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**United States  
Environmental Protection  
Agency**

**Office of Atmospheric Programs**

**September 2011**



## **SYNTHESIS OF COMMENTS RELATED TO ACCOUNTING APPROACHES FROM EPA'S CALL FOR INFORMATION ON GREENHOUSE GAS EMISSIONS ASSOCIATED WITH BIOENERGY AND OTHER BIOGENIC SOURCES**

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# **Synthesis of Comments Related to Accounting Approaches from EPA's Call for Information on Greenhouse Gas Emissions Associated with Bioenergy and Other Biogenic Sources**

**Prepared by the**

**U.S. Environmental Protection Agency**

**Office of Atmospheric Programs**

**Climate Change Division**

**Washington, DC**

**September 2011**

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[http://www.epa.gov/climatechange/emissions/biogenic\\_emissions.html](http://www.epa.gov/climatechange/emissions/biogenic_emissions.html)

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## Acronyms

<b>ABC</b>	Annual basis carbon
<b>AF&amp;PA</b>	American Paper & Forest Association
<b>BACT</b>	Best available control technology
<b>BMP</b>	Best management practices
<b>Btu</b>	British thermal unit(s)
<b>CAA</b>	Clean Air Act
<b>CAR</b>	Climate Action Reserve
<b>CARB</b>	California Air Resources Board
<b>CBD</b>	Center for Biological Diversity
<b>CCX</b>	Chicago Climate Exchange
<b>CDM</b>	Clean Development Mechanism
<b>CEC</b>	California Energy Commission
<b>CEQ</b>	Council on Environmental Quality
<b>CFI</b>	Call for information
<b>CH<sub>4</sub></b>	Methane
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>CO<sub>2e</sub></b>	Carbon dioxide equivalent
<b>EDF</b>	Environmental Defense Fund
<b>EPA</b>	U.S. Environmental Protection Agency
<b>FR</b>	Federal Register
<b>EU-ETS</b>	European Union Emission Trading Scheme
<b>FSC</b>	Forest Stewardship Council
<b>GHG</b>	Greenhouse gas
<b>GWP</b>	Global warming potential
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>ISO</b>	International Standards Organization
<b>JI</b>	Joint Implementation program
<b>LCA</b>	Life-cycle analysis
<b>LULUCF</b>	Land Use, Land Use Change, and Forestry
<b>MSW</b>	Municipal Solid Waste
<b>NAAQS</b>	National Ambient Air Quality Standards
<b>NAFO</b>	National Alliance of Forest Owners
<b>NSPS</b>	New Source Performance Standards
<b>PSD</b>	Prevention of Significant Deterioration
<b>RGGI</b>	Regional Greenhouse Gas Initiative
<b>SAB</b>	Science Advisory Board
<b>SFI</b>	Sustainable Forestry Initiative
<b>SIP</b>	State implementation plan
<b>tpy</b>	Tons per year
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change

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# I Background on Accounting for Biogenic CO<sub>2</sub> Emissions from Stationary Sources

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The U.S. Environmental Protection Agency (EPA) has taken a series of actions related to biogenic CO<sub>2</sub> emissions from stationary sources, in particular those subject to the Prevention of Significant Deterioration (PSD) and Title V programs.<sup>1</sup> One of those actions was the *Call For Information on Greenhouse Gas Emissions Associated with Bioenergy and Other Biogenic Sources* (CFI) (75 FR 41173 and 75 FR 45112). The CFI solicited information and viewpoints from interested parties on approaches to accounting for greenhouse gas (GHG) emissions from bioenergy and other biogenic sources. As requested, the Agency received substantial information on the sources of biogenic CO<sub>2</sub> emissions, general technical comments on accounting for these emissions, and comments on the underlying science that should inform possible accounting approaches as well as specific comments on how to account for these emissions in the PSD and Title V programs.

