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October 16, 2008
NTH Project No. 16-050556

RECEIVED

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AIR QUALITY DIV.

**RE: Information and Clarification on Previous Clean Air Act Section 112(g) Analyses
Case-by-Case MACT Determination
Holland Board of Public Works
Application 25-07**

Dear Mr. Patel:

On behalf of the Holland Board of Public Works (“HBPW”), NTH Consultants, Ltd. (“NTH”) is providing this letter to re-affirm our proposed MACT limit for Hg, propose a new MACT limit for acid gases as a result of new information, and update the proposed MACT limit for organic and metal HAPs. During recent conference calls with MDEQ, HBPW was asked to confirm final MACT limits for the four (4) primary categories of HAPs emitted from coal-fueled power plants. This letter provides the requested confirmation of HBPW’s proposed MACT limits for mercury, acid gases, organic HAPs, and metal HAPs.

Mercury (Hg) MACT Limit

On August 13, 2008, HBPW submitted an updated case-by-case MACT analysis for mercury and proposed a MACT limit of 0.0078 lb/GW for the proposed new CFB boiler (Unit 10). This limit was based upon a comprehensive analysis establishing a MACT Floor and incorporated a beyond-the-floor analysis. This is an aggressive limit based upon the range of fuels proposed for this project and anticipated heat rate into the boiler. As we have discussed previously, HBPW has committed to installing and operating a sorbent injection system to meet this limit.

Organic HAPs MACT limit

On April 25, 2008, HBPW submitted a case-by-case MACT determination that included a discussion on organic HAP emissions. As organic HAP compounds form as a result of incomplete combustion, it was concluded that the same control technology that would be employed to minimize CO and VOC emissions would represent MACT for organic HAPs. However, a specific MACT limit for this family of compounds was not proposed. During subsequent discussions with MDEQ, the use of either CO or VOC as a surrogate for estimating the control of organic HAP emissions was proposed.

Organic HAP compounds are considered a subset of VOC and will be controlled similarly in a combustion source, such as the proposed Unit 10 CFB boiler. Therefore, use of VOC as a surrogate for estimating control of organic HAP emissions is most appropriate in this instance.

As part of the initial air permit application, HBPW proposed a VOC limit of 0.005 lb/MMBtu. Since the time of the initial application, additional information has become available that indicates that a lower limit could be achieved by the CFB boiler utilizing state-of-the-art combustion controls. Specifically, HBPW proposes a VOC limit of 0.0036 lb/MMBtu and, further proposes to use this limit as a surrogate for organic HAP emissions. This limit has been proposed based upon review of VOC limits in recently issued and proposed air permits for other similar units, and also based upon a minimal set of test data.



Specifically, the MACT Floor for VOCs, as a surrogate for organic HAPs, has been established by East Kentucky Power Cooperative, Inc. Unit 3 in Air Quality Permit V-06-007 Revision 1. Unit 3 is a CFB boiler rated at 2,500 MMBtu/hr capable of firing coal or TDF. To date, testing has not been completed to demonstrate compliance with this limit. As discussed in our previous MACT analyses, HBPW Unit 10 will be capable of firing wood waste up to 30 percent of the total annual heat input. As soft woods are estimated to have a higher VOC content, as indicated by USEPA in Section 1.6 of the AP-42 document (0.017 lb/MMBtu), no evidence exists that an emission lower than this could be achieved when firing a combination of both coal and wood waste. Therefore, the VOC limit of 0.0036 lb/MMBtu represents the MACT BTF limit.

Metal Compounds (Other than Mercury)

On April 25, 2008, HBPW submitted a case-by-case MACT determination that included a discussion on metal compound emissions. As most, if not all, of the non-mercury metal compounds are contained in the ash of the fuel, it was concluded that the same control technology that would be employed to minimize filterable particulate matter (PM) emissions would represent MACT for metal compounds. However, a specific MACT limit for metal compounds was not proposed. During subsequent discussions with MDEQ, the use of PM as a surrogate for estimating the control of metal HAP emissions was proposed and agreed to.

