



National Alliance of Forest Owners  
*Investing in the Future of America's Forests*

August 23, 2010

Submitted via [www.regulations.gov](http://www.regulations.gov) and mail

EPA Docket Center (EPA/DC)  
Environmental Protection Agency  
Mailcode: 2822T  
1200 Pennsylvania Avenue, NW  
Washington, DC 20460  
Docket ID No. EPA-HQ-OAR-2002-0058

**Re: National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters; Proposed Rule; 75 Fed. Reg. 32006 (June 4, 2010)**

To Whom It May Concern:

The National Alliance of Forest Owners (“NAFO”) respectfully submits the following comments in response to the Environmental Protection Agency’s (“EPA’s”) proposed rule establishing national emission standards for hazardous air pollutants (“HAP”) for major sources, reflecting the application of the maximum achievable control technology (“MACT”). 75 Fed. Reg. 32006 (June 4, 2010). As explained below, NAFO believes that the proposed rule would establish overly stringent standards that are not necessary to protect human health and the environment and that are extremely difficult to achieve in practice. NAFO is particularly concerned about the limits established for biomass boilers, which will likely discourage the use of biomass and may even disadvantage biomass as compared to other, higher-carbon fuel sources. NAFO urges that EPA finalize the rulemaking in a manner that encourages and incents the use of forest-derived biomass—an important source of renewable energy—in boilers at major sources. Ensuring that biomass is not disadvantaged in this rulemaking will encourage renewable energy markets and have positive climate impacts.<sup>1</sup>

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<sup>1</sup> NAFO requests that EPA also consider these comments in connection with its proposed rules for area source boilers, 75 Fed. Reg. 31896 (June 4, 2010), and for commercial and industrial solid waste incinerators (“CISWI”), 75 Fed. Reg. 31938 (June 4, 2010). NAFO is concerned that these proposed rules would also establish overly stringent emissions limitations and discourage the use of biomass. For example, the proposed area source rulemaking would establish limitations for carbon monoxide (“CO”) that are unnecessarily stringent and extremely difficult for biomass boilers to satisfy. Above all, EPA should ensure that the area source and CISWI rules are finalized in a way that encourages the use of biomass.

NAFO's mission is to protect and enhance the economic and environmental values of private forests through targeted policy advocacy at the national level. At the time of this submission, NAFO's members represent 75 million acres of private forests in 47 states. NAFO was incorporated in March 2008 and has been working aggressively since to sustain the ecological, economic, and social values of forests and to assure an abundance of healthy and productive forest resources for present and future generations.

### **Background**

NAFO has a strong interest in ensuring that the MACT emission limits established for major sources are lawful and fair and that biomass units are not subject to unnecessary or disproportionate requirements and restrictions. The landowners represented by NAFO benefit from growing markets for forestry biomass because these markets consume an expanded array of materials derived from forestry operations and provide revenue streams that expand the use of good forestry practices to improve forest health and reduce forest fire hazard, among other benefits. These growing markets also benefit the U.S. public by motivating landowners to maintain their land in forests and reducing reliance on fossil fuels, which contributes to our energy security and reduces impacts to our atmosphere. As such, expanding opportunities for forestry biomass will have important environmental benefits. See *infra* at Section I.

NAFO members' customers include pulp, paper, and wood product mills, as well as other facilities burning biomass, some of which would be considered major sources under the proposed rule. These customers rely on boilers and process heaters for steam, heat (e.g. to dry lumber), and for producing electrical energy. By placing unnecessary and unlawful restrictions on biomass boilers and process heaters, the proposed rule threatens NAFO's ability to supply its customers and misses an opportunity to grow the renewable energy market. As explained below, NAFO members believe the proposed rule's treatment of biomass boilers is disproportionately negative and would likely discourage the use of biomass as a fuel source. In response to the proposed rule's restrictions, NAFO members believe their customers' ability to use biomass boilers could be jeopardized. In turn, NAFO members could suffer a decline in demand for their fiber and experience revenue loss as their customers switch to fuel sources that have more favorable treatment under the rule, despite less favorable environmental profiles. Not only would this result in a negative financial impact to NAFO members, it would threaten to undermine our nation's climate change and renewable energy goals, as well as causing the adverse environmental impact of

increasing the likelihood that acres will be removed from forest management and dedicated to more intensive land uses.

In short, the proposed emission limitations for biomass boilers would threaten the interests of NAFO's traditional customers, who have large investments in biomass boilers, would harm the landowners who supply existing biomass boilers because the rule would encourage fuel switching, and would hinder the development of new renewable energy markets.

### **Summary**

These comments are divided into three main sections. First, NAFO provides background information on the role that private forests play in achieving renewable energy goals and reducing the nation's carbon footprint. As explained in Section I, there are specific, important benefits associated with using biomass as a fuel source for major source boilers. As such, it is critical that EPA's rulemaking establish a regulatory framework that encourages and incents forest-derived biomass.

Second, NAFO identifies certain aspects of the proposed rule that may discourage the use of biomass and should be changed in the final rule. Specifically, NAFO recommends that for biomass boilers, the final rule adopt work practice standards in lieu of emissions limitations for certain HAPs, and provide the option of a health-based compliance alternative for other pollutants. For the remaining HAPs, EPA should establish more reasonable emissions limitations.

Third, NAFO explains why EPA should adjust its approach to establishing MACT. By looking at emission data separately for each HAP, EPA has set standards based on hypothetical "best performing" units that demand performance that may not be achievable by any actual sources. The proposed emissions limits, and especially the limits for biomass units, are thus arbitrary and capricious and a violation of the Clean Air Act ("CAA").

#### **I. The final rulemaking should encourage and incent the use of biomass.**

##### **A. Forest biomass is an important renewable fuel source leading to lower GHG lifecycle emissions than conventional fuels.**

Wood from sustainably managed forests provides a renewable, low-carbon energy source as an alternative to fossil fuels. According to U.S. Energy Information Administration ("EIA") data, biomass already supplies over 50% of the nation's

renewable energy.<sup>2</sup> Forests can provide ample, sustainable, domestic supplies of biomass to produce liquid transportation fuels, electricity, thermal energy (heat and power for manufacturing and other industrial uses), and synthetic natural gas. See NAFO, Carbon Neutrality of Energy from Forest Biomass, *available at* <http://nafoalliance.org/carbon-neutrality-of-energy-from-forest-biomass/>.

In evaluating the GHG emissions associated with fuels, a lifecycle analysis incorporates all steps in a “product system” to evaluate broader environmental impacts of products and processes. Using forest biomass as a renewable fuel source has significant carbon benefits because it has a more favorable lifecycle analysis than petroleum and other fuels. The Department of Energy (“DOE”) has estimated that “[c]ellulosic ethanol use could reduce GHGs by as much as 86%.” See U.S. Department of Energy, Ethanol Benefits, *available at* <http://www.afdc.energy.gov/afdc/ethanol/benefits.html> (last visited on May 4, 2010). EPA, in its final rulemaking adopting changes to the Renewable Fuel Standard Program, also recognized the GHG emissions reductions of greater than 60% that would result from the use of cellulosic biofuels compared to petroleum. Using the “displacement index” approach, EPA determined that every BTU of gasoline replaced by cellulosic ethanol will produce lifecycle GHG emission reductions of 92.7 percent.<sup>3</sup>

Recent studies have also documented the GHG benefits of electricity produced from forest biomass. One study released by the Green Power Institute, which is the renewable energy program of the Pacific Institute, has found that biomass energy production in California over the last 30 years has provided two kinds of greenhouse gas benefits. See Gregory Morris, Ph.D., Bioenergy and Greenhouse Gasses (2008). First, it has avoided the GHG emissions associated with the production of fossil fuels. Second, biomass energy production has avoided the biogenic greenhouse gas emissions (mainly methane) of the various alternative disposal fates of biomass residues, replacing them with the lower potency greenhouse gas emissions of energy production. *Id.* at 4. The prevailing science thus acknowledges the significant carbon benefits of energy produced using renewable biomass from managed forests.

