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MEMORANDUM

To: Biomass Energy Stakeholders
From: James C. Colman, Assistant Commissioner,
Bureau of Waste Prevention, MassDEP
Date: April 18, 2007
Subject: BACT guidance for Biomass Projects

As part of the MassDEP and Massachusetts Division of Energy Resources (DOER) coordination on revised procedures for reviewing biomass facility proposals, MassDEP is publishing the attached BACT (best available control technology) guidance document. This guidance is applicable to biomass facilities in Massachusetts that require a plan approval from MassDEP, and may differ from the proposed "low emission" limits¹ that pertain to qualification under the Massachusetts Renewable Portfolio Standard (RPS) for biomass plants in other states throughout the region. Biomass plants constructed in other states and requesting RPS qualification must meet the air permitting requirements in the permitting state, as well as the MA RPS' low emission limits, but not MassDEP BACT requirements.

This guidance was published in draft on June 23, 2006, and was open for comment until July 21, 2006. The Department received one formal comment, which related to the use of C&D wood waste as a biomass fuel. Specifically, the commenter was concerned about the use of C&D wood waste contaminated with heavy metals and the potential air emissions from such fuel. The commenter was also concerned about the ability of C&D wood fuel suppliers to adequately sort C&D wood waste to prevent the use of contaminated wood waste as a fuel.

MassDEP shares the concern about the potential emissions from contaminated C&D wood, and believes that the attached Guidance addresses this issue. In particular, an applicant proposing to use such fuel will be required to demonstrate that the emission controls on the proposed facility will prevent exceedances of health based standards. The sorting of C&D wood, if required, would be addressed in the Beneficial Use Determination (BUD) that MassDEP would issue for the use of C&D wood as a fuel.

Any questions about this guidance may be directed to Donald Squires at (617) 292-5618 or Donald.Squires@state.ma.us.

¹ The proposed MA RPS low emission limits include requirements for nitrogen oxides and particulate matter. See <http://www.mass.gov/doer/rps/rps-225cmr14-summary.pdf>

Best Available Control Technology (BACT) Guidance
Biomass-Fired Electric Generating Units
April 2007

INTRODUCTION

As a result of the Commonwealth's renewable energy programs, there is increasing interest in Massachusetts in building electric generating units that utilize biomass as a fuel. This guidance is meant to provide greater certainty to prospective developers of biomass facilities when preparing plan approval applications for MassDEP under 310 CMR 7.02. It provides guidance on Best Available Control Technology (BACT) for biomass fuel and technology combinations based on MassDEP experience.

The initial guidance (issued in April, 2007) addresses solid biomass fuel-fired steam electric generating units; future versions will address other fuel/technology combinations. In general, MassDEP intends to provide two sets of emissions limits for each fuel/technology combination covered. The first table will include limits from recently issued permits for the specific fuel/technology (for example, in the initial guidance below, see Table 1). Any application for a new generating unit of the specific type will need to comply with at least those limits. The second table will include limits MassDEP considers to be technically achievable (for example, in the initial guidance below, see Table 2). The more stringent limits will be based on applying advanced technology for a specific fuel/technology combination and achieving the same level of emission reductions achieved for other fuel sources. MassDEP considers these limits as the starting points from which to make determinations on emission limits for a new generating unit of the specific type based on fuel use, energy, environmental, and economic impacts and other costs.

While this April, 2007 Guidance for new solid fuel-fired steam electric generation units is based on current permits and expectations for technology transfer, MassDEP anticipates that this Guidance will evolve over time and the emission limits for solid fuel-fired steam electric generation units may be amended in the future to reflect advances in technology. This guidance will expire on December 31, 2009. Prior to that date, MassDEP will review its experience with this guidance and initiate a public discussion to determine next steps, such as affirming and/or revising this guidance, or proposing regulations that will codify biomass performance standards.

In order to expedite permitting, and provide greater certainty, transparency and consistency across regions, MassDEP has formed a multi-disciplinary Energy Team¹ to expedite the review of air, solid waste, water, and other issues that may arise from energy projects, as well as to work with the Division of Energy Resources (DOER) on Renewable Portfolio Standard issues. MassDEP strongly encourages project proponents to contact the Regional Director in the appropriate regional office or the Chief of Staff in the Commissioner's Office early in the project planning process in order to discuss the application of this guidance, as well as other applicable regulations, if necessary. This will help reduce delays later in the permitting phase of the project.