Metal compounds are a subset of PM and will be controlled identically by a fabric filter. Therefore, use of PM as a surrogate for estimating control of metal compound emissions is most appropriate in this instance.

As part of subsequent correspondence to MDEQ, HBPW proposed a PM limit of 0.012 lb/MMBtu, which is based upon vendor guarantees with a minimal contingency factor. Additional information has become available that indicates that a lower limit could be achieved by the CFB boiler and particulate control system combusting the range of fuels proposed. Specifically, HBPW proposes a PM (filterable only) limit of 0.011 lb/MMBtu and, further proposes to use this limit as a surrogate for metal HAP emissions. This limit has been proposed based upon review of PM limits in recently issued and proposed air permits for other similar units, and also based upon a minimal set of test data.

Acid Gases MACT limit

On July 28, 2008, HBPW submitted an updated case-by-case MACT determination that included a discussion on acid gas emissions. As detailed in this analysis, the primary acid gas emissions subject to the MACT will be in the form of HCl and HF. In this analysis, it was concluded that control of acid gases will be accomplished primarily through the injection of limestone in the CFB boiler, similar to SO₂ emissions. The originally proposed acid gas MACT limits were 0.005 lb/MMBtu for HCl and 0.0006 lb/MMBtu for HF. These limits assumed a control efficiency of 91 percent based upon the uncontrolled emission factors for each found in Section 1.1 of USEPA's AP-42 document. A review of the background document for this section revealed that the emission factors for HCl and HF are based solely on pulverized coal boilers and represent an average of minimal test data. Further, these emission factors represent an averaging from both controlled and uncontrolled sources and the Cl and F content of the fuels is unknown.

For these reasons, it is imperative that HBPW revisit the originally proposed MACT limit for acid gases based on available test data. Additionally, recent discussions with HBPW's engineering firm and CFB boiler manufacturer and fabric filter vendors for guarantees regarding HCl and HF control efficiencies has revealed that none have been willing to provide any guarantee for acid gas removal and that opinions regarding the expected removal vary dramatically.



Both HCl and HF are formed as a result of oxidation of the chlorine and fluorine present in the fuel during combustion. During normal operation, the CFB boiler is designed to inject limestone into the boiler bed simultaneously with the fuel to promote the capture of pollutants and to maintain furnace temperature. While the main purpose of limestone injection is to minimize SO₂ emissions, it also serves to reduce acid gases. Through the use of limestone injection and the fabric filter, minimal control of acid gases can be expected as a result of contact with the alkaline fly ash accumulation on the bag surfaces. HBPW's engineers inform us that the actual expected reduction of acid gases as a result of limestone injection and a fabric filter is generally in the range of 30 to 80 percent. The upper range representing expected HF reductions and lower range representing HCl reductions.

Review of available data for similar sources revealed little information and few test results for acid gases, and data was only available for HF. In addition, none of these results provided information regarding the Cl or F content of the fuel. Further, there are only limited facilities with permit limits for either or both of these HAPs. Therefore, the case-by-case MACT limit for HCl for this project would be established by HBPW and is proposed to be 0.047 lb/MMBtu. As a MACT Floor has been established for HF and seems to indicate a reduction of greater than 70 percent, HBPW proposes a MACT limit of 0.0017 lb/MMBtu. To go beyond these emission limits would require the installation of a dry scrubber, which is not needed to control SO₂ emissions and is not viewed to be viable for further acid gas control.

Finally, due to the variability of Cl and F content of the range of fuels proposed and the lack of test data, HBPW is willing to revisit these limits once all performance testing for Unit 10 has been completed. As state above, proposing any limits for acid gases in the absence of any test data is very risky for HBPW given the large investment that must be made to support this project.

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

Sincerely,

NTH Consultants, Ltd.