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<sup>2</sup> See EIA, U. S. Energy Consumption by Energy Source (July 2009), *available at* [http://www.eia.doe.gov/cneaf/alternate/page/renew\\_energy\\_consump/table1.html](http://www.eia.doe.gov/cneaf/alternate/page/renew_energy_consump/table1.html).

<sup>3</sup> See EPA, EPA420-D-06-008, *Renewable Fuel Standard Program: Draft Regulatory Impact Analysis* at 191 (September 2006).

**B. The combustion of forest biomass is part of the ongoing carbon cycle.**

The prevailing view in the science community is that carbon emissions from forest biomass are offset by the prior absorption of carbon through photosynthesis that created the biomass. In other words, the carbon that enters the atmosphere when forest biomass is combusted was previously absorbed from the atmosphere by the forest biomass and will be reabsorbed when new biomass is grown.

As the EPA has concluded, there is “[s]cientific consensus . . . that the CO<sub>2</sub> emitted from burning biomass will not increase total atmospheric CO<sub>2</sub> if this consumption is done on a sustainable basis.”<sup>4</sup> Consistent with this conclusion, in its most recent Inventory, EPA did not include emissions from the combustion of wood biomass in its national emissions totals because it “assumed that the carbon . . . released during the consumption of biomass is recycled as U.S. forests and crops regenerate, causing no net addition of CO<sub>2</sub> to the atmosphere.” EPA 2010 Inventory at 3-10. In addition, EPA’s Mandatory Greenhouse Gas Reporting Rule does not include biogenic CO<sub>2</sub>, such as the carbon contained in wood and wood residues, in its reporting threshold. See *generally* 74 Fed. Reg. 56260 (Oct. 30, 2009). DOE’s Voluntary Reporting of Greenhouse Gases Program, authorized by Section 1605(b) of the Energy Policy Act of 1992, also provides for exclusion of combustion of biomass fuels.<sup>5</sup> The international GHG accounting methods developed by the IPCC also recognize that biogenic carbon is part of the natural carbon balance and will not add to atmospheric concentrations of carbon dioxide. Thus, a strong consensus exists that treating combustion of biomass as “carbon neutral” is scientifically sound.

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<sup>4</sup>Environmental Protection Agency Combined Heat and Power Partnership, *Biomass Combined Heat and Power Catalog of Technologies*, 96 (Sept. 2007), available at [www.epa.gov/chp/documents/biomass\\_chp\\_catalog.pdf](http://www.epa.gov/chp/documents/biomass_chp_catalog.pdf).

<sup>5</sup> See DOE, *Technical Guidelines: Voluntary Reporting of Greenhouse Gases (1605(b)) Program* (January 2007) at 77 (“Reporters that operate vehicles using pure biofuels within their entity should not add the carbon dioxide emissions from those fuels to their inventory of mobile source emissions because such emissions are considered biogenic and the recycling of the carbon is not credited elsewhere.”).

**C. The promotion of renewable energy is a national policy that EPA must follow.**

As described above, forests can play an important role in reducing and managing greenhouse gas emissions. Expanding the sources of renewable energy is a central feature of both national and international policy to reduce reliance on fossil fuels.

The EPA, in considering approaches toward addressing climate change, has long recognized that responsibly managed forests are considered one of five key “groups of strategies that could substantially reduce emissions between now and 2030.” See *Regulating Greenhouse Gas Emissions Under the CAA*, 73 Fed. Reg. 44,354, 44,405 (July 30, 2008). Similarly, the United Nation’s Intergovernmental Panel on Climate Change (“IPCC”) report on mitigation technologies highlights forest management as a primary tool to reduce GHG emissions. *Id.* at 44,405-06; *see also* NAFO, *Carbon Mitigation Benefits of Working Forests* (identifying trading platforms and registries that recognize forest management), *available at* <http://nafoalliance.org/mitigation-benefits-working-forests/>.

President Obama has emphasized that renewable energy derived from feedstocks such as forest biomass hold the key to transitioning the nation to a “sustainable, low carbon energy future.” See Letter from President Barack Obama to Governors John Hoeven and Chet Culver (May 27, 2009), *available at* <http://www.governorsbiofuelscoalition.org/assets/files/President%20Obama's%20Response5-27-09.pdf>; *see also* President Barack Obama, Memorandum for the Secretary of Agriculture, the Secretary of Energy, and the Administrator of the Environmental Protection Agency, 74 Fed. Reg. 21531-32 (May 5, 2009).

With Presidential endorsement, if not direction, of national renewable energy policy and the role of biomass in that policy, EPA must conduct its programs in a manner consistent with that policy. In light of this policy, EPA must not adopt any mandatory environmental controls, such as those set forth in the proposed rulemaking, that will require large expenditures of time and resources by industry, but are not necessary to protect human health and the environment. Similarly, to act consistently with this nation’s renewable energy policy, EPA must not impose restrictions on biomass boilers that are not legally required and that stand to disadvantage the use of biomass as a fuel source. The proposed rule lacks any justification for its departure from this policy and, as explained below, is thus arbitrary and capricious.

**II. The proposed rule should be revised to eliminate disincentives to using biomass as a fuel sources.**

The proposed rule is arbitrary and capricious because its sets emissions limitations for biomass boilers that are so low they would require adoption of expensive, novel control technology at very little benefit to human health or the environment. In these comments, we highlight a few of the concerns with the treatment of biomass in the proposed rules. We refer EPA to the comments filed by the affected industries, such as those filed by the American Forest & Paper Association (“AF&PA”) and by the American Wood Council, for a more in-depth analysis of the technical and policy issues raised by EPA’s regulatory approach.

The limits for biomass boilers are set extremely low because their baseline for emissions is very low compared to other fuels. Biomass contains very small amounts of hydrogen chloride (“HCl”), dioxin/furan, and mercury. Despite the fact that biomass is an inconsequential source of these HAPs, the proposed rule establishes extremely low limits for these HAPs in emissions from biomass combustion. For example, EPA’s faulty MACT floor approach, discussed in Section III below, resulted in extremely low limits for HCl (as a surrogate for acid gases) for biomass boilers. As a result, under the proposed rule, biomass boilers would be required to make major technological adjustments to control for HCl with extremely little benefit to public health or the environment. In addition, there are no EPA-approved methods that are appropriate in measuring the proposed HCl limits. See Attachment 1, Letter from Kerry R. Flick, Metso Power, to Donna Harman, America Forest & Paper Association at 4 (Aug. 13, 2010). For mercury, the available methods are not adequate because their reliable detection limits are well above the proposed emission limits. *Id.* The control technology for dioxin/furan is also not well understood and may not be available to meet the limits set forth in the proposed rule. The emission limits for particulate matter (“PM”) (as a surrogate for non-mercury metals, and for CO (as a surrogate for non-dioxin organic air toxics), are also far too stringent. The proposed limits for biomass boilers could require facilities to adopt costly new control equipment and result in higher operating costs, which may discourage facilities from using biomass in favor of fossil fuels.