This document synthesizes the key science and technical issues related to accounting for biogenic CO<sub>2</sub> emissions from stationary sources that were highlighted in comments to the CFI. This document is not meant to be a comprehensive summary of all the issues raised by all commenters, nor is it intended to serve as the type of formal Response to Comments document normally published as part of a rulemaking. All of the comments to the CFI are available to the public via [www.regulations.gov](http://www.regulations.gov) at EPA-HQ-OAR-2010-0560, and an index of the unique comments appears in Appendix C.

## I.1 Definition of Biogenic CO<sub>2</sub> Emissions

For the purposes of this synthesis, biogenic CO<sub>2</sub> emissions are defined as CO<sub>2</sub> emissions directly resulting from the combustion, decomposition, or processing of biologically based materials other than fossil fuels, peat, and mineral sources of carbon through combustion, digestion, fermentation, or decomposition processes.<sup>2</sup> Examples of biogenic CO<sub>2</sub> emissions include, but are not limited to:

- CO<sub>2</sub> from the combustion of biogas collected from biological decomposition of waste in landfills, wastewater treatment or manure management processes;
- CO<sub>2</sub> from fermentation during ethanol production;
- CO<sub>2</sub> from combustion of the biological fraction of municipal solid waste or biosolids;
- CO<sub>2</sub> from combustion of the biological fraction of tire-derived fuel; and

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<sup>1</sup> The relevant actions can be found at [http://www.epa.gov/climatechange/emissions/biogenic\\_emissions.html](http://www.epa.gov/climatechange/emissions/biogenic_emissions.html) and <http://www.epa.gov/NSR/actions.html>. Appendix A also has a list of the relevant regulatory actions and brief descriptions of them.

<sup>2</sup> Biologically-based feedstocks are defined as non-fossilized and biodegradable organic material originating from modern or contemporarily grown plants, animals or micro-organisms (including products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material). This does not include materials such as peat and coal that are ultimately derived from biologic materials but are not renewable on policy-relevant timescales.

- CO<sub>2</sub> derived from combustion of biological material, including all types of wood and wood waste, forest residue, and agricultural material.

## **I.2 Information Requested in the CFI**

The CFI solicited information and viewpoints on approaches to accounting for greenhouse gas (GHG) emissions from bioenergy and other biogenic sources, including the following topics and questions listed below:

- Biomass under PSD/ BACT. What criteria might be used to consider biomass fuels and the emissions resulting from their combustion differently with regard to applicability under PSD and with regard to the Best Available Control Technology (BACT) review process under PSD?
- National-scale carbon neutrality in the IPCC Guidelines. In the IPCC accounting approach, at the national scale emissions from combustion for bioenergy are included in the LUCF Sector rather than the Energy Sector. To what extent does this approach suggest that biomass consumption for energy is “neutral” with respect to net fluxes of CO<sub>2</sub>?
- Smaller-scale accounting approaches. The Clean Air Act (CAA) provisions typically apply at the unit, process, or facility scale, whereas the IPCC Guidance on accounting for GHG emissions from bioenergy sources was written to be applicable at the national scale. EPA is interested in understanding the strengths and limitations of applying the national-scale IPCC approach to assess the net impact (i.e. accounting for both emissions and sequestration) on the atmosphere of GHG emissions from specific biogenic sources, facilities, fuels, or practices. To what extent is the accounting procedure in the IPCC Guidelines applicable or sufficient for such specific assessments?
- Alternative accounting approaches. Both a default assumption of carbon neutrality and a default assumption that the greenhouse gas impact of bioenergy is equivalent to that of fossil fuels may be insufficient because they oversimplify a complex issue. If this is the case, what alternative approaches or additional analytical tools are available for determining the net impact on the atmosphere of CO<sub>2</sub> emissions associated with bioenergy? Please comment specifically on how these approaches address:
  - The time interval required for production and consumption of biological feedstocks and bioenergy products. For example, the concept of “carbon debt” has been proposed as the length of time required for a regrowing forest to “pay back” the carbon emitted to the atmosphere when biomass is burned for energy.
  - The appropriate spatial/ geographic scale for conducting this determination. For example, the question of spatial scale has legal complications under the CAA, but may be relevant for some of the suggested approaches.
- Comparison with fossil energy. EPA is interested in approaches for assessing the impact on the atmosphere of emissions from bioenergy relative to emissions from fossil fuels such as coal, oil, and gas. What bases or metrics are appropriate for such a comparison?
- Comparison among bioenergy sources. EPA is also interested in comments on accounting methods that might be appropriate for different types of biological feedstocks and bioenergy sources. What bases or metrics are appropriate for such a comparison among sources? In other words, are all biological feedstocks (e.g. corn stover, logging residues, whole trees) the same, and how do we know?