¹ The Energy Team is co-chaired by the Assistant Commissioner of the Bureau of Waste Prevention (BWP) and the Associate Commissioner for Operations, and is made up of representatives of the region in which the facility is proposed and Boston staff as appropriate. The Chief of Staff in the Commissioner's Office is the Boston contact for the Energy Team.

BACKGROUND

Before starting construction of a fuel utilization facility (e.g. boiler, combustion turbine, reciprocating engine, etc.) whose energy input capacity will be above the thresholds contained in the regulations (310 CMR 7.02), the owner or operator must obtain written approval of the Plan Application from MassDEP.

The requirement to obtain a Plan Approval before the start of construction is set forth at 310 CMR 7.02(4) and (5). The thresholds for obtaining a Limited Plan Application are set forth at 310 CMR 7.02(4)(a), and for a Comprehensive Plan Application at 310 CMR 7.02(5)(a). Applicants proposing to install internal combustion engines burning a bio-fuel have the option of complying with the standards contained in Engines and Combustion Turbines (310 CMR 7.26(40)-(44)).

A Plan Approval for a fuel utilization facility requires the utilization of BACT, where BACT is defined as:

BEST AVAILABLE CONTROL TECHNOLOGY means an emission limitation based on the maximum degree of reduction of any regulated air contaminant emitted from or which results from any regulated facility which MassDEP, on a case-by-case basis taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems and techniques for control of each such contaminant. The best available control technology determination shall not allow emissions in excess of any emission standard established under the New Source Performance Standards, National Emission Standards for Hazardous Air Pollutants or under any other applicable section of 310 CMR 7.00, and may include a design feature, equipment specification, work practice, operating standard, or combination thereof. [310 CMR 7.00 Definitions]

In addition, more stringent emission limits than are determined through the BACT analysis are required if MassDEP determines they are necessary to avoid causing a condition of air pollution, which is “the presence in the ambient air space of one or more air contaminants or combinations thereof in such concentrations and of such duration as to:

- (a) cause a nuisance;
- (b) be injurious, or be on the basis of current information, potentially injurious to human or animal life, to vegetation, or to property; or
- (c) unreasonably interfere with the comfortable enjoyment of life and property or the conduct of business.”[310 CMR 7.00 Definitions]

This guidance is intended to provide the framework for the application of BACT to biomass energy projects.

GUIDANCE

This guidance contains emissions limits from recently permitted facilities that MassDEP believes represent state of the art limits for some specific fuel/technology combinations. An application that proposes to meet the more stringent of these limits (the “starting point” seen in Table 2) will not be required to perform a top-down BACT analysis as part of the application².

² While MassDEP believes these limits represent a good starting point for a BACT evaluation, a final determination cannot be made on emissions limits for a specific facility until any required public comment period is completed. Reviews requiring public comment include: Non-attainment New Source Review (310 CMR 7.00 Appendix A) for non-attainment pollutants, and the Massachusetts Environmental Policy Act (MEPA – 301 CMR 11.00). Similarly, for projects subject to Prevention of Significant Deterioration (PSD – 40 CFR 52.21), which is administered in Massachusetts by the US Environmental Protection Agency, EPA cannot make their determination until after the close of the required public comment period.

If the applicant believes the limitations contained in this Guidance (Table 2) are either technologically or economically infeasible, or if the proposal is for a fuel/technology not covered by this guidance, the applicant may request further guidance from MassDEP. The Energy Team will attempt to respond to any such request within 30 days. If an applicant moves ahead with a proposal, the application will be reviewed using MassDEP's standard fee and permitting timelines, unless the applicant opts to use MassDEP's "fast-track" permitting process³.

BIOMASS-FIRED STEAM ELECTRIC GENERATING UNITS

Two sets of limits are included in the following tables. Table 1 contains limits from recent permits issued for solid fuel biomass-fired boilers. In general, MassDEP expects that any application for a new solid fuel biomass-fired boiler will need to comply with these limits.