The limitations for dioxin/furan are also arbitrary and capricious because these pollutants are not reliably detectable at the proposed regulatory level. As a result, the available methods of demonstrating compliance can not readily distinguish compliant boilers from noncompliant boilers. For example, the ability of tests to detect dioxin/furan at such low levels are so variable, that even boilers that are below the detection levels

may still exceed the proposed emissions limitations. In addition, with levels set so low, the risk of sample contamination is extremely high; for example, “one person smoking a cigarette in the vicinity of a test program could contaminate the sample with enough dioxin to put the facility out of compliance.” Attachment 1 at 5. Imposing emissions limitations in this situation would be unreasonable.

The combined effect of these arbitrary and unnecessary controls would substantially increase the cost of using biomass as a fuel source. As such, the proposed rule would negate the several government programs providing incentives to use biomass and to develop technologies reliant on biomass. With devalued incentives and increased costs, the nation would risk losing biomass as an integral part of renewable energy policy. The effect of the proposed rule would ultimately land at the foot of the forest landowner as biomass markets fail to grow or even disappear as heat and power facilities turn to other fuel sources. Most forest landowners calculate a return on their investment on a variety of markets for forest products. The elimination or dramatic reduction of a significant market such as biomass could affect the attractiveness of forestland ownership to the degree that owners look to use of the land for purposes other than forests in order to obtain an economic return.

As reported by an AF&PA analysis, the forest products industry estimates the cost of compliance with the emissions limitations for biomass boilers would be \$3.3 billion in that sector alone. In the preamble to the proposed rule, EPA recognizes that economic burden may justify an alternative compliance method. Because the costs to industry to achieve the proposed rule’s very low emissions limitations would be incredibly high and could not be consistently achieved in practice, EPA should revise its approach for biomass boilers to ensure that these boilers are not penalized because they start with a cleaner fuel. As discussed below, NAFO recommends that for dioxin/furan and mercury, a work practice standard be adopted for biomass boilers in lieu of emission limitations. For HCl and manganese, the use of health-based compliance alternative should be provided as an option. For the remaining HAPs, EPA should adopt more reasonable limitations that can be achieved in practice and will satisfy the legal requirements, without prohibitive costs to industry.

In addition to an economic justification for adopting alternative compliance methods or reduced emission limitations for biomass boilers, there is an environmental justification. Biomass is a “clean” fuel and, as described in Section I above, the combustion of biomass is carbon neutral. As such, by encouraging the use of biomass boilers, this rulemaking could have a positive impact on the nation’s carbon footprint. In

addition, as an abundant, renewable, domestic energy source, the use of biomass for energy has a positive contribution toward the nation's energy security. NAFO is concerned that because the proposed rule's stringent, numeric emissions limitations for biomass units are largely unachievable, it would create a disincentive to the continued and expanded use of biomass fuels and, in turn, could encourage the use of higher-carbon fossil fuels. As described by Metso Power, the proposed rule would discourage, if not eliminate, new development of renewable biomass power. See Attachment 1 at 2. Notably, EPA's own Regulatory Impact Analysis, at page 3-2, estimates *zero* new biomass units. Discouraging current or new enterprises from using biomass would be inconsistent with the CAA's emissions reduction goals.

NAFO recommends that, in the final rule, EPA eliminate the emission limits requirements for dioxin/furan and mercury, and replace them with work practice requirements. Section 112(h)(2)(B) of the CAA authorizes EPA to establish work practice standards when "the application of measurement methodology to a particular class of sources is not practicable due to technological and economic limitations." The proposed standards are not practicable due to technological limitations. For example, as explained above, for dioxin/furan, current technology is unable to accurately measure at the level of the proposed standard for dioxin/furan. Moreover, to reach the extremely low proposed standards, industry would be required to spend billions of dollars, while providing minimal environmental benefit. As such, the limitations are also not practicable due to economic limitations.

The proposed rule already adopts work practice standards for other fuel sources. For natural gas-fired units, the proposed rule would establish a work practice standard instead of emission limits. As such, operators would be required to conduct annual or biennial tune-ups for each unit instead of adopting add-on controls. NAFO believes that for dioxin/furan and mercury, EPA's rationale that supports establishing work practice standards for natural gas-fired units applies equally well to biomass units. EPA explained in the preamble that for gas-fired units larger than 100 mm Btu/hour, "the capital costs estimated for installing controls on these boilers and process heaters to comply with MACT limits for the five HAP groups is over \$14 billion." 75 Fed. Reg. at 32025. EPA further explains that "emission limits on gas-fired boilers and process heaters may have the negative benefit of providing an incentive for a facility to switch from gas (considered a 'clean' fuel) to a 'dirtier' but cheaper fuel (i.e., coal)." *Id.* NAFO believes that for certain HAPs a work practice standard (instead of numeric emissions limitations) is similarly warranted for biomass units. Like gas-fired units, the cost of compliance with the dioxin/furan and mercury limitations for biomass units would be

extraordinary. In addition, as described above, prescribing work practice standards would avoid creating an incentive for facilities to switch from biomass, a “clean” fuel, to a higher-carbon fossil fuel. Accordingly, for dioxin/furan and mercury, EPA should establish work practices rather than emissions limitations for biomass boilers.

NAFO further believes that EPA should exercise its authority under CAA §112(d)(4) to establish a health-based emissions limitation for HCl and manganese. This approach would ensure that public health is protected while eliminating the extreme cost to industry that could result from the proposed MACT emissions limitations.

Finally, for the remaining HAPs—PM and CO—EPA should adopt more reasonable emissions limitations that are less stringent and less costly, but achieve the statutory requirements.

### **III. The proposed emissions limits for biomass units are overly stringent.**

EPA’s approach to setting the MACT floor is arbitrary and capricious and a violation of the requirements of the CAA. EPA explains that “[f]or each pollutant, we calculated the MACT floor for a subcategory of sources by ranking all the available emissions data from units within the subcategory from lowest emissions to highest emissions, and then taking the numerical average of the test results from the best performing (lowest emitting) 12 percent of sources.” 75 Fed. Reg. at 32019. This “pollutant-by-pollutant” approach to determining MACT is not appropriate because it results in standards that do not reflect the performance of the best performing boilers for any fuel source.

The CAA requires that EPA set standards based on the performance of actual “sources.” Yet EPA’s analysis does not reflect the performance of any actual sources. Instead, it is a compilation of the best data, for each pollutant, regardless of which source the data came from. As a result, the proposed rule’s limits are unnecessarily stringent. They do not reflect the variability that occurs in real-world. For example, boilers go through warm-ups, shutdowns, load swings, fuel mix and fuel quality changes, control efficiency differences, and performance testing adjustments. By relying on pollutant-by-pollutant test data from a short period of time, EPA overlooks the variability that occurs even at the best-performing boilers. As a result, the standards can not actually be achieved by the best-performing 12 percent of sources, as EPA suggests and as contemplated by the CAA. In fact, the source data shows that no existing facility simultaneously meets all the proposed limits. See Attachment 1 at 3.

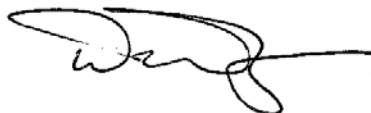
EPA's MACT determinations are also flawed because they are based on incomplete data. For example, even though the subcategory of biomass boilers is estimated to include 420 sources, EPA only has emissions testing data for a small subset of these sources (e.g. 192 units for PM, 91 units for mercury, and 92 units for HCl). EPA's lack of data makes its findings about the "best performing 12 percent of the existing sources," see CAA § 112(d)(3)(A), highly suspect and, in turn, makes the resulting emissions limits arbitrary and capricious.