Delbert Rector, P.E.
Project Manager

Jeffrey P. Jaros
Vice President

Enclosures

cc: Mr. David Koster, Holland Board of Public Works
Mr. Daniel Mitas, HDR|CB
Mr. William Presson, MDEQ
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DR/JPJ/mjb

Case-by-Case MACT

*Information and Clarification for Previous
Clean Air Act Section 112(g) Analyses
Holland Board of Public Works - PTI 25-07*

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Prepared For:
Holland Board of Public Works
Holland, Michigan

Project No. 16-050556
October 16, 2008

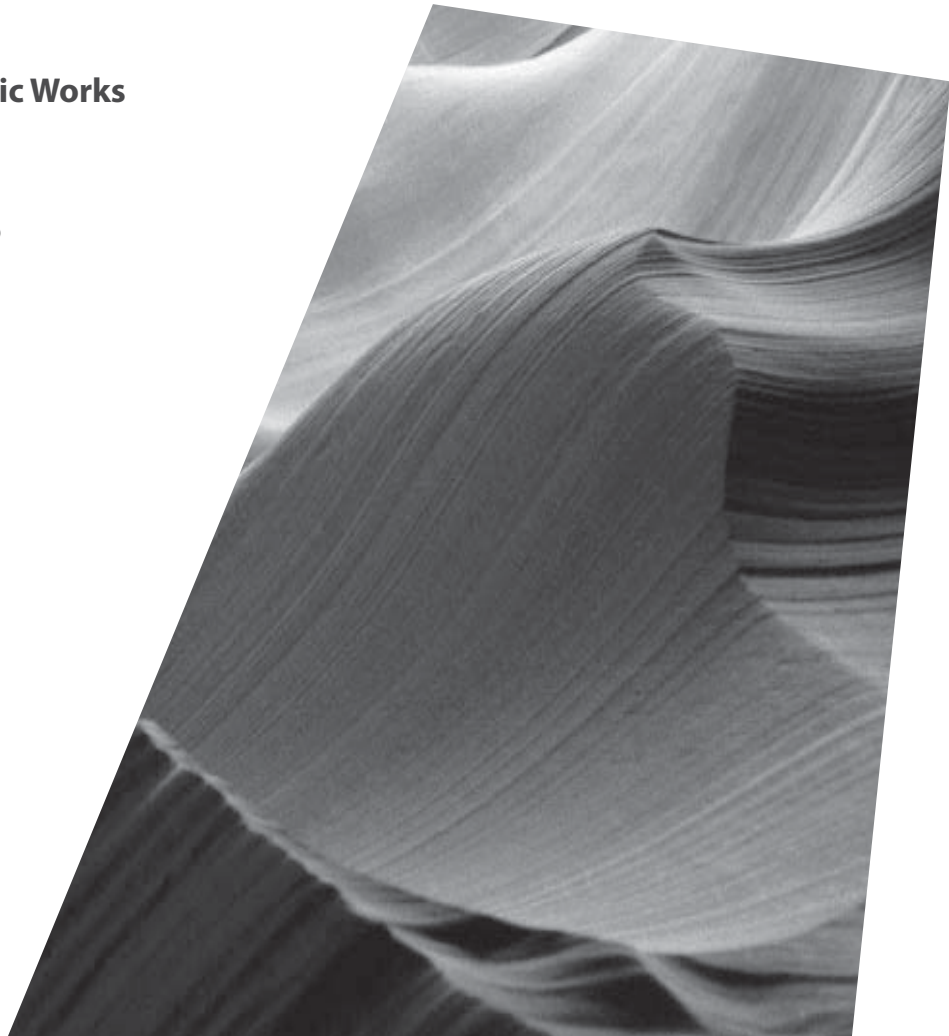


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1.0 INTRODUCTION

Holland Board of Public Works (HBPW) is submitting this revised case-by-case Maximum Achievable Control Technology (MACT) determination for acid gases for the proposed circulating fluidized bed (CFB) boiler as a result of new information received regarding the expected removal efficiency using limestone injection in conjunction with a fabric filter. In summary, the assumptions that were used in the original application to establish limits were based on the AP-42 emission factors for HCl and HF, and applied a control efficiency of 91 percent. During the past several weeks, new and relevant information has been obtained that indicates that these emission limits are too aggressive and do not represent either the MACT floor or a beyond-the-floor limit.

