



NTH Consultants, Ltd.

Infrastructure Engineering
and Environmental Services

608 S. Washington Avenue
Lansing, MI 48933
517.484.6900
517.485.8323 Fax

Mr. David Riddle, Sr. Environmental Engineer
MDEQ – AQD
Permit Section, Thermal Process Unit
Lansing, Michigan 48933

July 21, 2008
NTH Project 16-1601026

**RE: Updated 112(g) Case-by-Case MACT Analysis for
the proposed ASCPC Boiler
Permit to Install Application No. 341-07
Consumers Energy Company – Bay County**

Dear Mr. Riddle:

On behalf of Consumers Energy Company (Consumers), NTH Consultants, Ltd. is submitting the attached supplement to Permit to Install Application No. 341-07 updating the recently submitted case-by-case Maximum Achievable Control Technology (MACT) review for the proposed advanced supercritical pulverized coal (ASCPC) boiler project.

The MACT analysis has been updated as a result of additional information that you requested in your June 26, 2008 letter. In this letter you requested the details of how the proposed mercury emission limit represents MACT and that it is as stringent as the controls on the best similar source. You also indicated that MACT for hydrogen chloride emissions should be addressed and suggested that carbon monoxide (CO) be used as a surrogate for organic hazardous air pollutants in lieu of volatile organic compounds based on CO having a more optimum compliance method (i.e., continuous monitor instead of stack testing). Finally, you requested that a case-by-case MACT analysis be completed for the auxiliary boiler. The auxiliary boiler MACT analysis will be submitted under separate cover.

After further review of the MACT regulations codified as 40 CFR 63.40 through 63.44, NTH made several revisions to the May 7, 2008 112(g) analysis beyond what has been requested by your June 26 letter.

Consumers notes that in enacting the Section 112 amendments to the CAA, Congress clarified that hazardous air pollutants regulated under that section were not subject to the Prevention of Significant Deterioration regulatory program. Specifically, Congress stated that the provisions of Part C of this subchapter (PSD) shall not apply to the pollutants listed in this section (Section 112(b)(6)). With this language, Congress made it clear that PSD and MACT are mutually exclusive. Consequently the attached information, which is submitted as part of a MACT analysis, is not required by nor related to applicable PSD regulations.

If you have any questions concerning this amendment, please feel free to contact me at (517) 484-6900.

Sincerely

NTH Consultants, Ltd.

Delbert Rector, P.E.
Sr. Vice President

Lori Myott
Sr. Project Engineer

Attachment
LLM/DR/mjb

cc: Ms. Linda Hilbert, Consumers Energy Company



Case-by-Case MACT Determination
in
Support of the Permit to Install Application
No. 341-07
Installation of a New Advanced Supercritical Pulverized Coal Boiler
Consumers Energy Company
Karn/Weadock Generating Station
Hampton Township, Michigan

May 7, 2008

Revised July 21, 2008

NTH Project Number: 16-061026

Prepared by:
NTH Consultants, Ltd.
608 S. Washington Avenue
Lansing, MI 48933
(517) 484-6900



TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION	1
2.0 REGULATORY BACKGROUND	2
3.0 APPLICATION REQUIREMENTS	3
4.0 HAP EMISSIONS	4
5.0 CASE-BY-CASE MACT ANALYSIS METHODOLOGY	7
5.1 IDENTIFYING THE MACT FLOOR	8
5.2 BEYOND THE MACT FLOOR	11
6.0 CASE-BY-CASE MACT ANALYSIS	12
6.1 MERCURY COMPOUNDS	12
6.2 ACID GASES	22
6.3 METAL COMPOUNDS	26
6.4 ORGANIC HAPS	27
7.0 MONITORING, RECORDKEEPING AND TESTING	30
8.0 SUMMARY	31



LIST OF TABLES

- 3-1. Application Information**
- 4-1. Potential HAP emissions from the ASCPC Boiler**
- 6-1. State Mercury Emission Limitations for Coal-fired EGUs**
- 6-2. Operating Units Considered for MACT Floor Analysis for Mercury – Bituminous Coal**
- 6-3. Operating Units Considered for MACT Floor Analysis for Mercury – Sub-bituminous Coal**
- 6-4. Permitted Units Considered for BTF Analysis for Mercury**
- 6-5. Permitted Units Considered for BTF Analysis for Acid Gases**
- 6-6. Summary of Short-term and Long Term Emission Factors for Chlorine**
- 6-7. Summary of Short-term and Long Term Emission Factors as HCl**
- 6-8. Operating Units Considered for MACT Floor Analysis for Metal HAPs**
- 6-9. Permitted Units Considered for BTF Analysis for Metal HAPs**
- 6-10. Operating Units Considered for MACT Floor Analysis for Organic HAPs**
- 6-11. Permitted Units Considered for BTF Analysis for Organic HAPs**
- 7-1. MACT Compliance**
- 8-1. MACT Summary**



1.0 INTRODUCTION

Consumers Energy Company (Consumers) is submitting this revised case-by-case Maximum Achievable Control Technology (MACT) determination to clarify the previously submitted (May 7, 2008) 112(g) MACT Analysis for the Advanced Supercritical Pulverized Coal (ASCPC) boiler and in response to an additional information request from the Michigan Department of Environmental Quality (MDEQ). This document demonstrates that the emission limitations and air pollution control technology proposed in the permit to install (PTI) application and previous MACT submittal meets the requirements of a case-by case 112(g) MACT determination.

Consumers has applied to the MDEQ for a permit to install for the installation and operation of a new ASCPC boiler at the existing Karn/Weadock Generating Station, located in Bay County, Hampton Township, Michigan. The new boiler will be nominally rated at 8,190 MMBtu/hr with a gross output of approximately 930 megawatts (MW). Western sub-bituminous coal from the Powder River Basin (PRB) is currently the primary fuel for the existing solid fuel boilers at both the Karn and Weadock Generating Plants. The ASCPC boiler is being designed to burn 100 percent PRB coal as the primary fuel, but also will have the ability to blend in up to 50 percent Eastern bituminous coal, as limited by heat input.

Construction on this unit is expected to start in May 2011. Major construction is expected to be complete in June 2015, and initial startup will begin then. Commercial operation is expected to commence in December 2015.

The Air Quality Control System (AQCS) for the ASCPC boiler will consist of combustion controls and post combustion controls. Combustion controls include low NO_x burners (LNBS) and over-fire air (OFA) to minimize thermal nitrogen oxide (NO_x) formation within the boiler. Post-combustion controls include a selective catalytic reduction (SCR) system to further control NO_x emissions, a hydrated lime injection system to control sulfur trioxide (SO₃) and minimize acid gas formation, an activated carbon injection (ACI) system to control mercury emissions, a fabric filter to remove particulate and solid hazardous air pollutants (HAPs), primarily metals and their compounds from the flue gases, and a wet flue gas desulfurization (FGD) system using a



limestone slurry to remove sulfur dioxide (SO₂) and other acid gases (hydrogen chloride, hydrogen fluoride).

2.0 REGULATORY BACKGROUND

On February 8, 2008, the United States Circuit Court of Appeals for the District of Columbia (Court) issued an opinion evidencing its intent to vacate the Clean Air Mercury Rule (CAMR) and to overturn the United States Environmental Protection Agency's (USEPA) decision to delist electric generating units as sources regulated under Section 112 of the Clean Air Act (CAA). At this time, the exact implications of this decision on electric generating units (EGUs) in the permitting process are not known. One interpretation is that the vacatur now results in a requirement for major new sources of HAPs to conduct case-by-case preconstruction reviews, until such time as a MACT standard can be promulgated for EGUs. Regardless of the uncertainty surrounding the issue, Consumers has elected to proactively apply for a case-by-case MACT preconstruction review consistent with section 112(g) of the CAA. In the event that a successful appeal of the vacatur or other action results in re-instatement of CAMR and the delisting of EGUs from MACT review, Consumers requests that the permit contain language rendering all permit conditions associated with the MACT requirements as not applicable.