For these reasons, EPA's approach to setting MACT is not within EPA's authority and is arbitrary and capricious. EPA should determine MACT based on data representing what is actually achieved by real sources. EPA should factor into the MACT the variability in operations, fuels, designs and testing performance across the many types of boilers. Again, this arbitrary approach to the regulation of biomass boilers would add substantial costs to the use of biomass, causing markets to shrink which in turn would reduce the forest landowner's return on investment as described above.

### **Conclusion**

NAFO appreciates the opportunity to provide its views on this important rulemaking and hopes that its comments will assist EPA in finalizing a rule that encourages and incentivizes the use of biomass.

Respectfully Submitted,

A handwritten signature in black ink, appearing to read "David P. Tenny", with a long horizontal flourish extending to the right.

David P. Tenny  
President and CEO  
National Alliance of Forest Owners

# Attachment 1



August 13, 2010

America Forest & Paper Association  
1111 Nineteenth Street, NW, Suite 800  
Washington, DC 20036

Attention: Ms. Donna Harman

Reference: Metso Power Response to Proposed MACT Ruling; EPA 40 CFR Part 63  
**Docket ID No.: EPA-HQ-OAR-2002-0058**  
(Part V – National Emissions Standards for Hazardous Air Pollutants for Major Sources)  
**Docket ID No.: EPA-HQ-OAR-2006-0790**  
(Part III – National Emissions Standards for Hazardous Air Pollutants for Area Sources)

Dear Donna,

On April 29, 2010, the newly proposed United States Environmental Protection Agency (EPA) National Emissions Standards for Hazardous Air Pollutants, referred to as the Industrial Boiler MACT, was signed. It was then issued into the Federal Register on June 4, 2010. The new rules are being proposed in an effort to define various acceptable levels of emissions from the combustion of biomass, coal and oil within Industrial, Commercial, and Institutional boiler plants. Industry is now at task to review this proposed ruling and provide any comment/challenge to the EPA no later than August 23, 2010. This letter serves to provide feedback from Metso Power to the EPA, our respected clients, as well as to the various trade organizations in which we are members, in support of the overall industry's response to the two proposed EPA rulings noted above.

Metso Power is a leading global provider of combustion technology whose main focus is on fluidized bed combustion of biomass and/or fossil fuels. In addition, Metso Power is in the final stages toward commercialization of new technologies related to biomass gasification and pyrolysis, which provide for the production of syngas and bio-oil respectively. Regarding fluidized bed combustion technology, Metso Power brings a diverse experience base with biomass fuel-fired fluid bed boilers. Since 1980, Metso Power has supplied 182 fluid bed boilers to the global market (110 BFBs and 72 CFBs) firing various fuels, many of which fire biomass either alone or in combination with coal. Boilers range in size from as small as 5 MWe up to 240 MWe and are located in various institutions, industrial plants and utility power generating stations. With this experience we feel we are well qualified to evaluate the recently proposed MACT rulings as they relate to biomass combustion technology. From our perspective, we feel there are areas of significant concern within the proposed rulings and offer our comments and recommendations for change that will better support biomass as a renewable fuel and the industry as a whole.

First and foremost, Metso Power is a leading proponent of the reduction of the gaseous emissions from power generating sources. The improvement of existing technologies and development of new technologies to increase energy efficiency and reduce green house gas emissions are among our guiding principles. However, when reading the proposed ruling we feel that it is impractical in many areas as we will outline below. We believe that the proposed rulings will require the use of new and untested environmental control technologies to achieve the stated air emission levels. Further, the proposed rulings provide for emission limits that are considerably below those set in Europe, where the combustion of biomass as a renewable energy source has been in practice for several years.



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If the ruling is written into law as proposed, the future of the U.S. biomass renewable energy market will be significantly impacted. Most new plants will not be feasible from a financial perspective given the high costs associated with the integration of needed technologies and equipment. There will be a significant increase in the cost to make power and Utilities will be forced to pass this onto the consumer, resulting in a much higher price for electricity. Thus, it is believed that the proposed ruling will discourage, if not eliminate, new development of renewable biomass power. We believe that this is not the intent of the current Administration from an energy or economic policy perspective. As a form of renewable energy, biomass energy is CO<sub>2</sub> neutral hence does not contribute to the global green house gas emissions. Furthermore, producing energy from biomass clearly helps our rural economy and energy security.

### **Data Relevance**

In Metso's opinion, the data used to develop the proposed emissions limits does not have the required depth, and individual pollutant limits have been set without considering pollutant co-dependence. We recommend that additional existing sources be considered and that the emissions limits be set based on the complete data sets of the best performing sources. In addition, we also suggest that due to the variability in biomass (from a fuel/ash composition, time of harvesting and regional sourcing standpoint), that consideration be given to making a change to the ruling of the Clean Air Act (CAA) that sets the MACT floor for new units based solely on the "top performer" for each individual pollutant. Suggested changes for MACT floor settings for a new biomass renewable energy plant should be based upon the complete set of measured emissions from only the top "operating" performer in each regional location and for each given biomass classification as defined below, regardless of the combustion technology employed:

- 1) Regional location (i.e. Northeast; Midwest; Southeast; Southwest; Northwest; West; and Coastal)
- 2) Classification of biomass:
  - a. agricultural (crops, dedicated energy crops, animal wastes, and agricultural processing residue);
  - b. wood (forest products, logging residue, primary mill residuals, secondary mill residuals, urban wood wastes and wastes from Pulp and Paper manufacturing); and
  - c. urban residual (railroad ties, mixed paper, construction and demolition debris, refuse derived fuel, residential municipal solid waste, scrap tires, and yard wastes)
  - d. Units firing multiple classifications of biomass to be subject to the more stringent classification.
- 3) Performance from "operating" units should only be used
- 4) Pollutant co-dependence must be carefully considered

It is understood that while facilities may not be available at this time, in every region - for every classification, consideration should be given to finalizing an environmental air permit for a given plant based upon the optimized demonstrated performance of the new plant after its first year of operation.

The proposed rule defines thresholds for limits related to only certain toxic air pollutants. If a particular facility emits less than 25 tons per year of total toxic air pollutants, and less than 10 tons per year of any



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individual toxic pollutant it will be classified as an "Area Source" location. Above these thresholds a facility would be deemed a "Major Source" location. For existing units, limitations on various pollutants are to be set utilizing the established MACT floor criteria for each source designation. Limitation setting is to be "*based on the average emission limitation achieved by the best performing 12 percent of the existing sources (for which the Administrator has emissions information), in the category or subcategory for categories and subcategories with 30 or more sources.*" (CAA section 112(d)(3)(A)). Unfortunately, as evidenced by the data published, there are only a few plants available in the United States that provide all the specific emissions information. Although the sample population is not nearly adequate, it has nevertheless been used to establish the proposed emissions levels for both existing and new facilities. It is Metso's opinion that this is not fair representation, particularly when the fuel source is as varied as biomass. The information contained in the Federal Register itself, clearly questions the relevance of the limited number of existing sources and asks Congress for its interpretation of CAA Section 112(d)(3)(B), and the necessity to obtain data from at least the top five (5) existing facilities. We feel that Congress must insist on maintaining this minimum requirement. If a complete set of data is not available from a minimum of five operating units, the EPA should be directed to look further, possibly toward the European community, to support establishment of the MACT floor criteria for both new and existing units.