Table 2 contains limits MassDEP believes are technically achievable. These more stringent limits are based on applying Selective Catalytic Reduction (SCR – control of NOx), and an Oxidation Catalyst (control of carbon monoxide and unburned hydrocarbons) to biomass-fired boilers⁴ to achieve the same level of reduction that has been achieved on other fuel sources. In evaluating technical feasibility (part of the BACT analysis) of achieving the Table 2 limits, MassDEP considers the ability of the applicant to obtain manufacturer guarantees.

MassDEP is concerned with reducing NOx, PM and CO because:

- NOx is a precursor to the formation of ozone, a pollutant for which the Commonwealth is classified non-attainment for the National Ambient Air Quality Standard. NOx is also a precursor to acid deposition and regional haze.
- PM can accumulate in the lungs and produce respiratory and cardio-vascular symptoms. PM emissions contain unburned carbon, toxic metals (depending on the fuel source), and unburned hydrocarbons.
- Unburned hydrocarbons are a precursor to ozone formation, and many of the unburned hydrocarbons are also air toxics.
- Symptoms of high CO exposure include shortness of breath, chest pain, headaches, confusion, and loss of coordination. Achieving low CO levels also minimizes unburned hydrocarbon emissions.

In general, if an applicant proposes the limits in Table 2, MassDEP believes these are approvable as BACT – please see footnote 2. Depending on the fuel(s) being combusted, MassDEP will consider alternative emission limits to Table 2 once the applicant has prepared a complete application, including a BACT determination.

Typical biomass electric generating facilities are smaller than fossil fuel-fired generating facilities. In addition, biomass fuels are generally more variable than fossil fuels, the typical operating temperatures of biomass facilities are lower than in fossil-fuel-fired facilities, and the amount of catalyst needed to meet

³ Pursuant to Section 40 of Chapter 149 of the Acts of 2004, MassDEP and a permit applicant may agree upon appropriate fees, related funding and schedules for projects that meet certain criteria.

⁴ Although they are not meeting the same stringent limits as in Table 2, there are two wood-fired boilers in New England equipped with SCR. One of these is also equipped with an oxidation catalyst.

the emission limits in Table 2 may be large. Therefore, MassDEP understands that Table 2 emissions limits may not be readily achievable at this time and may not require facilities to achieve these limits in every case. However, given the likely improvements in biomass technology, MassDEP considers believes these limits represent a reasonable starting point for a BACT analysis.

In any case, where MassDEP requires the applicant to design the facility to approach or meet the Table 2 emission limits, MassDEP may adjust the final permit limits after optimization if such optimization demonstrates that the limits cannot be met in practice.

Table 1
New Solid Fuel-Fired Steam Electric Generation Units
Currently Permitted Emission Limitations¹

Nameplate capacity	Equal to or greater than 25 MW	Equal to or greater than 10 MW and less than 25 MW	Equal to or greater than 1 MW and less than 10 MW
SO ₂	0.025 lbs/MMBtu	0.025 lbs/MMBtu	0.025 lbs/MMBtu
NO _x	0.075 lbs/MMBtu	0.075 lbs/MMBtu	0.093 lbs/MMBtu
Ammonia	13 PPM @ 3% O ₂	13 PPM @ 3% O ₂	25 PPM @ 3% O ₂
CO	0.1 lbs/MMBtu	0.17 lbs/MMBtu	0.25 lbs/MMBtu
PM ²	0.012 lbs/MMBtu	0.012 lbs/MMBtu	0.012 lbs/MMBtu
VOC	0.01 lbs/MMBtu	0.01 lbs/MMBtu	0.01 lbs/MMBtu
Toxics ³	Based on modeling	Based on modeling	Based on modeling
Opacity	10%	10%	10%
HCl (biomass containing chlorinated compounds)	20 ppm @ 3% O ₂	20 ppm @ 3% O ₂	20 ppm @ 3% O ₂
Monitoring	CEMS – NO _x , opacity, NH ₃ , SO ₂ Annual PM test For C&D, also metals ⁴ testing	CEMS – NO _x , opacity, NH ₃ , SO ₂ Annual PM test. For C&D, also metals ⁴ testing	PMS Annual PM. For C&D, also metals ⁴ testing
Reporting	Quarterly, annually	Quarterly, annually	Quarterly, annually

¹ The boilers used to develop these limits are: Schiller Station in Portsmouth, NH, Whitefield Power in Whitefield, NH, Boralex in Stratton, ME, Ware Cogen in Ware, MA, and McNeil Station in Burlington, VT.