Michigan has developed regulations in order to both implement and supplement the federal requirements. Specifically, MDEQ has promulgated rules and regulations under the Natural Resources and Environmental Protection Act (Act 451 of 1994, As Amended) and Section 336 of the Michigan Compiled Law (MCL) for the control of air pollution. Per Rule 299(e), Michigan has adopted by reference, the regulations implementing Section 112(g), codified as 40 CFR §63.40 through §63.44. Michigan has also published Operational Memorandum No. 15 which defines the "procedure for processing permit applications subject to Federal Clean Air Act Section 112(g)."

This case-by-case determination has been prepared in accordance with Michigan Rule 299(e) and Operational Memorandum No. 15. Section 112(g) MACT requirements apply to the proposed ASCPC boiler because the boiler itself is a major source of HAPs.



3.0 APPLICATION REQUIREMENTS

The application requirements for a case-by-case MACT determination under CAA Section 112(g) are provided at 40 CFR 63.43(e). It states: “(1) An application for a MACT determination ... shall specify a control technology selected by the owner or operator that, if properly operated and maintained, will meet the MACT emission limitation or standard as determined according to the principles set forth in paragraph (d) of this section.” In each instance where a constructed or reconstructed major source would require additional control technology or a change in control technology, the application for a MACT determination must contain the following information in Table 3-1. Much of this required information has already been provided with PTI Application No. 341-07 and the remaining is included with this application for a MACT determination.

Table 3-1. Application Information

Required Information	Where Found
i) The name and address (physical location) of the major source to be constructed or reconstructed;	Application
(ii) A brief description of the major source to be constructed or reconstructed and identification of any listed source category or categories in which it is included;	Application
(iii) The expected commencement date for the construction or reconstruction of the major source;	MACT Analysis
(iv) The expected completion date for construction or reconstruction of the major source;	MACT Analysis
(v) the anticipated date of start-up for the constructed or reconstructed major source;	MACT Analysis
(vi) The HAP emitted by the constructed or reconstructed major source, and the estimated emission rate for each such HAP, to the extent this information is needed by the permitting authority to determine MACT;	Application
(vii) Any federally enforceable emission limitations applicable to the constructed or reconstructed major source;	Application
(viii) The maximum and expected utilization of capacity of the constructed or reconstructed major source, and the associated uncontrolled emission rates for that source, to the extent this information is needed by the permitting authority to determine MACT;	Application
(ix) The controlled emissions for the constructed or reconstructed major source in tons/yr at expected and maximum utilization of capacity, to the extent this information is needed by the permitting authority to determine MACT;	Application and MACT Analysis



Required Information	Where Found
(x) A recommended emission limitation for the constructed or reconstructed major source consistent with the principles set forth in paragraph (d) of this section;	MACT Analysis
(xi) The selected control technology to meet the recommended MACT emission limitation, including technical information on the design, operation, size, estimated control efficiency of the control technology (and the manufacturer's name, address, telephone number, and relevant specifications and drawings, if requested by the permitting authority);	MACT Analysis
(xii) Supporting documentation including identification of alternative control technologies considered by the applicant to meet the emission limitation, and analysis of cost and non-air quality health environmental impacts or energy requirements for the selected control technology; and	MACT Analysis
xiii) Any other relevant information required pursuant to subpart A.	MACT Analysis

4.0 HAP EMISSIONS

The proposed ASCPC boiler will be nominally rated at 8,190 MMBtu/hr heat input with a gross output of approximately 930 MW. The emission rates are reflective of maximum operation with coal as the fuel source and consistent with the maximum pollutant emissions across a range of coal fuels proposed for this project. The fuel specifications have been presented in section 2.2 of PTI application 341-07.

As identified in the permit to install support materials, the proposed ASCPC boiler will emit HAPs listed in Section 112(b)(1) of the CAA. In its proposed 2004 National Emission Standard for Hazardous Air Pollutants (NESHAP), the USEPA established a MACT limit only for mercury for coal fired EGUs. Nevertheless, this MACT analysis will evaluate groupings of non-mercury HAPs in addition to mercury. Pursuant to Michigan Rule 299(e) and Operational Memorandum No. 15, the analysis does not require that each HAP be considered independently but different forms of HAPs (e.g., particulate HAPs, organic HAPs, etc.) are expected to be evaluated separately. EPA has allowed the grouping of HAPs based on how they are characterized and controlled together, along with using surrogates for measuring compliance. As such, the HAPs



have been broken down into the following categories: acid gases, mercury compounds, metal compounds, and organic HAPs.

Radionuclide emissions, a listed HAP in section 112(b) of the CAA, have not been included in this analysis because the emissions are considered *de minimus* and an analysis is not required pursuant to Section 112(q) of the CAA. Section 112(q) of the Clean Air Act provides:

[T]his section [CAA 112], as in effect prior to the date of enactment of the Clean Air Act Amendments of 1990, shall remain in effect for radionuclide emissions from . . . coal-fired utility and industrial boilers . . . unless the Administrator, in the Administrator's discretion, applies the requirements of this section as modified by the Clean Air Act Amendments of 1990 to such sources of radionuclides.

A MACT analysis was not required until the 1990 amendments to the CAA. Since the CAA 112(q) savings provision states that pre-1990 CAA 112 requirements remain in effect for radionuclide emissions from coal-fired utilities, no MACT analysis is required for radionuclide emissions from Consumers' proposed ASCPC boiler.

Additionally, recent EPA studies have found that the health risks due to exposure to radionuclide emissions from coal fired boilers are minimal when compared to the natural background radiation. Specifically, USEPA's report, *Study of Hazardous Air Pollutant Emissions from Electric Utility Steam Generating Units - Final Report to Congress*, Volume 1, Executive Summary at ES-22 to ES-23 (February 24, 1998), states that the average exposure to natural background radiation (excluding radon) for the U.S. population has been estimated to be about 67 times higher than the highest exposure due to radionuclide emissions from utilities. Radionuclides are emitted primarily as particulate; therefore control measures for particulate and metal compounds can also be used to reduce radionuclide emissions.

The potential HAP emission factors for coal (Western sub-bituminous and Eastern bituminous coals) are based on vendor information, where available, and the *Compilation of Air Pollutant Emissions Factors*, USEPA Document No. AP-42, Fifth Edition, September 1998 in the absence



of vendor information. The emissions represent normal operating conditions and do not include startups or shutdowns. All annual calculations are based on continuous operation at 8,760 hours per year at base load (100 percent load) conditions. The potential emissions of HAPs from the ASCPC are detailed in Appendix B of PTI Application No. 341-07 and are summarized in Table 4-1 below.

Table 4-1. Potential HAP emissions from the ASCPC Boiler¹

Compound	Western Sub-Bituminous Coal		50/50 Blend ²		Maximum Emission Rates	
	Emission Rates		Emission Rates		Emission Rates	
	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Acid Gases						
HCl	18.7	24.8	32.8	70.5	32.8	70.5
HF	2.5	8.76	2.2	7.66	2.5	8.76
Mercury Compounds						
Mercury	5.7E-03	2.5E-02	7.3E-03	3.22E-02	7.3E-03	3.22E-02
Metal Compounds						
Antimony	8.88E-03	3.89E-02	7.44E-03	3.26E-02	8.88E-03	3.89E-02
Arsenic	2.02E-01	8.86E-01	1.69E-01	7.42E-01	2.02E-01	8.86E-01
Beryllium	1.04E-02	4.54E-02	8.68E-03	3.80E-02	1.04E-02	4.54E-02
Cadmium	2.52E-02	1.10E-01	2.11E-02	9.23E-02	2.52E-02	1.10E-01
Chromium, total	1.28E-01	5.62E-01	1.07E-01	4.70E-01	1.28E-01	5.62E-01
Chromium, hexavalent	3.90E-02	1.71E-01	3.26E-02	1.43E-01	3.90E-02	1.71E-01
Cobalt	4.93E-02	2.16E-01	4.13E-02	1.81E-01	4.93E-02	2.16E-01
Lead	3.50E-02	0.15	6.54E-02	0.29	6.54E-02	0.29
Manganese	2.42E-01	1.06	2.02E-01	8.87E-01	2.42E-01	1.06
Nickel	1.38E-01	6.05E-01	1.16E-01	5.07E-01	1.38E-01	6.05E-01
Selenium	6.41E-01	2.81	5.37E-01	2.35	6.41E-01	2.81
Organic HAP Compounds						
Organic HAPs	4.4	19.2	3.7	16.0	4.4	19.2
Total HAP Emission Rates	27.1	59.4	40.0	99.9	41.3	105.3

¹ This table has been updated with revised HCl emission estimates based on fuel analysis, rather than the AP-42 emission factor used in the original application. Lb/hr values based on 99th percentile values; TPY values based on 95 percent upper confidence level on the mean (UCL).