Further, the source data shows that no existing facility simultaneously meets all the proposed limits, even the few plants with environmental controls. Pollutant co-dependence is critical in understanding environmental emissions from the combustion process for several pollutants are related to each other – some inversely to others, such as NO<sub>x</sub> and CO. The relevancy of utilizing the results from multiple boilers as the "best performer" for individual pollutants (one for CO and another for PM) is therefore not justified when setting limits for new units. The use of this method does not account for the co-dependence of these pollutants as they relate to boiler operating parameters and the variability in biomass type and composition. As such, if upheld, costly changes/additions in technology (many of which are currently unproven) to new and existing facilities will need to be made in order to comply with the proposed ruling. The payback period for making these changes will exceed the two year payback period set by section 325(o)(2)(B)(iii) of the Energy Policy and Conservation Act as a justifiable economic energy conservation standard for the installed cost to implement the given technology will be greater than 3x the value of the first year energy savings resulting from the change. The MACT floor for the "best performer" which establishes new facility regulations should therefore be based on all emissions measured from that plant at the same time and firing the same fuel, and not based on the performance from different plants for individual pollutants.

### **Startup and Averaging Periods**

Startup periods are not predictable and should not be included in the emissions averaging period. We recommend that startup periods be treated outside the averaging period similar to "*periods of malfunction*" (CAA section 112(d)).

In addition, a 24-hour averaging period (the proposed standard for Area Source facilities) does not provide owners/operators an adequate period of time to deal with transient operating conditions. We recommend that the averaging period for measuring emissions be based on a 30-day rolling average. The definition of the averaging period at Area Source facilities needs to be revised to be consistent with that proposed for Major Sources.



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The combustion of biomass has its challenges. Biomass has a low calorific value and high moisture content when compared to fossil fuels. Biomass characteristics can vary significantly based on a number of factors, including species, geographic origin, and time of year. Thus, there is variability in biomass that is not inherent to the combustion of fossil fuels. This variability along with the extreme dynamics associated with startups of a biomass fired boiler make it unreasonable to include them in the emissions compliance averaging period. The proposed ruling states that "*Periods of startup, normal operations, and shutdown are all predictable and routine aspects of a source's operation.*" We have not found this to be the case in practice when it comes to biomass combustion. The variability in biomass makes it difficult to standardize an optimized mode of operation on a consistent basis, particularly during startup conditions. Thus, emission control during startup is anything but predictable and consistent. The source data supports this. The data presented for CO emissions fluctuates significantly during the performance testing period. Metso believes that no technology is commercially available, including oxidation catalysts, to control emissions of CO during startup or shutdown to the degree that would be required to satisfy the proposed rulings. These variations are further complicated by the fact that many units are not based-loaded and must deal with fluctuations in load that will create transient conditions, even during normal operation. This can result in frequent operating instabilities lasting several hours, compounding the unpredictable nature of biomass combustion and the resulting emissions. Over a sufficient period of time it is reasonable to expect the emissions average to be stable. Our experience would suggest that not less than 30 days should be considered a reasonable period for this purpose.

#### **Methods of Measurement – Ability to Ensure Consistency and Accuracy in Results**

Some of the measurement and test methods are unable to reliably or accurately measure the proposed low-level emissions on a consistent basis with repeatability. We recommend that the EPA make modifications to the proposed ruling to ensure an accurate and reliable means is available to measure these low-level emissions. Measurement tolerances should be established to account for variability in testing as well as given biases.

It is imperative that one can accurately measure and consistently prove compliance with all air regulations. The proposed ruling for new boilers would mandate emission limits that have yet to be demonstrated on a consistent and repeatable basis. We have questioned the ability to accurately and consistently measure these emissions at these limits. For this reason we sought the advice of the Energy & Environmental Research Center (EERC). Attached is a formal response from EERC addressing these issues. The EERC is a former National Laboratory that currently operates as a private research center located at the University of North Dakota. In 1992, the US-EPA established EERC as the Center of Excellence for Air Toxic Metals (CATM). Their input provides great insight into the relevancy of the proposed ruling.

In summarizing the EERC letter, we have been advised that:

- There are no EPA approved methods (such as Method 26A, or 13B) that are appropriate in measuring the proposed HCl limit. Values less than 5 ppm will lack precision and accuracy.
- Similarly, for mercury, neither the Ontario Hydro (OH) nor Method 29 should be considered relevant as their reliable detection limits are well above the proposed emission limit. There is an alternative method, Method 30B, which has demonstrated accurate measurement of mercury at the proposed levels. However, for biomass applications, compliance using continuous monitoring



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methods has not been validated and is still in the developmental/testing stage. Early results are not promising.

- For the measurement of dioxins/furans, using Method 23 could prove to be problematic depending on how the regulations are implemented and what is allowed or not allowed. There are two potential issues with the low level measurements required – detection limits and sample contamination. Regarding detection limits, non-detect values must be reported as “zero” values, as stated in the method. However, if regulatory bodies start to require that non-detects be assigned the detection limit value, the summation of the numerous dioxin/furan compounds will be greater than the proposed emission limit. As for sample contamination, simply put - one person smoking a cigarette in the vicinity of a test program could contaminate the sample with enough dioxin to put the facility out of compliance.

Finally, emission limits should recognize and allow for measurement variance within the test method. This is currently not the case in the United States. In Europe for example, acceptable testing tolerances for given pollutants have been established to account for these variances. Further, testing at these low levels will require testing contractors who are *extremely* familiar with the stated methods and their inherent biases and/or interferences. There are a very limited number of testing contractors that fit this criterion.

### **Technology and Emission Equivalency**

Historically, various types of grate-fired boilers (stokers and fluidized beds) have been employed in biomass firing. Over time, facilities have placed more emphasis on fuel efficiency, which has often led to the replacement of stoker firing by fluidized bed combustion. Fluidized bed boilers have demonstrated more flexibility in terms of accepting higher moisture fuels and various types of biomass fuels while maintaining better fuel efficiency and lower emission levels. For these reasons the vast majority of modern day plants in Europe employ fluidized bed technology for biomass combustion. While both technologies continue to be employed in the US for producing renewable energy from biomass, their mutual competitiveness is generally based upon many factors including not only emissions capabilities, but also fuel efficiency, cost of equipment, and the like. Given this, we feel the proposed limits for these technologies are not equitable and do not see the rationale for disparity between the technologies in the proposed limits. We feel that both technologies (stokers and fluidized beds) should have the same limitations (i.e. 560 ppm<sub>dv</sub> @ 3% O<sub>2</sub> for CO).

The same equity should be applied to limits for dioxin/furan (D/F). A value in-line with the proposed fluid bed combustion technology is recommended. But even at this level, powder activated carbon may be required in order to meet the proposed limits. This will add up-front capital cost as well as operational cost to all new installations. In addition, the use of activated carbon will have a detrimental impact on ash disposal. The higher level of carbon in the ash will make it difficult to sell and will likely lead to controlled ash disposal, a secondary environmental impact not considered in this proposed ruling. There would then be a reduced revenue stream and an added disposal cost.



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We trust this information provides you with sufficient input from a boiler supplier's perspective and welcome you to include it along with any challenges you are issuing to the EPA on the recently issued proposed MACT ruling. Should you have any questions, please let us know.

Sincerely,

**METSO POWER**

A handwritten signature in black ink, appearing to read 'Kerry R. Flick'.