Specifically, the background document for Chapter 1 of *AP-42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, was reviewed to determine the source for the published emission factors of 1.2 lb/ton for HCl and 0.15 lb/ton for HF. In summary, these limits are a mathematical summary of limited test data from pulverized coal (PC) boilers only. Further, these limits include data from both controlled and uncontrolled PC boilers. Therefore, including an additional control factor on top of these emission factors was inappropriate.

Finally, HBPW has performed an exhaustive review of similar sources and has contacted several boiler and fabric filter manufacturers for additional information regarding expected control efficiencies for HCl and HF from a CFB boiler operating on the range of fuels proposed for Unit 10. As a result of new information obtained, it is necessary and prudent to update the case-by-case MACT determination for acid gases, including HCl and HF. This revision addresses only these HAPs.

1.1 CIRCULATED FLUIDIZED BED BOILER

CFB boilers are specifically designed to minimize the formation of nitrogen oxides (NO_x), carbon monoxide (CO), volatile organic compounds (VOC) including organic hazardous air pollutants (HAP), and particulate matter (PM). HBPW will utilize state-of-the-art combustion and post-combustion control systems to further minimize emissions. For particulate emissions, including metal HAPs, the CFB is equipped with a high temperature cyclone to capture the unburned portion of the ash and return it to the primary combustion

chamber, in conjunction with a fabric filter for additional control. In order to minimize the sulfur dioxide (SO₂) emissions, limestone will be fed into the boiler bed simultaneously with the coal. Acid gas emissions, including hydrogen chloride (HCl) and hydrogen fluoride (HF), are also captured in smaller proportions via limestone injection. Through proper design and good combustion practices the formation of NO_x, CO, VOCs, and organic HAP emissions can be limited by controlling the peak combustion temperature, gas residence time at peak temperature, and the air-to-fuel ratio. To further control NO_x emissions, HBPW will be installing a selective non-catalytic reduction (SNCR) system in the primary cyclone where temperatures are conducive to removal of NO_x. Finally, an activated carbon injection (ACI), or other appropriate sorbent, system will be installed to enhance the removal of mercury (Hg) emissions from the new unit.

1.2 FUELS

As described in the original application and via correspondence to MDEQ, HBPW will be designing the CFB boiler to utilize a wide range of fuels, including bituminous and sub-bituminous coals, wood waste, sewage sludge, tire derived fuel, and petcoke. Each of these fuels contains varying quantities of chlorine (Cl) and Fluorine (F), and trace amounts of these compounds are also present in the limestone.

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, HBPW has applied 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, HBPW requests that the permit contain language rendering all permit conditions associated with the MACT requirements as not applicable.

2.1 STATE SPECIFIC REGULATION

Michigan has developed rules 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 R 336.1299(e) 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 revision for acid gases has been prepared in accordance with Michigan Rule 299(e) and Operational Memorandum No. 15. Section 112(g) MACT requirements apply to the proposed CFB 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 Application No. 25-07 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 and MACT Analysis
(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 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;	Application and 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 CFB boiler will be nominally rated at 865 MMBtu/hr heat input with a gross output of approximately 78 MW. The emission rates are reflective of maximum operation with the range of fuels proposed and consistent with the maximum pollutant emissions across the range of fuels proposed for this project.

As identified in the permit to install support materials, as updated on July 1, 2008 in a letter to Mr. John Vial of the MDEQ, the proposed CFB 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 only established a limit for mercury emissions from coal-fired EGUs. Nevertheless, this case-by-case MACT analysis will evaluate non-mercury HAPs; specifically inorganic HAP emissions (acid gases). Pursuant to Michigan Rule 299(e) and Operational Memorandum No. 15, the analysis does not require that each HAP be considered independently, but rather different forms of HAPs (e.g., particulate HAPs, organic HAPs, etc.) are expected to be evaluated separately. USEPA has allowed the grouping of HAPs based on how they are characterized and controlled together, along with using surrogates for measuring compliance. HAPs are typically categorized into inorganic acid gases, mercury compounds, metal compounds, and organic HAPs.