² The coal blend is based on 50 percent Western sub-bituminous and 50 percent Eastern bituminous coals, based on heat input, as described in the permit application support document.



5.0 CASE-BY-CASE MACT ANALYSIS METHODOLOGY

MACT is a case-by-case analysis for categories of major sources of HAP emissions where EPA has not promulgated emission standards. It is meant as a means to predict what EPA would determine is MACT in rulemaking for each source category.

MACT is defined in §63.41 as:

the emission limitation which is not less stringent than the emission limitation achieved in practice by the best controlled similar source, and which reflects the maximum degree of reduction in emissions that the permitting authority, 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 by the constructed or reconstructed major source. (emphasis added)

The principles of case-by case MACT determinations have been codified in 40 CFR 63.43(d):

(d) Principles of MACT determinations.

The following general principles shall govern preparation by the owner or operator of each permit application or other application requiring a case-by-case MACT determination concerning construction or reconstruction of a major source, and all subsequent review of and actions taken concerning such an application by the permitting authority:

(1) The MACT emission limitation or MACT requirements recommended by the applicant and approved by the permitting authority shall not be less stringent than the emission control which is achieved in practice by the best controlled similar source, as determined by the permitting authority.

(2) Based upon available information, as defined in this subpart, the MACT emission limitation and control technology (including any requirements under paragraph (d)(3) of this section) recommended by the applicant and approved by the permitting authority shall achieve the maximum degree of reduction in emissions of HAP 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.

(3) The applicant may recommend a specific design, equipment, work practice, or operational standard, or a combination thereof, and the permitting authority may approve such a standard if the permitting authority specifically determines that it is not feasible to



prescribe or enforce an emission limitation under the criteria set forth in section 112(h)(2) of the Act.

(4) If the Administrator has either proposed a relevant emission standard pursuant to section 112(d) or section 112(h) of the Act or adopted a presumptive MACT determination for the source category which includes the constructed or reconstructed major source, then the MACT requirements applied to the constructed or reconstructed major source shall have considered those MACT emission limitations and requirements of the proposed standard or presumptive MACT determination.

The methodology establishes a two-step analysis in determining MACT. Step 1 of the MACT analysis is to identify the emission limit achieved in practice by the best controlled similar source. This is often referred to as the “MACT floor”. While the term “MACT floor” is specifically defined in §63.51 for sources subject to 112(j) of the CAA, it is used here to describe the compilation of the best controlled similar sources. Step 2 of the MACT analysis requires the applicant to look at the maximum reduction in HAPs using any technology, not just that representing the MACT floor. This entails determining the maximum reduction in HAP emissions that the specific source, on a case-by-case basis, can achieve taking into consideration cost and non-air quality health and environmental impacts and energy requirements. Step 2 is referred to as “beyond-the-floor” MACT analysis.

5.1 IDENTIFYING THE MACT FLOOR

Pursuant to 40 CFR 63.43(d), an applicant is required to review all “available information” in determining the emission limit achieved in practice by the best controlled similar source.

Available information is defined in §63.41 as:

for purposes of identifying control technology options for the affected source, information contained in the following information sources as of the date of approval of the MACT determination by the permitting authority:

- (1) A relevant proposed regulation, including all supporting information;*
- (2) Background information documents for a draft or proposed regulation;*
- (3) Data and information available for the Control Technology Center developed pursuant to section 113 of the Act;*
- (4) Data and information contained in the Aerometric Informational Retrieval System including information in the MACT data base;*



(5) Any additional information that can be expeditiously provided by the Administrator; and

(6) For the purpose of determinations by the permitting authority, any additional information provided by the applicant or others, and any additional information considered available by the permitting authority.

40 CFR 63.43(d) (4) as well as the definition of “available information” described above, require that the emission limitations and requirements of a proposed standard or presumptive MACT determination for a source category be considered in a MACT determination. Therefore, it is appropriate to consider background and supporting information for the proposed and vacated regulations regarding coal fired EGUs when establishing the MACT floor (e.g., CAMR, 40 CFR Part 63, Subpart UUUUU).

5.1.1 Determination of Similar Source

For a coal-fired EGU like the ASCPC boiler, it is important to recognize that not all EGUs will qualify as a similar source. EPA defined “similar source” at 40 CFR 63.41as:

*“a stationary source or process that has **comparable emissions** and is **structurally similar in design and capacity** to a constructed or reconstructed major source such that the source could be **controlled using the same control technology.**”* (emphasis added)

Based on this definition, when proposing the mercury NESHAP for EGUs, USEPA proposed subcategories based on the fuel used, as well as distinct combustion technologies. Specifically, EPA subcategorized coal-fired EGUs based on the rank of coal fired (e.g., bituminous, sub-bituminous, etc.) and identified IGCC units separately (69 FR 4652, 4662-63, Jan. 30, 2004). For units that fire multiple fuels (e.g., bituminous coal and sub-bituminous coal), EPA proposed a blended standard based on the amount of each fuel fired (69 FR 4674-75, Jan. 30, 2004). For example, an EGU burning 80 percent bituminous coal and 20 percent sub-bituminous coal would be subject to a different standard than a unit burning 50 percent bituminous coal and 50 percent sub-bituminous coal even though both units may be using the same control technologies. Thus, in determining what a best controlled similar source is for a proposed coal-fired EGU for which a



case-by-case MACT is being performed, the most important parameter is the fuel that will be fired.

The design of the unit can also be a factor in determining whether the source is similar. For example, a small CFB unit (less than 100 MW) using bituminous coal may be able to comply with stringent mercury emission limits, such as the AES Thames units in Connecticut, without the use of activated carbon injection. This means that small CFB units are not similar to large PC units like the ASCPC unit proposed by Consumers.

The ASCPC boiler is a 930 MW (gross) fossil fuel fired boiler that burns sub-bituminous coal from the Power River Basin and will have the capability to blend up to 50 percent low-sulfur Eastern bituminous coal. The boiler technology is advanced supercritical. According to the mercury NESHAP, EPA subcategorized coal-fired EGUs based on the rank of coal fired (e.g., bituminous, sub-bituminous, etc.) and identified IGCC units separately. Therefore, similar sources for this MACT analysis are defined as large supercritical boilers that burn primarily sub-bituminous coal and have the capability to blend up to 50 percent low-sulfur Eastern bituminous coal. While CFB's might be similar to the ASCPC for some pollutants when burning bituminous coal, there is little experience or data of CFB's operating on sub-bituminous coal. In some cases (e.g., acid gases) the inherent design and operation of a CFB would make it a dissimilar source.