Kerry R. Flick  
General Manager – Technology

Attachments: Summary Table of Proposed Emission Limits for Biomass Combustion

EERC Assessment of Methods of Measurement of Hg, HCl, and Dioxin/Furans in a  
Biomass Fired Fluidized Bed Combustor Environment



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### ATTACHMENTS

The following values for biomass combustion are to be imposed:

#### Proposed Emission Limits for Biomass Combustion:

| Area Source  | Technology   | Avg Period | PM (lb/MMBtu) | CO (ppmdv @7% O <sub>2</sub> ) | Hg (lb/MMBtu)        | HCl (lb/MMBtu) | Dioxin/Furan (ng/dscm@7% O <sub>2</sub> ) |
|--------------|--------------|------------|---------------|--------------------------------|----------------------|----------------|---|
| New          | Fluid Bed    | 24-hour    | 0.03          | 100                            | --                   | --             | --  |
| New          | Stoker/Grate | 24-hour    | 0.03          | 100                            | --                   | --             | --  |
| Existing     | Fluid Bed    | 24-hour    | --            | 160                            | 3.0x10 <sup>-6</sup> | --             | --  |
| Existing     | Stoker/Grate | 24-hour    | --            | 160                            | 3.0x10 <sup>-6</sup> | --             | --  |
| Major Source | Fuel         | Avg Period | PM (lb/MMBtu) | CO (ppmdv @3% O <sub>2</sub> ) | Hg (lb/MMBtu)        | HCl (lb/MMBtu) | Dioxin/Furan (ng/dscm@7% O <sub>2</sub> ) |
| New          | Fluid Bed    | 30-day     | 0.008         | 40                             | 2.0x10 <sup>-7</sup> | 0.004          | 0.007                                     |
| New          | Stoker/Grate | 30-day     | 0.008         | 560                            | 2.0x10 <sup>-7</sup> | 0.004          | 5.0x10 <sup>-5</sup>                      |
| Existing     | Fluid Bed    | 30-day     | 0.020         | 250                            | 9.0x10 <sup>-7</sup> | 0.020          | 0.020                                     |
| Existing     | Stoker/Grate | 30-day     | 0.020         | 560                            | 9.0x10 <sup>-7</sup> | 0.020          | 0.004                                     |

Values denoted in "red" text indicate gross inequities between technologies.



July 22, 2010

Dr. Reyhaneh Shenassa  
Research & Development Manager, North America  
METSO Power  
3430 Toringdon Way, Suite 201  
Charlotte, NC 28277

Dear Dr. Shenassa:

Subject: EERC Assessment of Methods for Measurement of Mercury, HCl, and Dioxin/Furans in a Biomass-Fired Circulating Fluidized-Bed Combustor Environment

The Energy & Environmental Research Center (EERC) assessed the ability of several U.S. Environmental Protection Agency (EPA)-approved methods for measuring low levels of mercury, HCl, and dioxin/furans that METSO Power may be asked to guarantee for newly constructed biomass combustors in response to the recently proposed EPA Industrial Boiler MACT (maximum achievable control technology) regulations, with limits as shown in the table below. It should be clearly noted that the EERC did not assess whether the emission limits are achievable but only as to whether appropriate methods can be used for accurate measurement at or below the stated limits.

| Emission           | Method   | Value     | Unit                     |
|--------------------|--|-----------|--------------------------|
| HCl                | EPA Method 26 or 26A (M26 or M26A)                             | 0.004     | lb/MMBtu (HHV*)          |
| Hg                 | M29 or ASTM International D6784-02 (Ontario Hydro [OH] method) | 0.0000002 | lb/MMBtu (HHV*)          |
| Dioxins/<br>Furans | EPA Method 23 (23)   | 0.007     | ng/dsm <sup>3</sup> (**) |

\* Based on fuel input higher heating value (HHV).

\*\* 0.007 ng/dscm (toxic equivalent quantity) corrected to 7% oxygen.

To compare to method detection limits, based on fuel properties and calculated flue gas flow rates, the above emission limits are presented on a dry volumetric basis, corrected to standard conditions, as follows.

| Emission | Value* | Unit              | Value* | Unit |
|----------|--------|-------------------|--------|------|
| HCl      | 5.40   | mg/m <sup>3</sup> | 3.31   | ppmv |
| Hg       | 0.35   | µg/m <sup>3</sup> | 0.22   | ppmv |

\* Presented on a dry volumetric basis corrected to 32°F, 6% oxygen, and 14.7 psia atmospheric pressure.

Dr. Shenassa/2  
July 22, 2010

## HCl

Based on this assessment, accurate measurement of HCl at or below the proposed emission limit of 0.004 lb/MMBtu, 3.31 ppmv (dry), will be problematic and not possible using M26A, or other methods, as further explained in Enclosure A. Considering the uncertainties and errors associated with sample collection and known biases, values less than 5 ppm will lack precision and accuracy. To account for error associated with all known biases (refer to Enclosure A) and have a high degree of confidence and accuracy, a limit of 20 ppmv should be considered. At a minimum, the emission limit should recognize and allow for variance within the methods as discussed in Enclosure A. Additionally, to obtain accurate low-level values, the EERC believes that it will require contractors who are extremely familiar with the methods and their inherent biases and/or interferences.

## Mercury

The EPA-proposed Industrial Boiler MACT mercury limit for new installations of circulating fluidized-bed units firing biomass is 0.0000002 lb/MMBtu. Should a facility want to comply by fuel choice alone, the mercury concentration in the biomass feedstock would have to be lower than 0.0012 ppmw (dry), assuming a heating value of 6000 Btu/lb (dry). Most biomass feedstocks have mercury concentrations that range from <0.001 to 0.04 ppmw (dry) as shown in Enclosure B. Meeting this limit by fuel choice alone, especially when taking variability into consideration, will be extremely difficult and, in most cases, not possible unless the unit is designed and demonstrated to capture mercury or the addition of specific mercury control technology such as activated carbon is used.

Low-level measurement of total mercury at the proposed mercury limit of 0.0000002 lb/MMBtu (approximately  $0.35 \text{ ug/m}^3$ , depending on the heating value of the biomass) is possible, but not with the proposed methods or with continuous monitoring instruments. Neither the OH method nor M29 should be considered as the compliance method as they lack the ability to provide good consistent results and repeatable background blanks at these levels. Increasing sampling time with these methods does not improve (lower) detection limits or provide higher quality data because of other factors that interfere with the measurements. The detection limit for M29 is  $0.59 \text{ ug/m}^3$  and  $0.5 \text{ ug/m}^3$  for the OH method. These numbers are optimistic based on existing data quality and are above the limit of  $0.35 \text{ ug/m}^3$  (0.0000002 lb/MMBtu). An alternative method that has demonstrated accurate measurement of mercury at low levels is M30B. The detection limit for M30B is extremely good, and most testers have had good success making low-level measurements in the range of the proposed limit. For biomass applications, compliance using continuous monitoring methods has not been validated and is still in the developmental/testing stage. When applied to biomass facilities, some sort of validation testing is needed before continuous monitoring instruments or Appendix K should be generally accepted for compliance purposes.

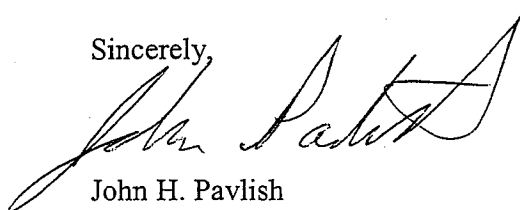
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### Dioxins/Furans

The measurement of dioxins/furans using M23 to demonstrate compliance at  $0.007 \text{ ng/dsm}^3$  ( $7 \text{ pg/dsm}^3$ ) should be possible but could prove to be problematic depending on how the regulations are implemented and what is allowed or not allowed. There are two potential problematic areas when attempting to make low-level measurements that are at or below  $0.007 \text{ ng/dsm}^3$ . The first has to do with detection limits, and the second is related to sample contamination. To address potential issues related to detection limits, nondetect values must be treated as zero values, as stated in the method. Otherwise, the accumulated detection limit for all dioxin/furan compounds will exceed the proposed limit of  $0.007 \text{ ng/dsm}^3$ . Since the limit is extremely low, care must be given to sample collection, possible contamination, and the use of field blanks. Retesting must be allowed to address situations when contamination is identified. More discussion on this is included in Enclosure A.

