6.0 MAXIMUM ACHIEVABLE CONTROL TECHNOLOGY

6.1 METHODOLOGY

GREC will be a major source of HAPs since potential facility emissions exceed 10 tpy for any individual HAP and 25 tpy for total combined HAPs. As a major source of HAPs, the GREC biomass-fired BFB boiler may have been subject to the MACT standards contained in the NESHAP for Industrial, Commercial, and Institutional Boiler and Process Heaters codified as 40 CFR 63, Subpart DDDDD (commonly referred to as the boiler MACT). However, the United States Court of Appeals vacated and remanded this rule effective July 30, 2007. No subsequent rule has been promulgated for industrial, commercial, and institutional boilers or process heaters.

Newly constructed major sources of HAPs without a promulgated 40 CFR 63 NESHAP are subject to a Section 112(g) case-by-case MACT determination in accordance with the provisions of 40 CFR 63.40 through 63.44. Therefore, the GREC BFB boiler, as well as other GREC HAP emission sources, are subject to a case-by-case MACT determination in accordance with 40 CFR 63.42, which states:

> "In the event that the permitting authority fails to adopt a program to implement section 112(g) with respect to construction or reconstruction of major sources of HAP…and the permitting authority concludes that it is able to make case-by-case MACT determinations…, the permitting authority may make those determinations."

Case-by-case MACT determinations for the construction of major sources include the following requirements:

- MACT emission limitations 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; i.e., the MACT *floor*.
- MACT emission limitation and control technology 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 using those control technologies that can be identified from the available informa-

tion taking into consideration the costs of achieving such emission reductions and any non-air quality health and environmental impacts and energy requirements associated with the emission reduction.

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

GREC emission sources that will emit HAPs include the biomass-fired BFB boiler and two emergency diesel engines. The emergency diesel engines will only operate up to 96 hr/yr for routine testing and maintenance and will be fired with ULSD diesel fuel oil. Potential HAP emissions associated with the emergency diesel engines will therefore be insignificant; Table A-9 in Appendix A provides HAP emission estimates for the emergency diesel engines. Accordingly, the primary focus of this case-by-case MACT assessment is the BFB boiler.

The case-by-case MACT analysis first established the most stringent emission control achieved in practice by the best controlled similar source. The following sources were reviewed to determine the most stringent emission control achieved in practice:

- Recent FDEP case-by-case MACT or other permit determinations.
- BACT determinations contained in EPA's RBLC database.

Other recent PSD permit determinations that have been issued for similar type facilities and were considered include the following:

- Yellow Pine Energy Company, LLC—Fort Gaines, Georgia.
- Nacogdoches Power, LLC—Sacul, Texas.
- Highlands Ethanol—Brighton, Florida (minor source of HAP emissions).

One additional minor source determination for biomass-fired boilers was identified but not considered since this determination (i.e., Adage Hamilton, LLC, biomass power project proposed for a site in Jasper, Hamilton County, Florida) avoided PSD requirements and thus BACT and MACT review.

The case-by-case MACT analysis evaluated several pollutant categories in establishing MACT emission limitations:

- Inorganic HAP acid gases—Hydrochloric acid and hydrofluoric acid.
- Mercury.
- HAP metals (excluding mercury).
- Organic HAPs.

This grouping of HAPs addresses all of the HAPs regulated by 40 CFR 63.

The information required in an application for a case-by-case MACT determination is contained in 40 CFR 63.43(e) and is summarized as follows:

- Name and physical address of the major source to be constructed.
- Brief description of the major source to be constructed.
- Expected commencement date of construction.
- Expected completion date of construction.
- Anticipated startup date.
- Estimated emission rate of each HAP emitted.
- Any applicable federally enforceable emission limitations.
- Capacity factor and uncontrolled HAP emission rates.
- Controlled HAP emission rates (tpy).
- Proposed emission limitation.
- Proposed control technology.
- Supporting documentation.

GREC emission source descriptions, estimated project milestone dates, and emission rates were previously presented in Section 2.0. Section 4.0 provides a discussion of applicable federal emission limitations. Detailed HAP emission estimates are provided in Appendix A. The following sections provide the proposed emission limitations and control technologies for each group of HAPs evaluated.

6.2 INORGANIC HAP ACID GASES

Inorganic HAP acid gases that will be emitted by the BFB boiler include hydrogen chloride and hydrogen fluoride. Emissions of these two acid gases result from the release of chlorine and fluorine naturally occurring in the biomass fuel.

In general, control technologies used to control emissions of SO_2 will also reduce HAP acid gas emissions. A discussion of available SO_2 emission control technologies was previously provided in Section 5.5 of the BACT analysis. Due to the naturally occurring alkaline (i.e., calcium) content of woody biomass fuel, a portion of the biomass fuel chlorine and fluorine will react within the bed to form chlorine and fluorine compounds that will exit the boiler as fly ash and will be subsequently removed from the boiler flue gas by the fabric filter.