- Renewable or sustainable feedstocks. Specifically with respect to bioenergy sources (especially forest feedstocks), if it is appropriate to make a distinction between biomass feedstocks that are and are not classified as “renewable” or “sustainable,” what specific indicators would be useful in making such a determination?
- Other biogenic sources of CO<sub>2</sub>. Other biogenic sources of CO<sub>2</sub> (i.e., sources not related to energy production and consumption) such as landfills, manure management, wastewater treatment, livestock respiration, fermentation processes in ethanol production, and combustion of biogas not resulting in energy production (e.g., flaring of collected landfill gas) may be covered under certain provisions of the CAA, and guidance will be needed about exactly how to estimate them. How should these “other” biogenic CO<sub>2</sub> emission sources be considered and quantified? In what ways are these sources similar to and different from bioenergy sources?
- Additional technical information. EPA is also interested in receiving quantitative data and qualitative information relevant to biogenic greenhouse gas emissions, including but not limited to the following topics:
  - Current and projected utilization of biomass feedstocks for energy.
  - Economic, technological, and land-management drivers for projected changes in biomass utilization rates.
  - Current and projected levels of GHG emissions from bioenergy and other biogenic sources.
  - Economic, technological and land-management drivers for projected changes in emissions.
  - Current and projected C sequestration rates in lands used to produce bioenergy feedstocks.
  - Economic, technological and land-management drivers for projected changes in sequestration rates.
  - The types of processes that generate or are expected to generate emissions from bioenergy and other biogenic sources.
  - The number of facilities that generate or are expected to generate such emissions.
  - Emission factor information, particularly for the biogenic CO<sub>2</sub> source categories of wastewater treatment, livestock management, and ethanol fermentation processes.
  - Potential impacts on specific industries and particular facilities of various methods of accounting for biogenic GHG emissions.
  - Potential impacts of GHG emissions from bioenergy and other biogenic sources on other resources such as water availability and site nutrient quality.
  - Potential impacts of GHG emissions from bioenergy and other biogenic sources on other air pollutants such as VOCs, other criteria pollutants, and particulate matter.

## **2 Synthesis of Stakeholder Comments Received via the Call for Information on Greenhouse Gas Emissions Associated with Bioenergy and Other Biogenic Sources**

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### **Part A: Synthesis of Key Scientific and Technical Information on Accounting Approaches Contained in CFI Comments**

This section synthesizes scientific and technical information related to accounting approaches from key comments received in response to the July 2010 CFI. This information was used to inform the development of the accounting framework for biogenic CO<sub>2</sub> emissions from stationary sources presented in the *Accounting Framework for Biogenic CO<sub>2</sub> Emissions from Stationary Sources* (September 15, 2011). Within Part A, the information from the comments is summarized and presented according to the various questions/topics contained in the CFI. As explained above, this document is not meant to be a comprehensive summary of all the issues raised by all commenters, nor is it intended to serve as the type of formal Response to Comments document normally published as part of a rulemaking. Rather, this document summarizes the information contained in the CFI comments related to certain specific scientific and technical issues relevant to the development of the accounting framework.

This synthesis is based on the *Call for Information on Greenhouse Gas Emissions Associated with Bioenergy and Other Biogenic Sources*. It is limited to synthesizing a subset of the substantive comments that are directly related to developing accounting approaches. The full text of all of the comments received in response to the CFI can be found through [www.regulations.gov](http://www.regulations.gov) by searching Docket ID EPA-HQ-OAR-2010-0560.

