

Memorandum

To	Brian Warner/Wolverine Power Cooperative	Page	1
CC	File		
Subject	Proposed Greenhouse Gas Limits for WCEV		
From	Michael Zebell, P.E.		
Date	April 6, 2011		

This memorandum is prepared to propose and document the Greenhouse Gas (GHG) emission limit for the proposed Wolverine Clean Energy Venture (WCEV) power generating facility. Table 1 on page 2 of this memorandum shows the GHG emission from the Circulating Fluidized Bed (CFB) units only in terms of English units of carbon dioxide equivalent (CO₂e) and includes the emissions from direct combustion of the design fuel including biomass.

Based on the information in Table 1 and information provided to MDEQ in the original GHG BACT review and supplemental information, Wolverine Power Cooperative (Wolverine) proposes the following BACT permit limits for the WCEV CFB units:

Total annual CO₂e emissions from the boilers included in FGCFB shall not exceed 2.1 lb / gross KWh based on a 12-month rolling average, as determined using a CO₂ CEMS, and other fuel factors for the remaining CO₂e compounds for periods of operation at 70% load or greater and 6,024,107 English short tons of CO₂e per year based on a 12-month rolling average for all operating conditions.

In addition, the following definition of biomass should be incorporated into the permit:

The biomass usage for each boiler included in FGCFB shall not exceed 20 percent on a heat input basis per year. Biomass is defined as non-chemically treated wood and wood residue, bark, or any derivative fuel or residue thereof, in any form, including but not limited to sawdust, sander dust, wood chips, scraps, slabs, millings, shavings, processed pellets made from wood or other forest residues, switchgrass, and other similar fuels. (R 336.1225, R 336.1702(a), R 336.2810, 40 CFR 52.21(j))

For the purposes of meeting the GHG BACT requirements, all biomass meeting the FGCFB biomass fuel limit shall also comply with the definition of the State of Michigan's Renewable Portfolio Standard for biomass, including forest residue, short rotation woody crops and wood derived from sustainably managed forests as defined by MCL 18.1261c

Table 1 - WCEV CFB CO₂e Emissions

Source of CO ₂	Emission Factor ⁽¹⁾	Maximum Consumption ⁽⁴⁾	GWP ⁽⁵⁾	CO ₂ e TPY	Intensity lb/kWh ⁽⁶⁾
CFB Boilers (Both Units)					
Carbon in Fuel					
70/25/5% Petcoke/PRB/Biomass	221.5 lb/MMBtu	53,085,600 MMBtu/yr	1	5,878,168	
Limestone Calcination	0.44 Ton/Ton ⁽²⁾	267,180 TPY ⁽³⁾	1	117,559	
N ₂ O Portion of NOx	0.0033 lb/MMBtu	53,085,600 MMBtu/yr	310	27,153	
Methane	0.0022 lb/MMBtu	53,085,600 MMBtu/yr	21	1,226	
Total CFB (Both Units)					
70/25/5% Petcoke/PRB/Biomass				6,024,107	2.1
<p>⁽¹⁾ All factors from the US Energy Information Administration (www.eia.doe.gov/oiaf/1605/coefficients.html) unless noted. Petcoke - 225.1 lb/MMBtu Biomass - 206.8 lb/MMBtu (40 CFR Part 98 Subpart C, Table C-1)</p> <p>⁽²⁾ 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Assumes that all added limestone is calcined and results in CO₂ emission.</p> <p>⁽³⁾ <i>Technology Selection Study - Exhibit 54 (pg 85), maximum of 30.5 TPH limestone make-up.</i></p> <p>⁽⁴⁾ All values based on permit or design values.</p> <p>⁽⁵⁾ 40 CFR Part 98, Subpart A, Table A-1</p> <p>⁽⁶⁾ Based on a gross generating capacity of 660 MW.</p>					