5.1.2 Achieved In Practice

The determination of best controlled similar source is limited to emission limits that have been achieved in practice, which of necessity means existing operating units and not units that may operate in the future. As proposed, the ASCPC EGU will fire 100 percent PRB coal or a blend of low sulfur bituminous coal, and PRB (sub-bituminous) coals. Therefore, similar sources to be considered and compared to the proposed ASCPC are multi-fuel pulverized coal (PC) boilers. However, just because an EGU is a PC burning bituminous coal and sub-bituminous coal unit does not automatically mean that it is a similar source to the ASCPC. As discussed above, the blend of fuels is critically important in determining what is similar. Emissions of HAPs (such as metals and acid gases) are directly related to the amount of the pollutant (or precursor) in the fuel, which varies even within the same fuel type. Coal properties affecting emissions (mercury,



fluoride and chlorine contents) vary from each mine and even from each seam. Short-term stack test results do not adequately account for that variability in fuel type, much less with different blends.

Achieved in practice means a MACT limit that is able to be met continuously under reasonably foreseeable worst-case conditions (*Sierra Club v. EPA*, 167 F.3d 658, 665, D.C. Cir. 1999). It does not mean the lowest HAP emission rate ever measured from a similar source, which primarily, if not exclusively, are the result of short-term stack tests conducted under normal operations. To establish a limit based on the lowest emission rate ever measured would guarantee that limit would be violated, even by the source upon which it is based. *See id.* (“It is reasonable to suppose that if an emissions standard is as stringent as ‘the emissions control that is achieved in practice’ by a particular unit, then that particular unit will not violate the standard. This only results if ‘achieved in practice’ is interpreted to mean ‘achieved under the worst foreseeable circumstances.’”) Thus, to ensure the MACT limits are continuously achievable, it is appropriate to include a margin of safety in the limit to ensure that reasonably foreseeable worst-case circumstances are covered, particularly when based on limited data. *See id.*; *see also* 69 Fed. Reg. at 4678 (describing approach EPA used in developing proposed MACT limits for new EGUs to address uncertainty and variability in emission test results).

The method of measurement of the emissions is also an important factor when it comes to the determination of variability and achievability. This is especially important when evaluating mercury emissions. In evaluating the emission rates that have been achieved by similar sources, it is important to compare units with similar methods of measurement.

5.2 BEYOND THE MACT FLOOR

Having identified the MACT floor, the next step is referred to as “beyond the floor” (BTF) analysis. The BTF analysis involves a review of whether or not it is appropriate to set an emission limit at a level more stringent than the MACT floor. BTF determines the maximum reduction that can be achieved using available technology and taking into consideration economic cost, non air quality related health and environmental impacts and energy requirements (40 CFR 63.43(d)(2)).



The permit application for the ASCPC boiler contains limits consistent with the state and federal Prevention of Significant Deterioration (PSD) BACT, New Source Performance Standards (NSPS), and Michigan's BACT for toxic air contaminants (T-BACT). However, a case-by-case MACT review requires that the proposed control technology be re-evaluated to determine whether the proposed PSD BACT controls also satisfy the MACT standard. In some cases, the limits on criteria emissions such as PM or CO, will serve as the surrogate limit for HAPs. For example, a stringent limit on CO emissions requires good combustion practices, which is also needed to minimize emissions of individual organic HAPs. It is also noted that some control technologies are effective in removing multiple pollutants; for example, hydrated lime injection, as a co-benefit to controlling SO₃, controls acid gases such as hydrogen chloride and hydrogen fluoride.

A review of the USEPA's RACT/BACT/LAER Clearinghouse (RBLC) for existing PC units using a similar fuel blend to the ASCPC boiler shows that the best controlled operating PC units use SCR, fabric filters with hydrated lime injection, wet FGD, and good combustion practices to control emissions. It is important to note that the list of PC units from the RBLC contains only supercritical and subcritical units as compared to the advanced supercritical design of the proposed Consumers boiler. While an emission rate or reduction may not be directly transferable to the ASCPC unit because such units may not be a similar source, the control technology used by those best controlled PCs is transferable. Consumers has proposed the same control technologies, as well as additional technology (activated carbon injection) to control both HAPs and regulated New Source Review (NSR) pollutants (e.g., PM, SO₂ and NO_x).

6.0 CASE-BY-CASE MACT ANALYSIS

The case-by-case MACT analysis for each HAP category is described below.

6.1 MERCURY COMPOUNDS

Mercury is a naturally occurring constituent of coal. Thus, emissions of mercury are dependent upon the mercury content of the fuel. Other factors that affect the potential emissions of mercury include the chlorine content of the coal, unburned carbon, or loss on ignition (LOI) within the boiler, type of burner design and the removal efficiency of the add-on control technology.



6.1.1 Mercury MACT Floor Analysis

According to §63.43(d) this MACT determination must consider any proposed §112(d) MACT standard. In proposing MACT standards (69 Federal Register 4652, January 30, 2004), U.S. EPA made several determinations relevant to this MACT analysis. They include:

- The performance of the best performing units was dependent on mercury and chlorine content of the coal, which vary considerably with coal rank. Specifically, bituminous coals have higher chlorine content than sub-bituminous coals. The higher chlorine content results in more conversion of the elemental mercury that exists in the high temperature boiler region to oxidized mercury which is more amenable to collection. This resulted in the sub-categorization of coal into bituminous, sub-bituminous and lignite fuels.
- To encourage fuel efficiency, the limits were proposed on a mass per energy output basis. (69 Federal register 4652, page 4667, January 30, 2004).
- The type of firing equipment (pulverized, stoker, cyclone or fluidized bed) for bituminous coal did not greatly affect the mass rate of emissions or the emission characteristics. The same claim was not made for sub-bituminous coals.
- The proposed MACT standard for new bituminous coal-fired units was 6.0 pounds of mercury per trillion watt hours (terawatt-hour). The proposed standard for new sub-bituminous coal-fired units was 20.0 pounds of mercury per terawatt-hour. This was based on best performing units, taking into account fuel and performance variability.
- The final CAMR standards (40 CFR § 60.45Da(a)(1)) for new bituminous coal-fired units was 20 pounds of mercury per terawatt-hour and for new sub-bituminous coal-fired units in areas receiving more than 25 inches rain per year was 66 pounds of mercury per terawatt-hour. Units burning a blend of bituminous and sub-bituminous coal would have an emission limit that was based on a weighted average of these two limits.



In addition to the information sources listed in Section 5.1 above, there are three additional sources of information for this analysis. The first is from the National Association of Clean Air Agencies (NAACA), which published a summary in December 2007 of actions taken by the states to control mercury emission from coal-fired electric generating units (EGUs). That list can be found at <http://www.4cleanair.org/documents/statetable.pdf>. The second is from the USEPA, which published an update to the list of the national coal projects on April 29, 2008. That list can be found at <http://www.epa.gov/region4/air/permits/>. The third source is the May 31, 2006 Memorandum from William H. Maxwell, Energy Strategies Group, Office of Air Quality Planning and Standards, U.S. EPA concerning the “Revised new source performance standard (NSPS) statistical analysis for mercury emissions.”

Table 6-1. State Mercury Emission Limitations for Coal-fired EGUs

State	Requirement	Limit Lb/GW-hr ¹	Reduction Required
Connecticut	State statute requires 90 percent reduction or to comply with mercury emissions limit of 0.6 lb/TBtu by 7/1/2008, with provision for alternative if controls fail to achieve limitation. More stringent limits possible after 7/1/2012. Alternate limit allowed for units unable to meet standard	0.006	90 percent
Massachusetts	Adopted rule requires 85 percent capture or 0.0075 lb/GW-hr by 1/1/2008 and 95 percent capture or 0.0025 lb/GW-hr by 10/1/2012. Averaging between units at the same facility is allowed.	0.0075	85 percent
New Jersey	Adopted rule requires control efficiency of 90 percent or 3 mg/MW-hr by 12/15/2007, for coal-fired boilers of any size. A multi-pollutant approach can reduce the initial reduction required and extend compliance to 12/15/2012.	0.0066	90 percent

¹ Assumes 10MMBtu/MW-hr conversion factor

The NAACA list shows there are currently effective emission limitations in three states, which provides the opportunity to have units which have demonstrated compliance, and thus be considered for the MACT floor. These three state requirements are shown below in Table 6-1.