The potential emissions of HAPs from the CFB are detailed in Appendix B of PTI Application No. 25-07 and updated on July 1, 2008. Please refer to the previously submitted emission estimate spreadsheet for a summary of the expected HAP emission from the proposed Unit 10 CFB boiler.

5.0 CASE-BY-CASE MACT ANALYSIS METHODOLOGY

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

5.1 MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY

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 40 CFR 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.

5.2 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 from 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 EGUs when establishing the MACT floor (e.g., CAMR, 40 CFR Part 63, Subpart UUUUU).

5.2.1 Determination of Similar Source

It is important to recognize that not all EGUs will qualify as a similar source. USEPA 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, USEPA 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), USEPA 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. USEPA recognized that fluidized bed combustion (FBC) units are a “distinct type of boiler” (FR 4693 January 30, 2004). USEPA did not subcategorize the mercury limits based on process because their “test data results for FBC units were not substantially different from those at similarly fueled conventionally fired units...”. For acid gases, the combustion process, control technology, and fuel are of critical importance and the similar sources for acid gases consist of CFB boilers with limestone injection.

5.2.2 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 CFB boiler will be capable of firing 100 percent sub-bituminous coal, 100 percent bituminous coal, a blend of these coals, or a blend with the other fuels identified in Section 1.2. One of the great advantages of CFB technology is the ability to accommodate a wide range of fuels while minimizing air pollutant emissions. Therefore, similar sources to be considered and compared to the proposed CFB are multi-fuel CFB boilers. Emissions of HAPs (such as 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, fluorine 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 USEPA 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 acid gas emissions. In evaluating the emission rates that have been achieved by similar sources, it is important to compare units with similar methods of measurement.

5.3 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)).

6.0 CASE-BY-CASE MACT ANALYSIS

The case-by-case MACT analysis for acid gases (HCl and HF) is described below.

6.1 ACID GAS HAPS

The primary acid gas (inorganic HAP) emissions from the proposed CFB boiler will be hydrogen fluoride (HF) and hydrogen chloride (HCl). HF and HCl formation are a result of oxidation of the fluorine and chlorine present in the fuel during combustion. For Unit 10, control systems have not been specifically designed to control emissions of HF and HCl. Instead, reductions of acid gas emissions are achieved as a co-benefit from the sulfur dioxide (SO₂) and particulate control systems; namely injection of limestone into the CFB boiler and the fabric filter.

6.1.1 Acid Gas MACT Floor Analysis

As mentioned above, the primary acid gas emissions from a CFB boiler utilizing coal as the primary solid fuel are HF and HCl. In the proposed Utility Boiler MACT (40 CFR 63 – Subpart UUUUU) USEPA concluded that emissions of HF and HCl did not pose a significant health risk because no exceedances of the benchmark were found (see Utility Report to Congress). Consequently, USEPA chose not to propose an emission standard for inorganic (acid gas) HAP emissions. Nonetheless, as part of the case-by-case MACT analysis, HBPW is required to address these emissions and determine the appropriateness of establishing a MACT Floor.

SO₂ is typically a PSD pollutant for coal-fired boilers; therefore, there is available data on control technology and emission limits. As detailed in the Technical Support Document (TSD) for Application No. 25-07, the proposed project will not result in a significant net increase in emissions of SO₂. In fact, HBPW is proposing to shutdown and remove existing Unit 3, an uncontrolled pulverized coal-fired boiler, as part of the project, which will result in an overall reduction in SO₂ emissions of 178.8 tpy. Therefore, HBPW was not required to complete a control technology review and implement BACT per 40 CFR 52.21(j). This makes the HBPW analysis unique when setting the MACT floor in that most CFB boilers use additional control systems for SO₂ emissions to meet PSD BACT.