As previously discussed, wet FGD and dry FGD SDA and CDS systems have not been installed on biomass-fired boilers due to their low uncontrolled SO_2 flue gas concentrations. Therefore, GREC LLC proposes BFB technology and DSI as MACT for inorganic HAP acid gases.

For new large solid fuel units, the boiler MACT specified hydrogen chloride as a surrogate for inorganic HAP acid gases with a limit of 0.02 lb/MMBtu. A review of EPA's RBLC database was performed for MACT or BACT determinations for hydrogen chloride and hydrogen fluoride emissions from biomass-fired boilers from 1999 to present. The only MACT determination for hydrogen chloride was for Public Service of New Hampshire Schiller Station and was updated in February 2005. The MACT emission limit was 0.02 lb/MMBtu and was based on using lime injection. There were no other appli-

cable MACT or BACT determinations contained in the RBLC database. Table 6-1 provides a summary of the acid gas (hydrogen chloride and hydrogen fluoride) emission rates for the three recent biomass boiler projects that were considered in this case-by-case MACT analysis. The proposed Highlands Ethanol project is not a major source of HAPs and therefore was not subject to MACT review. However, the hydrogen chloride emission control technology planned for the much smaller Highlands Ethanol BFB boilers is comparable to that proposed for GREC; i.e., injection of an alkaline reagent to neutralize hydrogen chloride followed by a fabric filter. The expected performance of this control technology (i.e., the controlled hydrogen chloride emission rate) is essentially the same for both projects.

Consistent with the approach that was taken for the Boiler MACT, hydrogen chloride is proposed as a surrogate for inorganic HAP acid gases. Hydrogen chloride MACT emission limit proposed for the GREC BFB boiler is summarized as follows:

- Emission Limit—0.006 lb/MMBtu
- Averaging Period—Stack test duration.
- Compliance Method—EPA Reference Methods 26 or 26A (Part 60).

For the emergency diesel engines, limited operation, use of ULSD fuel oil, and compliance with the applicable emission standards of NSPS Subpart IIII is proposed as MACT for inorganic HAP acid gases.

6.3 MERCURY

Mercury emissions from the BFB boiler will be low (i.e., 16.7 lb/yr) due to the low concentration of naturally occurring mercury in the biomass fuels. Due to the low chlorine content of the biomass fuels, mercury in the BFB boiler flue gas is expected to be in the vapor phase as primarily elemental mercury.

Control technologies for mercury include injection of activated carbon followed by a collection device and, for the soluble oxidized forms of mercury, wet scrubbing. Due to the

Table 6-1. Summary of Acid Gas (Hydrogen Chloride and Hydrogen Fluoride) Emission Rates for Similar Biomass-Fired Boilers

Facility	Boiler Type	Fuel	Boiler Rating (MMBtu/hr)	Hydrogen Chloride Emission Rate (lb/MMBtu)	Hydrogen Fluoride Emissions Rate (lb/MMBtu)
Nacogdoches Power, LLC	BFB	Wood chips	1,374	0.0213	None
Yellow Pine Energy Company	FB	Biomass, TDF, ULSD, or propane	1,529	0.006	None
Highlands Ethanol	BFB	Spillage cake and biogas	436	0.0054	None

Source: ECT, 2009.

already low concentration of mercury in the BFB boiler flue gas, neither of these control technologies are considered feasible since removal mercury efficiencies would be low.

For new large solid fuel units, the boiler MACT specified a mercury limit of 3×10^{-6} MMBtu. A review of EPA's RBLC database was performed for MACT or BACT determinations for mercury emissions from biomass-fired boilers from 1999 to present. There are two permit determinations for mercury in the RBLC database. The only MACT determination was 3×10^{-6} lb/MMBtu issued for the Public Service of New Hampshire Schiller Station. The only BACT determination was 0.013 tpy and issued for the South Point Biomass Generation project. Table 6-2 provides a summary of the mercury emission rates for the three recent biomass boiler projects considered in this case-by-case MACT analysis. Estimated GREC BFB boiler mercury emission rates (1.4×10^{-6} MMBtu and 0.0084 tpy) are well below the Boiler MACT and prior MACT/BACT determinations.

Mercury MACT emission limit proposed for the GREC BFB boiler is summarized as follows:

- Emission Limit—1.4×10^{-6} MMBtu.
- Averaging Period—Stack test duration.
- Compliance Method—EPA Reference Methods 29 (Part 60) or 101A (Part 61).

For the emergency diesel engines, limited operation, use of ULSD fuel oil, and compliance with the applicable emission standards of NSPS Subpart IIII is proposed as MACT for mercury.

6.4 HAP METALS (EXCLUDING MERCURY)

Non-mercury HAP metal emissions will be low due to the relatively low concentration of naturally occurring metals in the biomass fuels. Metal oxides that have condensation temperatures below the BFB boiler flue gas prior to the fabric filter will be removed by the fabric filter as fly ash PM

Table 6-2. Summary of Mercury Emission Rates for Similar Biomass-Fired Boilers

Facility	Boiler Type	Fuel	Boiler Rating (MMBtu/hr)	Mercury Emission Rate (lb/MMBtu)
Nacogdoches Power, LLC	BFB	Wood chips	1,374	2.99×10^{-6}
Yellow Pine Energy Company	FB	Biomass, TDF, ULSD, or propane	1,529	2.50×10^{-6}

Source: ECT, 2009.