6.1.1.1 Bituminous Coal

The operating facilities that have emission limits from state permits, state rules or state law that are considered for setting the MACT floor for bituminous coals are listed in Table 6-2.

Table 6-2. Operating Units Considered for MACT Floor Analysis for Mercury - Bituminous Coal

State	Unit	Largest Unit Size (MW)	Equivalent Mercury Limit (lb/GW-hr)
New Jersey	B.L. England	176	0.0066
Massachusetts	Brayton Point	630	0.0075
South Carolina	Santee Cooper Cross 3	640	0.036

The lowest limit listed in the table is the B.L. England Generating Station in New Jersey which has 2 coal-fired boilers with a wet FGD to remove SO₂ from the West Virginia coal and tire fuel that is used. New Jersey Department of Environmental Protection stated in a conversation with NTH on July 14, 2008 that this unit has achieved compliance on its initial test, but that 4 quarters of documented compliance is required. Other Plants, including the PSEG Mercer and Hudson Stations have not yet tested, and have extended compliance dates. For the purpose of this MACT demonstration, Consumers accepts that the emission limit of 6.6 pounds per terawatt-hour for the B.L. England Generating Station sets the MACT floor for bituminous fired facilities.

Not included in the MACT floor analysis for bituminous coal is the AES Thames plant in Connecticut, which is subject to a limit of 0.6 pounds per trillion Btu (0.6 lb/TBtu), or 90 percent reduction which became effective on July 1, 2008. According to the Connecticut Clean Air Mercury Rule State Plan dated October 29, 2007, the AES Thames Units 1 & 2 complies with this emission limit, as verified by stack testing. According to that plan, “AES Thames, LLC operates a cogeneration facility located in the Uncasville, Connecticut. The facility produces electricity, which it sells to the grid, and steam, which it sells to a neighboring paper plant. The two units are identical Combustion Engineering circulating fluidized bed boilers, each with maximum heat input of 923 MMBtu/hr. Together the two units can generate 181 MW of electricity. Dry limestone injection followed by fabric filtration controls sulfur emissions. The



boilers are primarily fired with bituminous coal. Distillate oil is used during startup, shutdown and operational stabilization. The boilers are designed to operate continuously.” These units do not use activated carbon for additional control. These 90 MW CFB boilers using bituminous coal are not “similar” to the proposed 930 MW gross ASCPC unit due to size and fuel, and therefore are not considered for determining the MACT floor.

6.1.1.2 Sub-bituminous Coal

There are no sub-bituminous coal-fired EGUs that have been demonstrated to be in compliance with the requirements of Connecticut, Massachusetts or New Jersey mercury rules. Therefore all of the units to be considered for setting the MACT floor are operating units with state permit mercury limits. The units with lowest emission limits that have demonstrated compliance are shown in Table 6-3.

Table 6-3. Operating Units Considered for MACT Floor Analysis for Mercury – Sub-bituminous Coal

State	Unit	Size (MW)	Equivalent Mercury Limit (lb/GW-hr)
Connecticut	Bridgeport Harbor ¹	410	0.0060
Iowa	MidAmerican Energy Walter Scott Jr. 4 ²	870	None
Arizona	Springerville 3	400	0.068

¹ Operating, but not yet tested for compliance

² Operating, but §112(g) emission limit of 0.015 lb/GW-hr was removed from permit in May 2007

The PSEG Power plant at Bridgeport Harbor has 3 coal-fired boilers, permitted under a Title V Permit No. 015-0217-TV. Unit 3 is a 410 MW coal-fired boiler which has installed a fabric filter control system and activated carbon injection for mercury control for compliance with the state imposed limit. This plant uses Adaro sub-bituminous coal from Indonesia. This coal typically has very low mercury content (3-4 lb/TBtu) compared to the PRB coal specified for the ASCPC unit (maximum of 13.2 lb/TBtu; average 7 lb/TBtu) and a relatively high heating value (9,600 Btu/lb) compared to the ASCPC design coal of 8,300 Btu/lb. According to the Connecticut Department of Environmental Protection, as of July 11, 2009, the facility had completed



installation but had not yet submitted the protocol for the compliance test. Thus it is several months before the data will be available that would allow this unit to be considered for the MACT floor. While NTH has been informed that preliminary vendor test data from the plant indicates that compliance has been achieved, this does not represent compliance data and hence is not available to the public for use in evaluating the MACT floor, including the variability analysis because of the difference in critical fuel parameters.

The next most stringent mercury emission limit for an operating EGU using sub-bituminous coal was the Walter Scott Jr. Energy Center Unit 4, operated by Mid American Energy Company and located in Council Bluffs, Iowa. An emission limit of 1.7×10^{-6} lb/MMBtu was set by a §112(g) determination in 2003 in Permit No. 03-A-425P. The emission limit was based on a design capacity of 7,675MMBtu/hr, 870 megawatts (gross) and a gross heat rate of approximately 8,820 MMBtu/KWh and is equivalent to 0.015 pounds per GW-hr, when expressed on a gross output basis. While test data from tests in May and August 2007 confirm compliance with this limit, the limit was rescinded in May 2005 under Permit No. 03-A-425P2. Since construction of this unit commenced prior to January 30, 2004 it is not subject to the mercury (Hg) standards of Subpart Da, therefore no Hg limit currently applies. This was confirmed by the Iowa Department of Natural Resources on July 11, 2008. Therefore this unit cannot be considered for establishing the MACT Floor for sub-bituminous coal.

The Springerville Unit 3 in Arizona is the only unit listed in Table 6-3 that can be considered in the MACT floor analysis because it is contained in a permit and since the unit started operation in 2006, it is assumed to have demonstrated compliance. The permit limit is 6.9 lb/TBtu, equivalent to 0.068 pounds per GW-hr.

Since the Springerville 3 mercury emission limit exceeds the limit of 20 pounds per terawatt for new sub-bituminous coal fired units proposed by USEPA on January 30, 2004 at 40 CFR §63 Subpart UUUUU, and USEPA had determined that this was an achievable level for new facilities it is appropriate to set the MACT floor for sub-bituminous coals at 0.020 lb/GW-hr.



6.1.1.3 Blended Bituminous and Sub-bituminous Coals

Some research has shown that chlorine concentrations in the fuel in the 300-500 ppmw range, depending on calcium and other coal constituents, are sufficient to promote oxidation of the mercury. The PRB sub-bituminous coal considered for the ASCPC unit is expected to have a mean chlorine concentration of approximately 210 ppm (95 percent of the time at or above 140 ppmw). The Eastern bituminous coal is expected to have a mean concentration of approximately 1100 ppmw (95 percent of the time at or above 800 ppmw). There are substantial variations in each type of coal. This means that the chlorine content of the sub-bituminous coal will not be high enough to promote as much oxidation of the mercury as would bituminous coal, or even primarily bituminous blends.

Duke Energy has taken the position in their recent Cliffside §112(g) analysis that the blending up to 50 percent sub-bituminous coal into their principle bituminous coal will not affect the mercury oxidation from that which would be achieved by burning only bituminous coal. The ASCPC unit is fundamentally different than the proposed Cliffside unit in that the ASCPC unit will be principally a PRB fired unit with the ability to fire up to a 50 percent blend of bituminous coal. Determining the level of chlorine in the coal being burned needed to achieve compliance with the proposed mercury emission limit can only be determined by an optimization study.

6.1.1.4 Summary of the Mercury MACT Floor Analysis

The MACT floors for bituminous and sub-bituminous coals have been identified above as 0.0066 pound per GW-hr for bituminous coal and 0.020 pound per GW-hr for sub-bituminous coal. Since the ASCPC unit is being designed to burn a blend of these fuels, the MACT floor would be a weighted ratio of these floors based on the amount of each fuel used. In other words, the lowest MACT floor would be for the 50/50 blend of bituminous and sub-bituminous coals proposed by Consumers, which would be $(0.066 + 0.020)/2 = 0.0133$ lb/GW-hour.

