | Table 1.1-14 | 0.011 | 97 | 0.05 |
| Styrene (organic HAP) | 0.000025000 | Table 1.1-14 | 0.008 | 69 | 0.03 |
| Chlorobenzene (organic HAP) | 0.000022000 | Table 1.1-14 | 0.007 | 61 | 0.03 |
| Beryllium (metal HAP) | 0.000021000 | Table 1.1-18 | 0.007 | 58 | 0.0 |
| Methyl methacrylate (organic HAP) | 0.000020000 | Table 1.1-14 | 0.006 | 56 | 0.03 |
| Antimony (metal HAP) | 0.000018000 | Table 1.1-18 | 0.006 | 50 | 0.02 |
| Phenol (organic HAP) | 0.000016000 | Table 1.1-14 | 0.005 | 44 | 0.02 |
| Acetophenone (organic HAP) | 0.000015000 | Table 1.1-14 | 0.005 | 42 | 0.02 |
| Vinyl acetate (organic HAP) | 0.000007600 | Table 1.1-14 | 0.002 | 21 | 0.01 |
| 2-Chloroacetophenone (organic HAP) | 0.000007000 | Table 1.1-14 | 0.002 | 19.4 | 0.01 |
| Cumene (organic HAP) | 0.000005300 | Table 1.1-14 | 0.002 | 14.7 | 0.01 |
| Ethylenedibromide (organic HAP) | 0.000001200 | Table 1.1-14 | 0.0004 | 3.3 | 0.002 |
| 2,4-Dinitrotoluene (organic HAP) | 0.000000280 | Table 1.1-14 | 0.0001 | 0.78 | 0.0004 |
| Total PAH | 0.000020758 | Table 1.1-13 | 0.007 | 57.64 | 0.029 |
| TOTAL PCDD + PCDF | 0.000000244 | Table 1.1-12 | 0.00008 | 0.7 | 0.00034 |

(1) All calculations based on a maximum Coal Usage Rate of 317 tons/hr