² The PM limits are designed to ensure compliance with toxics limits, including metals, and will likely require use of a baghouse. Compliance testing for PM emissions are to be tested according to 40 CFR 60 Appendix A Method 5. In addition, testing for condensable PM will be required.

³ Ambient air quality modeling will be required to demonstrate that the MassDEP's Acceptable Ambient Levels and Threshold Effects Levels will be required for some projects. For example:

1. Where construction and demolition wood is burned. MassDEP may require it for some other fuels of particular environmental concern.
2. For boilers that are major sources of criteria or Hazardous Air Pollutants.

⁴ Metals testing is required for facilities burning wood from construction and demolition wood, and possibly other biomass sources. This testing would be required to demonstrate that any limits in a plan approval to prevent exceedances of AALs/TELS are being met.

Table 2

New Solid Fuel-Fired Steam Electric Generation Units
Suggested BACT Starting Point¹

[The limits more stringent than Table 1 are shaded.]

Nameplate capacity	Equal to or greater than 25 MW	Equal to or greater than 10 MW and less than 25 MW	Equal to or greater than 1 MW and less than 10 MW
SO ₂	0.02 lbs/MMBtu	0.02 lbs/MMBtu	0.02 lbs/MMBtu
NO _x	0.015 lbs/MMBtu	0.015 lbs/MMBtu	0.093 lbs/MMBtu
Ammonia	2 PPM @ 3% O ₂	2 PPM @ 3 % O ₂	10 PPM @ 3% O ₂
CO	0.01 lbs/MMBtu	0.01 lbs/MMBtu	0.25 lbs/MMBtu
PM ²	0.012 lbs/mmBtu	0.012 lbs/mmBtu	0.012 lbs/MMBtu
VOC	0.01 lbs/MMBtu	0.01 lbs/MMBtu	0.01lbs/MMBtu
Opacity	5%	5%	5%
HCl (biomass containing chlorinated compounds)	20 ppm @ 3% O ₂	20 ppm @ 3% O ₂	20 ppm @ 3% O ₂
Toxics ³ - arsenic, antimony, beryllium, cadmium, chromium III, chromium VI, copper, lead, mercury, nickel, and selenium (wood containing C&D wood)	85% removal of mercury and 99% removal of the other metals, or reduce emissions below the detection limit. Also, ambient modeling to demonstrate MA AALs/TELs are not exceeded.	85% removal of mercury and 99% removal of the other metals, or reduce emissions below the detection limit. Also, ambient modeling to demonstrate MA AALs/TELs are not exceeded.	85% removal of mercury and 99% removal of the other metals, or reduce emissions below the detection limit. Also, ambient modeling to demonstrate MA AALs/TELs are not exceeded.
Monitoring	CEMS – NO _x , opacity, NH ₃ , SO ₂ Annual PM. For, C&D, also metals ⁴ testing	CEMS – NO _x , opacity, NH ₃ , SO ₂ Annual PM. For C&D, also metals ⁴ testing	Parametric monitoring will be defined. Annual PM. For C&D, also metals ⁴ testing
Reporting	Quarterly, annually	Quarterly, annually	Quarterly, annually

¹ These limits are based on applying Selective Catalytic Reduction (SCR) and Oxidation Catalyst to wood fired boilers, to achieve the same level of reduction that has been achieved on other fuel sources. SCR and oxidation catalyst have been used on wood-fired boilers. MassDEP thinks there are opportunities to achieve lower emissions than have been achieved.

² The PM limits are designed to ensure compliance with toxics limits, including metals, and will likely require use of a baghouse. Compliance testing for PM emissions are to be tested according to 40 CFR 60 Appendix A Method 5. In addition, testing for condensable PM will be required.

³ Ambient air quality modeling will be required to demonstrate that the MassDEP's Acceptable Ambient Levels and Threshold Effects Levels will be required for some projects. For example:

1. Where construction and demolition wood is burned. MassDEP may require it for some other fuels of particular environmental concern.
2. For boilers that are major sources of criteria or Hazardous Air Pollutants.

⁴ Metals testing is required for facilities burning wood from construction and demolition wood, and possibly other biomass sources. This testing would be required to demonstrate that any limits in a plan approval to prevent exceedances of AALs/TELs are being met.