6.1.2 *Mercury MACT Beyond the Floor Analysis*

The final step in the MACT setting process is to perform a BTF analysis for the ASCPC unit. The purpose of this portion of the analysis is to determine whether Consumers can reduce the mercury emissions from the proposed ASCPC unit to levels that are more stringent than the MACT Floor



levels, taking into consideration the cost of achieving such emission reductions, and any non-air quality health and environmental impacts and energy requirements.

In considering what can be achieved beyond the MACT floor, permitted but not yet demonstrated units are considered. The most stringent limits for permitted units are listed in Table 6-4.

Table 6-4. Permitted Units Considered for BTF Analysis for Mercury

State	Unit	Size (MW)	Mercury Limit (lb/GW-hr)
Bituminous			
Wisconsin	Elm Road ¹	727	0.012
Kentucky	Thoroughbred Generating	750	0.021
West Virginia	Longview Maidsville	600	0.024
Texas	Sandy Creek	860	1.09
Sub-bituminous			
Georgia	Longleaf	600	0.015

¹The Elm Road permit limit is based on use of bituminous coal, although it will have ability to blend PRB coal.

None of the state permitted units using bituminous coal are as low as the MACT floor for bituminous coal as established in this analysis.

The most stringent permit limit for sub-bituminous coal in any permit is the 15E-06 lb/MMBtu (0.015 lb/GW-hr) in the LS Energy, Longleaf Energy Station Permit. The most stringent law or rule limit is the Connecticut Law (CGS section 22a-199) which according to the Connecticut CAMR Plan “requires the owners and operators of the three CAMR units to meet an emissions rate of equal to or less than 0.6 pounds of mercury per TBtu, or meet a mercury emissions rate equal to a 90 percent reduction of mercury from the measured inlet conditions for the unit.” Connecticut also has an opportunity for facilities to establish an alternate limit if this limit, or control efficiency cannot be met. In Massachusetts, the regulation allows compliance with a mercury emission limit of 0.0075 lb/GW-hr or 85 percent removal efficiency.



Because of the inherent variability in mercury content of the fuels and a paucity of long term monitoring data for newly installed control systems, the states are adopting regulations that allow the compliance option of a limit or control efficiency. According to NAACA, the highest control efficiency required is 90 percent. Because of the current accuracy issues associated with continuous monitoring of mercury to demonstrate compliance and the specific conditions under which vendor performance guarantees are given, it is unreasonable to commit to greater than 90 percent removal.

The proposed control technology for the ASCPC unit (SCR, limestone and ACI injection, fabric filter and wet FGD) include all of the known control equipment that has been shown to be effective in reducing mercury emissions. For pulverized coal fired boilers, there are no other control technologies that are as effective as this combination of controls for either bituminous or sub-bituminous coal. The issue therefore becomes not whether additional control equipment needs to be installed, but how can this equipment be optimized to control emissions. Because of the variables that will affect the performance of this control system, optimization cannot be established until the facility is operating and has the opportunity to perform a mercury emission optimization study. Two important variables are:

1. The chlorine content of the coal. There is a range of chlorine contents for both bituminous and sub-bituminous coal. The low chlorine content typical of PRB coal makes mercury removal more difficult.
2. The rate of ACI injection. Optimization studies are important to determine what this rate should be. For example, an optimization study at the Walter Scott Jr. Energy Center Unit 4 on December 20, 2007 showed that “further increases in PAC feed rate beyond approximately 1.5 lbs/MSCF will not produce significant additional reduction in stack emissions of mercury.”

It is recognized that fabric filter control with ACI injection has been shown to achieve 90 percent removal of mercury from selected PRB coals (e.g., We Energies Presque Isle Power Plant Demonstration Project). It is also known that air quality control systems which include an SCR, a



fabric filter and a wet FGD system will remove a substantial amount of mercury from bituminous coal-fired boilers, although co-benefits for sub-bituminous coals are comparatively low and variable. Combining all of these technologies as Consumers has proposed to do for the ASCPC unit provides some potential to go beyond 90 percent control, but there has been no demonstration of that level of performance and no assurance that it can be achieved. Going beyond 90 percent control therefore does not represent MACT.

6.1.3 MACT for Mercury

This review demonstrates that the ASCPC unit SCR, ACI, FF and Wet FGD, proposed as the case-by-case MACT for controlling mercury to an emission limit of 0.008 lb/GW-hr, or 90 percent removal, is lower than the MACT floor. 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 NAACA list of state mercury rules reflect that almost every state allows the option for an alternate emission limit or additional time if the state limit is not met.

The MACT limits must be met during all operating conditions. The uncertainties in measurement and the lack of long term monitoring data to show compliance with these stringent emission limits lead Consumers to propose that an optimization study be included in the mercury MACT decision. This optimization study would consider activated carbon injection rates, effects of fuel blending, the need for halide addition when low chlorine content fuels are being used, boiler operating conditions, and other factors that appear relevant during the first few months of startup. If the optimization study indicates that the ASCPC unit cannot achieve the 90 percent reduction or 0.008 lb/GW-hr, the limits established as MACT may need to be revised to reflect the levels that can be achieved with the highly sophisticated air pollution control system utilized.

Finally, 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 Hg concentrations in the outlet of a well controlled system will likely be in the range of 1-2 $\mu\text{g}/\text{m}^3$ (0.008 lb/GW-hr is approximately equivalent to 1.1 $\mu\text{g}/\text{m}^3$). The required relative accuracy of Hg



CEMS in the now vacated Hg monitoring provisions of 40 CFR Parts 60 and 75¹ was 20 percent, or less than or equal to an absolute difference of $1.0 \mu\text{g}/\text{m}^3$ in cases where the 20 percent relative accuracy requirement was not met and the average reference method value was less $5.0 \mu\text{g}/\text{m}^3$. Therefore, it is likely that average mercury concentrations out the stack could be approximately the same as the true quantification level of the CEMS. While there continues to be improvements in Hg CEMS technology (the effective minimum detection limit is claimed to be quite low, i.e., less than $0.01 \mu\text{g}/\text{m}^3$), the long term accuracy of the Hg CEMS at low concentrations still needs to be demonstrated. Thus, the performance of a Hg CEMS makes the results subject to significant uncertainty at low concentrations. This was seen in the Walter Scott Jr. Energy Center Unit 4 optimization study conducted in December 2007, where the CEMS were determined to be unreliable for the purpose of the study.

6.2 ACID GASES

The primary acid gases (HAPs) emitted from the ASCPC boiler will be hydrogen fluorides (HF) and hydrogen chlorides (HCl). HF and HCl are generated in the boiler from the fluoride and chlorine present in the fuel. Control systems have not been designed to primarily control emissions of HF and HCl. Instead, acid gas reduction is achieved through sulfur dioxide (SO_2) and sulfur trioxide (SO_3) controls (SO_3 formation contributes to emissions of sulfuric acid mist). Since SO_2 and sulfuric acid (H_2SO_4) are typically PSD pollutants for large coal-fired boilers, there is available data on control technology and emission limits.

6.2.1 Acid Gas MACT Floor Analysis

As stated in the PSD BACT analysis for SO_2 , PC boilers that are required to control SO_2 emissions will do so using dry, semi-dry or wet flue gas desulfurization (FGD). A further subcategory of each is once-through FGD systems. In wet FGD systems, an alkaline slurry of limestone is sprayed into the flue gas as it passes through an absorber tower. All wet FGD systems are considered post-combustion FGD systems. In dry or semi-dry FGD systems, an alkaline sorbent (usually lime) is sprayed onto the flue gas as it passes through a spray dryer vessel or limestone can be added directly into the boiler in the case CFB technology. Once-

¹ Refer to section 13.4 of Performance Specification 12A of 40CFR60, Appendix B or section 3.3.8 of 40CFR75, Appendix A.



through technologies are those systems where the SO_2 is permanently bound to the alkaline sorbent and is disposed of as a waste or saleable product (gypsum).