Control technologies used to remove filterable PM will also remove particulate metals. A discussion of available PM emission control technologies for the BFB boiler was previously provided in Section 5.7.1 of the BACT analysis. The GREC BFB boiler will be equipped with a fabric filter—the most efficient PM control technology available.

For new large solid fuel units, the boiler MACT specified a filterable PM emission limit of 0.025 lb/MMBtu. A review of EPA's RBLC database was performed for BACT determinations for PM_{10} emissions from biomass-fired boilers for the past 5 years. The lowest BACT determination for PM_{10} is 0.01 lb/MMBtu for the Koda Energy project. Table 6-3 provides a summary of the PM_{10} emission rates for the three recent biomass boiler projects considered in this case-by-case MACT analysis.

Consistent with the approach that was taken for the boiler MACT, PM is proposed as a surrogate for non-mercury HAP metals. PM MACT emission limit proposed for the GREC BFB boiler is summarized as follows:

- Emission Limit—0.015 lb/MMBtu (filterable).
- Averaging Period—Stack test duration.
- Compliance Method—EPA Reference Methods 5 or 17 (Part 60).

The proposed GREC PM emissions rate of 0.015 lb/MMBtu (filterable) is equal to the lowest PM_{10} emission rate listed in Table 6-3. In addition, the GREC BFB boiler PM emissions will be controlled by a fabric filter, which is considered the highest efficiency control option.

For the emergency diesel engines, limited operation, use of ULSD fuel oil, and compliance with the applicable emission standards of NSPS Subpart IIII is proposed as MACT for non-mercury HAP metals.

6.5 ORGANIC HAPS

The BFB boiler will emit trace amounts of organic HAPs due to incomplete combustion of the biomass fuels; the same mechanism which results in CO and VOC emissions. A

Table 6-3. Summary of PM_{10} Emission Rates for Similar Biomass-Fired Boilers

Facility	Boiler Type	Fuel	Boiler Rating (MMBtu/hr)	PM_{10} Emission Rate (lb/MMBtu)
Nacogdoches Power, LLC	BFB	Wood chips	1,374	0.015
Yellow Pine Energy Company	FB	Biomass, TDF, ULSD, or propane	1,529	0.025

Source: ECT, 2009.

discussion of available CO and VOC emission control technologies was previously provided in Section 5.6.1 of the BACT analysis. For the GREC BFB boiler, good combustion practice (GCP) is the only technically feasible control technology to reduce pollutants resulting from incomplete combustion, including organic HAPs. The large mass of bed material and fluidization achieves high combustion efficiency (approximately 99 percent) and stable combustion to minimize emissions due to incomplete combustion.

For new large solid fuel units, the boiler MACT specified CO as a surrogate for organic HAPs with a limit of 400 ppm corrected to 7-percent oxygen, which is approximately equivalent to 0.3 lb/MMBtu for a woody biomass fired boiler. A review of EPA's RBLC database was performed for BACT determinations for CO emissions from biomass-fired boilers for the past 5 years. The lowest CO emission limit was 0.19 lb/MMBtu for the International Biofuels, Inc., project. Table 6-4 provides a summary of the CO emission rates for the three recent biomass boiler projects considered in this case-by-case MACT analysis. Each of the projects listed in Table 6-4 have proposed the use of GCP to control CO emissions. The expected performance of GCP technology will vary depending on the boiler design (e.g., boiler size, combustion temperatures, residence times, etc.). The proposed Highlands Ethanol BFB boilers heat input rating of 218 MMBtu/hr per boiler is approximately one-sixth the size of the GREC BFB boiler. The CO emission limit proposed for the GREC BFB boiler is slightly lower than the two projects shown in Table 6-4 that are approximately the same size.

Consistent with the approach that was taken for the boiler MACT, CO is proposed as a surrogate for organic HAPs. PM MACT emission limit proposed for the GREC BFB boiler is summarized as follows:

- Emission Limit—0.120 lb/MMBtu.
- Averaging Period—30-day rolling average.
- Compliance Method— Continuous emissions monitoring in accordance with 40 CFR 60.

Table 6-4. Summary of CO Emission Rates for Similar Biomass-Fired Boilers

Facility	Boiler Type	Fuel	Boiler Rating (MMBtu/hr)	CO Emission Rate (lb/MMBtu)
Nacogdoches Power, LLC	BFB	Wood chips	1,374	0.15
Yellow Pine Energy Company	FB	Biomass, TDF, ULSD, or propane	1,529	0.149
Highlands Ethanol	BFB	Spillage cake and biogas	436	0.10

Source: ECT, 2009.