I hope that you find this assessment useful as you decide how best to address your clients' needs. Should you have any questions, please call me at (701) 777-5268.

Sincerely,



John H. Pavlish  
Senior Research Advisor  
Director, Center for Air Toxic Metals®

JHP/sah

Enclosures

c/enc: Kerry Flick, METSO Power  
Richard Schulz, EERC  
Lucinda Hamre, EERC

## ENCLOSURE A

This enclosure is a more thorough discussion of the Energy & Environmental Research Center's (EERC's) assessment of the methods used to measure HCl, Hg, and dioxin/furan emissions from biomass combustion sources using fluidized-bed combustion to comply with the new maximum achievable control technology (MACT) limits proposed by the U.S. Environmental Protection Agency (EPA) for industrial boilers.

### HCl

From a sampling standpoint, and for the methods that are available, there are not any EPA-approved methods (such as Method [M] 26 or M13B) that are appropriate for measuring HCl at or below the emission limits of 0.004 lb/MMBtu, 3.31 ppmv (dry).

The EERC would **not** recommend using M26A (Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method) for HCl measurements in the range needed to verify compliance with these low-level emission limits. The emission limit for HCL is below the ability of M26A to reliably and accurately determine the stack gas concentrations.

Although the M26A **laboratory detection limit** using ion chromatography for F<sup>-</sup> detection is 0.2 mg/m<sup>3</sup>, compared to the M13B ion-specific electrode detection limit of 0.02 mg/m<sup>3</sup>, the levels to be measured in a sample at the emission limit would still be approximately 20 times above the detection limit.

This value, however, does not address the uncertainty and errors associated with sample collection and possible biases. It should be recognized that M26A has a potential high bias for HCl in the presence of volatile materials, such as chlorine dioxide and ammonium chloride. There is also a potential measurable low bias for HCl under 20 ppmv, caused by moisture in the flue gas. This bias can be reduced by operating the probe at temperatures at the upper limits of the specified temperature and insuring that no water droplets are collected on probe surfaces. However, there is still likely to be some associated error or bias. The issue of low bias can be especially problematical if the samples are taken after a wet scrubber and at high-moisture levels. Low-level halogen measurements, taken after a wet scrubber or at high-moisture levels, should be assumed to be biased low, and this would also be true when using the optional cyclone at the probe inlet. Some of this bias can be reduced by elevating sample train temperatures, but this may lead to a high bias if ammonia is present in the flue gas. At this point, the EERC is not aware of any proposed alternative sampling methods that resolve the low-bias issue.

A short discussion follows of the biases associated with M26A, as outlined in the EPA document "Stack Sampling Methods for Halogens and Halogen Acids"(1). As stated in this document, the low bias associated with the method was not consistent from test to test but can be roughly correlated with the moisture content of the flue gas. Tests at 4.8 ppm HCl indicated a low bias of 50%. Another test indicated that spiked impinger recoveries were reasonable but that full-train spikes were low by a factor of 3 to 5. The presence of NH<sub>4</sub>Cl was found to produce a

positive bias in all cases, and any attempt to mitigate this bias aggravated the moisture bias. In flue gases containing ammonia slip, it could be assumed that the high bias for HCl due to NH<sub>4</sub>Cl could be as high as the ammonia slip value in the flue gas if the ammonia reacted with available Cl<sup>-</sup> ions. Since the emission limit for ammonia is over 10 ppm, the potential high bias using M26A could be several times the above-stated emission limit; certainly, it could be as high as 10 ppm.

The validation status discussed in this document indicates that the method is valid from “a few” ppm to 500 ppm but does not address the high bias potential and does not define what is meant by “a few” ppm; certainly, the proposed limit of 3.31 ppm would not be considered “a few.” The precision of the method was evaluated from 3.9 to 15.3 ppm HCl, and the stated precision was up to 0.49 ppm.

The test for the precision of this method did not challenge the method with worst-case scenarios: high moisture and ammonia. Since, this test did not include ammonia, which is known to cause a higher bias, the 0.49 ppm precision could easily be 10 ppm in the presence of a 10 ppm or greater ammonia slip.

One final note, EPA M0050 is nearly identical to M26A; it uses the same sampling probe, filter housing, and impinger configuration. Yet M0050 very clearly states the method **SHOULD NOT BE USED FOR HCl CONCENTRATION LESS THAN 20 ppm.**

In summary, there are methods to measure HCl with a **stated method detection limit** of 0.04 ppm in the stack gas, which taken by itself should provide values that are within emission limits of 1 to 2 ppm in the flue gas. However, when considering uncertainties and errors associated with sample collection and known biases as documented by EPA (1), the methods will not likely provide reliable values that are accurate and repeatable below 5 ppm (1), and even values below 20 ppm have shown bias values as much as 20%.

This is consistent with the conclusion from EPA’s Method Branch Office; a quote taken from the EPA’s “Stack Sampling Methods for Halogens and Halogen Acids” document states that “good precision and accuracy become difficult to achieve with these methods (M26 and M26A) at concentrations below 5 ppm” (1). Similar methods, such as EPA M0050, further state that the accurate measurement of HCl should be limited to 20 ppm or higher.

## **Mercury**

The EPA-proposed Industrial Boiler MACT limit for new installations of circulating fluidized-beds firing biomass is 0.0000002 lb/MMBtu. Should a facility want to comply by fuel choice alone, the mercury concentration in the biomass feedstock would have to be lower than 0.0012 ppmw (dry), assuming a heating value of 6000 Btu/lb (dry). Most biomass feedstocks have a mercury concentration that ranges from <0.001 to 0.04 ppmw (dry) as is shown in Enclosure B. Meeting this limit by fuel choice (see Enclosure B) alone, especially when taking variability into consideration, will be extremely difficult and, in most cases, not possible unless the unit is designed and demonstrated to capture mercury or the addition of specific mercury control technology such as activated carbon is used.

Low-level measurement of total mercury at the proposed mercury limit of 0.0000002 lb/MMBtu (approximately  $0.35 \text{ ug/m}^3$ , depending on the heating value of the biomass) is possible but not with the proposed methods or with continuous monitoring instruments. Neither the Ontario Hydro (OH) method nor M29 should be considered as the compliance method for mercury measurement at these low levels. These methods lack the ability to provide good consistent results and repeatable background blanks at these levels. Increasing sampling time with these methods does not improve (lower) detection limits or provide higher quality data because of other factors that interfere with the measurements, for example,  $\text{SO}_2$  interference, dilution of the sample because of condensate, and other factors. The detection limit for M29 is  $0.59 \text{ ug/m}^3$  and  $0.5 \text{ ug/m}^3$  for the OH method. These numbers are optimistic based on existing data quality and are above the limit of  $0.35 \text{ ug/m}^3$  (0.0000002 lb/MMBtu).

An alternative method that has demonstrated accurate measurement of mercury at low levels is M30B. The detection limit for M30B is extremely good, and most testers have had good success making low-level measurements in the range of the proposed limit. Yearly compliance testing to prove compliance even at these low values can be done without many complications using M30B. The problem with low-level mercury testing arises when continuous monitoring is required such as installation of continuous mercury monitors (CMMs) or when long-term Appendix K-type samples are required.