Based upon the five-step, top-down PSD BACT procedure, Consumers has selected a wet FGD system to control emissions of SO_2 . The two primary technologies to control H_2SO_4 from utility boilers are to 1) include a wet ESP on the back end of the air quality control system or 2) install a hydrated lime injection system upstream of the particulate control device. In general, a wet ESP is used on utility boilers firing higher sulfur bituminous coals where the SO_3 inlet loading to the wet ESP is relatively high. For utility boilers primarily designed to burn lower sulfur coals, such as that proposed for this project, the hydrated lime injection system is the preferred alternative as the need to handle additional waste water is avoided. Therefore, in addition to the wet FGD, Consumers has proposed to utilize hydrated lime injection upstream of the particulate control device (fabric filter) to control SO_3 formation.

For HF and HCl, the achievable limit is highly dependent on fluoride and chlorine content of the coal, and the type of control system that can be utilized. Facilities that are committed to burning 100 percent sub-bituminous coal typically control the sulfur dioxide and other acid gases with a dry FGD system. Consumers has selected the wet FGD to control acid gases because of the blend of bituminous and sub-bituminous coals. The MACT floor analysis needs to consider similar sources for HF and HCl as using a blend of fuels and with wet FGD technology. A review of the existing operating units with a HF or HCl emission limit, using a blend of coals and wet FGD control technology revealed that there is no similar source on which to base a MACT floor.

The National Association of Clean Air Agencies (NACAA) published a Permit Guidance Document in response to the vacatur of the industrial, commercial and institutional boilers and process heaters MACT (40 CFR 63, Subpart DDDDD). This document proposes MACT standards for existing sources based on the review of available test data on several boilers burning various fuels. For coal fired boilers, the test data shows an average HCl limit of 0.01 lb/MMBtu. HF was not reviewed in this report.



6.2.2 Acid Gas Beyond the Floor Analysis

FGD is the only known control method used to reduce acid gases from utility boilers. Whether or not a facility utilizes wet or dry FGD is dependant on the rank or blend of coal used. As previously stated, this is an important point when defining a similar source for acid gas control.

A wet FGD system and hydrated lime injection upstream of the fabric filter is the most optimum control for the fuel blend being proposed. Therefore, sources that use alternate controls are not included in the beyond the floor analysis. Table 6-5 below lists the permitted HF and HCl limits from similar sources as proposed by Consumers:

Table 6-5. Permitted Units Considered for BTF Analysis for Acid Gases

State	Unit	Size (MW)	HF Limit (lb/MMBtu)	HCl Limit (lb/MMBtu)
Wisconsin	Weston 4	500	0.00022	0.0021 ²
Arizona	Desert Rock	1,500	0.00024	NA ³
Missouri	Iatan 2	930	0.004 ¹	NA ³
Utah	Intermountain Unit 3	950	0.0005	0.018 ⁴

¹ This was calculated based on a permit limit of 33.15 lb/hr and a heat input rate of 8,100 MMBtu/hr

² This was calculated based on a permit limit of 10.94 lb/hr and a heat input rate of 5,173 MMBtu/hr

³ The Permits did not contain HCl limits

⁴ This was calculated based on a permit limit of 38.13 lb/hr and a heat input rate of 3,242 MMBtu/hr

6.2.3 MACT for Acid Gases

An emission limit of 0.0003 lb/MMBtu for HF, based on a 2-hour average and a limit of 0.004 lb/MMBtu for HCl, based on a 2-hour average are being proposed to satisfy MACT requirements. The use of hydrated lime injection and wet FGD will control acid gas emissions with an expected combined control efficiency of approximately 97 percent. This combination of controls is currently used by the best similar source and is therefore considered MACT for acid gas HAPs. Consumers will meet the proposed limits identified above and conduct initial and periodic performance tests to demonstrate compliance with MACT.



It is important to note that the 0.004 lb/MMBtu emission rate is higher than the 0.002 lb/MMBtu emission rate indicated in the permit application on a short term basis. The application values were based on an AP-42 emission factor. A review of the chlorine content of the fuels used as a basis of the ASCPC application shows that using a 50/50 blend of bituminous and sub-bituminous coals, and 97 percent control with the wet FGD, the short term emission level based on the 99th percentile concentration of chlorine in the coal is 0.004 lb/MMBtu as hydrogen chloride. The chlorine and HCl emissions are summarized in Tables 6-6 and 6-7 below.

Table 6-6. Summary of Short-term and Long Term Emission Factors for Chlorine

Coal Type	Chlorine (lb/MMBtu)	
	Hourly Emission Rate (99 th Percentile)	Annual Emission Rate (95% UCL)
Western sub-bituminous Coal	0.074	0.023
Eastern bituminous Coal	0.186	0.105

Table 6-7. Summary of Short-term and Long Term Emission Factors as HCl

Coal Type	HCl (lb/MMBtu)	
	Hourly Emission Rate (99 th Percentile)	Annual Emission Rate (95% UCL)
Western sub-bituminous Coal	0.076	0.023
Eastern bituminous Coal	0.191	0.108

For a 50/50 blend of coals the uncontrolled emission factor for short term limits is:

$$HCl \text{ Emissions} = \frac{0.076 + 0.191 \text{ lb} / \text{MMBtu}}{2} \times (1 - 0.97) = 0.004 \text{ lb} / \text{MMBtu}$$



6.3 METAL COMPOUNDS (OTHER THAN MERCURY)

Most of the non-mercury metallic HAPs from a PC boiler are present in the fly ash, which is emitted as particulate matter (PM). Therefore, the same control techniques that would be used to control the fly ash PM will control the non-mercury metallic HAP emissions.

6.3.1 Metal Compounds MACT Floor Analysis

As discussed in the control technology section (Section 5.2) of the PTI application support document, the possible control technologies for particulate emissions are fabric filters (baghouse) and electrostatic precipitators. The fabric filter and ESP technologies represent efficient and cost-effective methods for controlling PM emissions from utility boilers. While other control technologies exist, including mechanical collectors and wet scrubbers, neither has been proven to be an effective control technology due to efficiency and energy impacts and are used only as pre-cleaners to remove larger particles leaving the boiler. Since the metal compounds exist as particulates at the temperatures experienced at the fabric filter inlet, the focus is on filterable particulate emissions.

The best controlled similar PC units all use high efficiency fabric filters to achieve a control efficiency of 99 percent and above. As shown in Table 6-8 the PM emission limits for similar boilers shows that the lowest achieved PM filterable limit is 0.018 lb/MMBtu from the Santee Cooper Cross 3 unit which sets the MACT floor.

Table 6-8. Operating Units Considered for MACT Floor Analysis for Metal HAPs

State	Unit	Size (MW)	PM Filterable Limit (lb/MMBtu)
South Carolina	Santee Cooper Cross 3	610	0.018
Virginia	Clover	440	0.018
Missouri	Hawthorn 5	565	0.018



6.3.2 Metal Compounds Beyond the Floor MACT

The proposed ASCPC boiler is subject to BACT for PM emissions and a fabric filter will be utilized to control PM emissions from the boiler. Since the non-mercury metallic HAP emissions will be emitted as part of the PM emissions, the fabric filter will also control these emissions to the same level as for PM. The estimated control efficiency is expected to be approximately 99.9 percent. Therefore, the proposed fabric filter also represents MACT for this HAP category and further control beyond a fabric filter is not technically feasible. A review of USEPA’s RBLC database shows that the lowest permitted filterable particulate limit is 0.012 lb/MMBtu (Intermountain Power IPP3 and TS Power Plant). See Table 6-9.