In defining a similar source, the case-by-case MACT analysis is defined as a CFB boiler (utility) firing both bituminous and sub-bituminous coals and employing limestone injection technology within the CFB boiler bed. There is no data available for petcoke or renewable fuels. Since chlorine and fluorine levels are similar to the levels in bituminous and sub-bituminous coals, the MACT Floor review is based on the use of bituminous and sub-bituminous coals.

Emissions of HF and HCl are dependent upon the fluorine and chlorine content of the fuels. The uncontrolled emissions were based upon emission factors for bituminous and sub-bituminous coal combustion found in USEPA's AP-42 document; *AP-42, Fifth Edition, Volume I, Chapter 1, External Combustion Sources, Section 1.1*. In the original application, HBPW calculated the expected emission of HCl and HF assuming a control efficiency of 92 percent with a 15 percent safety factor (resultant control efficiency of 91 percent). This resulted in an emission limit of 0.005 lb/MMBtu for HCl and 0.0006 lb/MMBtu for HF.

However, a review of the background document supporting Section 1 of the USEPA AP-42 document details that the emission factors published for both HCl and HF are based upon a mathematical average of limited data and represents: 1.) only PC boilers; 2.) data from both controlled and uncontrolled PC boilers; and 3.) both EGUs and non-EGUs (i.e., industrial boilers). Therefore, the data used to develop these emission factors are not representative of similar sources.

Similar sources with emission limits for HCl and HF were reviewed to determine if compliance testing has been completed. This review identified only one (1) similar source; Manitowoc Public Utilities (MPU) Unit 9 (Permit No. 02-RV-147). Unit 9 is a 64 MWe (650 MMBtu/hr) CFB boiler utilizing limestone injection for control of SO₂ and acid gases, and capable of firing coal, petcoke and paper pellets. The MPU Unit 9 permit contains an emission limit for HF of 0.0017 lb/MMBtu and does not contain a limit for HCl. MPU completed compliance testing in March 2006 and was able to meet this limit; therefore 0.0017 lb/MMBtu represents the MACT Floor for HF emissions.

A review of available information did not find a similar source with a permitted HCl limit. It is concluded that a MACT Floor for HCl emissions from a CFB boiler with limestone injection does not exist. Therefore, HBPW is required to identify the MACT floor for HCl specific to Unit 10. Discussions with boiler and fabric filter

baghouse vendors has resulted in a wide variety of opinions regarding expected HCl removal efficiencies from the CFB boiler and fabric filter. There is little experience in the industry that provides a basis for clear understanding of the variables that affect HCl control. Given the range of fuels planned for Unit 10 and lack of industry test data, particularly for small CFB boilers (i.e., less than 100 MW), the MACT Floor is best identified by calculating the emission limit that would result based on the expected chlorine content of the fuel assuming minimal control. In the case of Unit 10, analytical data from coal suppliers indicates that bituminous coals can have widely varying chlorine content and range from 80 ppm to over 800 ppm. Recent discussions with major CFB boiler manufacturers have indicated that, while it is recognized that some reduction in HCl emissions is likely within the CFB boiler, actual quantification of this reduction cannot be derived from available data. Indications from CFB boiler manufacturers indicate that removal rates of 30 to 50 percent might be achieved, but cannot be guaranteed. Consequently, a minimal control efficiency of 30 percent for HCl emissions from the combination of the CFB boiler and fabric filter is reasonable.

Therefore, the theoretical HCl emissions from Unit 10 assuming 100 percent bituminous coal firing with a Cl content of 800 ppm wet (860 ppm on a dry basis) weight yields an HCl emission limit of 0.047 lb/MMBtu. This is based on bituminous coal with a heating value of 12,200 Btu/lb on a wet basis at 7 percent moisture (13,118 Btu/lb dry) and 30 percent control.

$$HCl\ Input = \frac{860\ ppm}{13,118\ Btu/lb} \times \frac{36.45\ g/mol}{35.45\ g/mol} \times (1 - 0.30) = 0.047\ lb/MMBtu$$

HBPW proposes a MACT Floor emission limit for HCl of 0.047 lb/MMBtu based on a chlorine content of 860 ppm for bituminous coals and no control.