Measurement of mercury using CMMs is currently not reliable below about  $1 \text{ ug/m}^3$ . The problem is twofold. The National Institute of Standards and Technology has not certified calibrators for low-level measurements, so calibration in these low ranges is not possible, and secondly, the errors associated with these low-level measurements can be as large as the measured value. Use of CMMs for compliance at the proposed limit are just now beginning to be evaluated for low-level measurements. Preliminary indications are that they **will not** work reliably to certify low-level numbers to any degree of certainty. For some flue gases, the CMMs may work fine, but for other measurements, the CMMs may present serious problems. Recent tests were conducted at the EERC's pilot plant facility with known mercury levels at  $0.37 \text{ ug/m}^3$ . Measured values from one instrument provided by a major vendor indicated a high bias equal to the actual mercury concentration (instrument reading  $0.74 \text{ ug/m}^3$ ). Any permit or regulatory limit needs to incorporate the possibility of this bias, should continuous monitoring be required. Otherwise, the high bias could potentially cause the facility to be noncompliant.

Continuous long-term measurement using Appendix K-type traps to measure low-level mercury concentrations have also run into problems. The Appendix K-type traps are sensitive to flue gas compositions; high moisture, high  $\text{SO}_2$ , and other acid gases can cause breakthrough of Section 1 to Section 2 and also create problems for spike recoveries in Section 3. Originally, the Appendix K-type traps were intended to continuously collect mercury for 1 to 2 weeks. Recent data indicated that in some cases the traps may need to be changed daily or at a minimum every few days. At this point, for biomass applications, it is impossible to predict with certainty how long the traps will work. Any permit that required the use of these traps as the compliance measurement would have to be very broadly written to cover the possibility that these measurements may be unreliable and inconsistent from test to test. When applied to biomass

facilities, some sort of validation testing is needed before Appendix K should be generally accepted for compliance purposes.

### **Dioxins/Furans**

The measurement of dioxins/furans using M23 to demonstrate compliance at  $0.007 \text{ ng/dsm}^3$  ( $7 \text{ pg/dsm}^3$ ) is possible but could prove to be problematic. There are two potential problematic areas when attempting to make low-level measurements that are at or below  $0.007 \text{ ng/dsm}^3$ . The first has to do with detection limits, and the second is related to sample contamination. Both are discussed in more detail as follows.

Detection Limit. The detection limit issue revolves around the fact that the laboratory detection limit for each of the dioxin/furan compounds is **approximately**  $2 \text{ pg}$ ,  $0.002 \text{ ng/dsm}^3$ . The family of regulated dioxins/furans include seven of the polychlorinated dibenzo dioxins, ten of the polychlorinated dibenzo furans, and twelve of the polychlorinated biphenyls, which each have an approximate detection limit of  $2 \text{ pg}$ ,  $0.002 \text{ ng/dsm}^3$ .

In many cases, the values that are measured are below the laboratory detection limit, or nondetects. These nondetects are **not** an issue if the method is followed as written. That is, the method specifically states that nondetect values are to be reported as **ZERO** values. However, the problem arises when regulatory bodies start to require that nondetects be assigned the detection limit value (approximately  $2 \text{ pg}$ ) rather than zero. Since there are numerous dioxin/furans compounds (as shown above), this could equate to an accumulative detection limit of well over  $0.007 \text{ ng/dsm}^3$  ( $7 \text{ pg/dsm}^3$ ) should all compounds be assigned a value equal to their detection limit or a lower value after applying a toxic equivalency factor. Consequently, if nondetects are not treated as zeros, it might not be possible for a facility to demonstrate compliance at a limit of at  $0.007 \text{ ng/dsm}^3$  ( $7 \text{ pg/dsm}^3$ ). Some relief from the method detection limit issue can be obtained by increasing the volume of gas sampled, but this does not always work. In some cases, the additional sample volume can create problems with the analytical and actually increase detection limits because of interference issues or problems separating peaks.

Sample Contamination. Since the value of  $0.007 \text{ ng/dsm}^3$  ( $7 \text{ pg/dsm}^3$ ) is extremely low, it is critical to the accurate measurement of dioxins/furans that any potential for sample contamination be minimized/eliminated. For example, even one person smoking a cigarette in the vicinity of a test program could contaminate the sample with enough dioxin to put the facility out of compliance. Extreme care must be taken, and in some cases, retesting may be required and should be allowed to ensure that samples are not contaminated.

M23 does not have any provisions that allow for subtracting background blank values from sample values. This may cause problems at some sites as background contamination may exist. Therefore, it is important that any permit or limit value allow for subtracting field blank values from sampled values. At a minimum, permit language should allow for retesting should contamination can be identified and isolated. Field blanks should be allowed to be used in way of subtraction and also to identify possible site contamination for each dioxin/furan compound. Should field blanks indicate that one or more compounds show possible contamination, retesting should be allowed. Field blank sample trains must be assembled, taken to the sample location,

leak checked, left at the sample location for the duration of the test run, leak checked after the run, and recovered in the same manner as test samples. For laboratory analysis, field blank samples must be treated exactly as test samples. That is, if dilutions or other procedures including filtering are performed on test samples, then the same dilutions or procedures must be applied to the field blank samples. It is extremely important to identify a testing agency and laboratory that can provide consistent data that is free from contamination, and it is equally important that each individual test run include a field blank to verify that measured values in that sample are from process sources and not from outside and/or background contamination.

### **Reference**

1. Johnson, L.D. Stack Sampling Methods for Halogens and Halogen Acids. Presented at the EPA/AWMA International Symposium on Measurement of Toxic and Related Air Pollutants, Research Triangle Park, NC, May 1996.

## ENCLOSURE B

### Mercury in Biomass

A short study conducted by the Energy & Environmental Research Center shows that mercury concentrations as measured in biomass are highly variable and tend to be approximately a factor of 10 to 100 lower than mercury-in-coal values. However, some biomass feedstocks had concentrations that were similar to coals that typically exhibit low mercury concentrations. The mercury data collected and reported herein ranged from <0.001 to 0.04 ppmw (dry) (1-6). Table 1 summarizes the mercury concentrations for different biomass feedstocks. Mentz et al. found that the bark from stemwood trees exhibited a significantly higher mercury concentration than the woody part of the tree (4). Mentz found that the stemwood mercury concentrations had a range of 0.001 to 0.004 ppmw, while the bark ranged from 0.001 to 0.037 ppmw with the average values represented in Table 1.

**Table 1. Biomass Feedstock Mercury Concentrations**

| Feedstock             | Hg, ppmw (dry) | Reference |
|-----------------------|----------------|-----------|
| Alfalfa               | <0.07          | 1         |
| Rice Straw            | 0.02           | 2         |
| Wheat Straw           | 0.028          | 2         |
| Wood Chips            | 0.032          | 2         |
| Wood Chips, high bark | 0.011          | 2         |
| Rice Straw            | 0.019          | 2         |
| Rice Straw            | 0.017          | 3         |
| Stemwood              | 0.0023         | 4         |
| Bark                  | 0.0125         | 4         |
| Spruce                | <0.002         | 5         |
| Beech                 | <0.002         | 5         |
| Oak                   | <0.001         | 5         |
| Spruce Bark           | <0.001         | 5         |
| Beech Bark            | <0.001         | 5         |
| Oak Bark              | <0.001         | 5         |
| Willow Bark, twigs    | 0.03           | 6         |
| Willow Bark, branches | 0.03           | 6         |
| Willow Wood, twigs    | 0.04           | 6         |
| Willow Wood, branches | 0.03           | 6         |

The data set shows a significant amount of variability, even within similar feedstock types. This indicates that geography (where the feedstock is grown) is a significant factor in the mercury concentration, along with other factors such as tree type, growth rate, age, etc.

### Conclusions

In general, biomass feedstocks have lower mercury concentrations than coal, with at least a factor of 10 to 100 lower mercury concentrations than most coals. If considering 100% biomass