Table 6-9. Permitted Units Considered for BTF Analysis for Metal HAPs

State	Unit	Size (MW)	PM Filterable Limit (lb/MMBtu)
Nevada	TS Power Plant ¹	200	0.012
Utah	Intermountain Power IPP3	950	0.012
Texas	Sandy Creek	800	0.015

¹ Started operating mid- 2008, so test data not available.

To comply with MACT, rather than establish emission limits for individual HAP metals, Consumers proposes that the particulate emission limits of 0.012 (filterable) be used as a surrogate for other trace metal emissions. This limit represents the most stringent level of filterable particulates achievable from both operating and permitted sources and is therefore MACT. As shown in Table 7-1, compliance with the particulate limits will be based on a continuous opacity monitoring system (COMS), a bag leak detector system or a particulate CEMS.

6.4 ORGANIC HAPS MACT

Similar to CO and VOCs, organic HAP compounds are emitted due to incomplete combustion of the organic matter in the coal. These emissions include alkanes, alkenes, aldehydes, alcohols and polycyclic organic matter (POM).



There is limited data on organic HAP emissions from PC boilers. USEPA has relied on the use of CO or VOC emissions as a surrogate for the control of organic HAPs as described in the vacated Boiler MACT (69 FR 55218, September 13, 2004). This is due to the fact that CO/VOC and organic HAPs are all products of incomplete combustion and can be controlled using similar combustion methods (e.g., proper air-to-fuel ratios as well as temperature, residence time and mixing). In addition, methods to measure CO/VOCs are much easier and cost effective than measuring each individual organic HAP. Therefore, using CO or VOCs as a surrogate for organic HAPs is a reasonable approach in determining MACT.

6.4.1 Organic HAP MACT Floor Analysis

Since CO and VOCs are typically PSD pollutants for coal-fired EGU's, emission limits and control technologies for these pollutants can be obtained through the RBLC or other sources. In determining what is a similar source for organic HAP emissions, the boiler technology (i.e., fluidized bed, supercritical, subcritical) and boiler size are more of a factor than the coal rank. Small gas or coal fired boilers that can inherently achieve significantly lower CO emissions than large gas or coal fired boilers, under "good combustion conditions," are not similar units for consideration in the MACT floor.

A review of recent BACT determinations for CO and VOCs from similar-sized PC boilers indicates that utilizing good combustion practices is the only known control method to reduce these pollutants. As shown in Section 5.2 of the PTI application support document, add-on control such as catalytic or thermal oxidation are not considered technically feasible control options for coal-fired boilers.

It is important to note that measures to reduce CO/VOC emissions will have the opposite effect on NO_x emissions. Therefore a similar source of organic HAP emissions should also have similar NO_x emissions. Since NO_x is a PSD pollutant as part of the ASCPC permit review, it is subject to stringent limits pursuant to BACT. The BACT review has resulted in a limit of 0.05 lb/MMBtu for NO_x.



A review of CO emission levels that have been achieved in practice for similar sources shows that the Dominion Energy Clover Units 1 and 2 represent the lowest limit at 0.10 lb/MMBtu. This is being achieved, however, with a corresponding NO_x limit of 0.35 lb/MMBtu. As previously stated, to be considered similar, the NO_x emission limit should be similar. The operating unit with the most stringent NO_x limit is Walter Scott Unit 4 (0.07 lb NO_x/MMBtu) and the corresponding CO limit is 0.154 lb/MMBtu. Table 6-10 below shows NO_x and CO emission limits for units in operation.

Table 6-10. Operating Units Considered for MACT Floor Analysis for Organic HAPs

State	Facility Name	Size MW	CO Limit lb/MMbtu	NO _x Limit lb/MMbtu
Virginia	Clover	440	0.10	0.35
Iowa	MidAmerican Energy Walter Scott Jr. 4	750	0.154	0.07
Missouri	Hawthorn 5	565	0.16	0.08

6.4.2 Organic HAP Beyond the Floor MACT

The inherent design and operation of the boiler provides the factors facilitating complete combustion of most of the organic compounds. These design and operational features include: extended residence time; consistent temperature in the combustion chamber; and continuous mixture of air and fuel. The control method used to reduce organic HAP emissions from coal-fired boilers is good combustion practices. Consumers has concluded that good combustion practices also represent MACT for organic HAPs from this unit. These conclusions are consistent with the other MACT determinations for a number of recent coal-fired projects in the Midwest, including those made by the Wisconsin Department of Natural Resources. A listing of proposed CO limits is contained in Section 5.2 of the PTI application support document and shows that the range of proposed emission limits is 0.10 to 0.16 lb/MMBtu. As previously stated, it is also important to consider the corresponding NO_x limit for each facility since reducing CO emission beyond a certain point can result in an increase in NO_x emissions. Table 6-11 presents a summary



of all of the facilities that have been issued PSD permits with both NO_x and CO emission limitations.

Table 6-11. Permitted Units Considered for BTF Analysis for Organic HAPs

State	Unit	Size MW	CO Limit lb/MMbtu	NO _x Limit lb/MMbtu
Arizona	Desert Rock Energy	1,500	0.1	0.06
Kentucky	Thoroughbred Generating	1,500	0.1	0.07
West Virginia	Longview Power	600	0.11	0.08
Illinois	Prairie State	1,500	0.12	0.07

Consumers has proposed a NO_x limit (0.05 lb/MMBtu) more stringent than any facility with lower CO limits, and believes the proper MACT limit, when considering the stringent NO_x BACT limit, is 0.0125 lb CO/MMBtu. This combination of stringent CO and NO_x emission limits represent combustion efficiencies for preventing or destroying organic HAP emissions equal to those of any other permitted unit. Consumers proposes that the CO emission limit of 0.125 lb/MMBtu be used as a surrogate for organic emissions. Compliance with the CO limit will be based on a continuous emission monitoring system.

7.0 MONITORING, RECORDKEEPING, AND TESTING

To provide for monitoring of the proposed MACT standards, Consumers will install, calibrate, and maintain a CEMS for mercury while emissions of HF and HCl will be verified through periodic stack testing. The remaining pollutants will be tracked through the use of surrogate emissions with compliance demonstrations through stack testing and/or continuous monitoring systems. Table 7-1 describes the monitoring and testing requirements for each category of HAPs as well as the proposed control technologies. Final periodic monitoring, recordkeeping, and testing requirements will be determined upon issuance of the final PSD permit.



Table 7-1. MACT Compliance

Compound	Surrogate	Control Technology	Compliance Method
Acid Gases	HF, HCl, SO ₂ and H ₂ SO ₄	Fabric filter, wet FGD and hydrated lime injection	SO ₂ CEMS; stack testing for HF HCl and H ₂ SO ₄
Mercury Compounds	Mercury	Fabric filter, SCR, Wet FGD and activated sorbent injection	Mercury CEMS
Metal Compounds	Particulate	Fabric filter (baghouse)	COMS and a bag leak detector system or a PM CEMS
Organic HAP Compounds	CO	Good Combustion	CO CEMS

8.0 SUMMARY

Consumers' combination of good combustion practices and back-end controls consisting of hydrated lime injection, activated sorbent injection, fabric filters and wet flue gas desulfurization represents control measures that are as stringent as the controls used by the best similar source and therefore will meet MACT under 112(g) for HAP emissions from the proposed ASCPC boiler.

Table 8-1 summarizes the MACT emission limits:

Table 8-1. MACT Summary

Compound	MACT Limit	Averaging Time Period
Acid Gases (HF and HCl)	HF: 0.0003 lb/MMBtu HCl: 0.004 lb/MMBtu	2-hour
Mercury Compounds	0.008 lb/GW-hr	Annual
Metal Compounds (PM-Filterable)	0.012 lb/MMBtu	2-hour
Organic HAP Compounds (CO)	0.125 lb/MMBtu	30-day rolling