6.1.2 Acid Gas Beyond the Floor Analysis

Having identified, and proposed in the case of HCl, the MACT Floors for HF and HCl, the next step is to identify a MACT limit based on a review of additional information in order to complete the beyond-the-floor (BTF) analysis.

As discussed above, recent discussions with CFB boiler manufacturers revealed that, while it is recognized that some reduction of HCl and HF emissions is likely to occur inside the boiler, actual quantification of

expected control efficiencies cannot be derived from available data. Previously, HBPW has stated that limestone injection is expected to achieve a minimum control efficiency of 91 percent for acid gas emissions. However, as a result of these discussions, this level of control cannot be supported by any data and is likely in error. Instead, a wide range of control efficiencies of between 30 and 80 percent for acid gases could be expected from the combination of the CFB boiler with limestone injection and the downstream fabric filter. In general, the upper range of this expected control efficiency could be appropriate for HF while the lower range is most appropriate for HCl.

In the case of HCl, however, test data for a CFB boiler at Michigan State University (Unit 4) has been obtained by MDEQ and the results show that the HCl emissions were 0.082 lb/MMBtu based on bituminous coal firing. Unit 4 is a CFB boiler rated at 350,000 lb/hr steam capable of firing coal and natural gas utilizing limestone injection for control of SO₂ and acid gases. This test data information indicates that very low capture efficiencies of HCl are achieved in the CFB boiler via limestone injection. The likely sources of bituminous coal for the HBPW Unit 10 CFB boiler will be similar to the source of coal for Michigan State University. Given this information, it seems unlikely that HBPW's Unit 10 can rely on any additional control beyond 30 percent for HCl emissions from the proposed boiler and downstream fabric filter.

For HF, HBPW estimates that the fluorine content of the coals proposed could be as high as 100 ppm on a dry basis. Assuming this input level into the boiler yields uncontrolled HF emissions of 0.008 lb/MMBtu calculated, as done for HCl. As the MACT floor for HF has been determined to be 0.0017 lb/MMBtu, this represents a control efficiency of 79 percent. This value is above the upper range of control expected for HF emissions utilizing LI and no further control is expected. Therefore, the BTF limit for HF is proposed to be 0.0017 lb/MMBtu.

6.1.3 MACT for Acid Gases

Emission limits of 0.0017 lb/MMBtu for HF and 0.047 lb/MMBtu for HCl are proposed to satisfy MACT requirements. The use of limestone injection and a fabric filter baghouse will be utilized to minimize emissions of these acid gases. HBPW will meet the proposed limits identified above and conduct initial and periodic performance tests to demonstrate compliance with MACT.

Shutdown of Unit 3

The Holland Board of Public Works has committed to shut down existing Unit 3, an 11 MW pulverized coal-fired boiler. Unit 3 is not equipped with an FGD system to control SO₂ or acid gas emissions. Therefore, emissions of acid gases from Unit 3 are emitted as uncontrolled. In fact, the estimated uncontrolled emissions of HF and HCl are 3.3 tpy and 23.8 tpy, respectively, based on a composite average fluorine concentration in coal for HF and AP-42 emission factor of 1.2 lb/ton for HCl. The estimated annual emissions of HF and HCl from the proposed Unit 10 CFB boiler are 1.47 tpy and 33.74 tpy. Therefore, a net emissions reduction of 1.8 tpy for HF as a result of this project is expected.

7.0 SUMMARY

As detailed in the previous sections, recent and relevant information required that HBPW revise the original case-by-case MACT analysis for acid gases. The MACT limits proposed in Section 6 now represent the BTF MACT limits for both HF and HCl, based on very limited test data and information from boiler manufacturers and fabric filter vendors. In summary, HBPW proposes an emission limit of 0.047 lb/MMBtu for HCl and 0.0017 lb/MMBtu for HF, consistent with the requirements of R 336.299(e) and Section 112 of the Clean Air Act.