Key aspects of the comments related to accounting approaches are synthesized in this section and a summary of the characteristics of the accounting approaches suggested in the comments are presented in Table 2-1 through Table 2-5 at the end of this section. A summary of non-unique comments received via form letters are included in Appendix B, Appendix C includes a summary of unique commenters organized by docket number, commenter name, and affiliation, and Appendix D presents a summary of data and literature cited in the comments received through the CFI.

### **2.1 Synthesis of Scientific and Technical Information on Accounting**

This section organizes and summarizes comments on developing accounting approaches received through the CFI according to the information EPA solicited on the following topics:

- IPCC Accounting Approach
- Accounting for Sequestration in Forest Products
- Key Features of Accounting Approaches
- Comparison with Fossil Energy
- Comparison among Bioenergy Sources

- Classification of Renewable or Sustainable Feedstocks
- Other Biogenic Sources of CO<sub>2</sub>
- Biomass Under PSD/BACT

### **2.1.1 IPCC Accounting Approach**

The Intergovernmental Panel on Climate Change (IPCC) developed a foundational approach for addressing the complexities associated with accounting for biogenic CO<sub>2</sub> emissions and removals (IPCC, 1996) at the national level. The IPCC was tasked with developing guidelines for countries to estimate and report all of their anthropogenic GHG emissions to the United Nations Framework Convention on Climate Change (UNFCCC) in a consistent and comparable manner. Accordingly, the United States follows the IPCC accounting guidelines when it develops the annual Inventory of U.S. Greenhouse Gas Emissions and Sinks (Inventory) as part of its obligations under the UNFCCC.<sup>1</sup>

Recognizing that many anthropogenic factors influence emissions and sequestration in biological systems, the IPCC opted to account for these factors comprehensively and holistically in an assessment of the entire Land-Use Change and Forestry (LUCF) Sector (Apps et al., 1997). As a result, biogenic CO<sub>2</sub> emissions, which reflect the return to the atmosphere of carbon stored in biological systems, were assigned to the land areas where carbon is stored, regardless of where the emissions actually take place. The IPCC's accounting system thereby measures the flows of carbon for fossil-fuel systems but the changes in land-based carbon stocks for biomass systems. Using this approach, countries have been able to communicate the contribution of their land areas to the global build-up of GHG concentrations in a consistent manner. To maintain consistency and to prevent double counting, the IPCC's approach for countries to estimate emissions from their Energy Sectors requires that CO<sub>2</sub> emissions resulting from biologically based fuels not be included in Energy Sector totals:

*Biomass Fuels: Biomass fuels are included in the national energy and emissions accounts for completeness. These emissions should not be included in national CO<sub>2</sub> emissions from fuel combustion. If energy use, or any other factor, is causing a long term decline in the total carbon embodied in standing biomass (e.g., forests), this net release of carbon should be evident in the calculation of CO<sub>2</sub> emissions described in the Land-Use Change and Forestry chapter.<sup>2</sup>*

The IPCC accounting system provides an accurate reflection of global GHG emissions because countries are required to account for all anthropogenic emissions, and to account for them only once (i.e., there is complete accounting).

The section below summarizes comments received on the strengths and limitations of applying the Inventory approach outlined in the IPCC Guidelines to stationary sources. It also describes comments received on methods to account for carbon sequestration in forest products.

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<sup>1</sup> The U.S. submits the Inventory to the Secretariat of the UNFCCC as an annual reporting requirement. The UNFCCC treaty, ratified by the U.S. in 1992, sets an overall framework for intergovernmental efforts to tackle the challenges posed by climate change.

<sup>2</sup> Page 1.10. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual.

### **2.1.1.1 Application of IPCC Approach to Stationary Sources**

Almost all commenters who mentioned the IPCC Guidelines, (10 out of 11) expressed that the IPCC Guidelines are inappropriate to use at the smaller scale required by many stationary source programs. The National Corn Growers Association (EPA-HQ-OAR-2010-0560-0189.1) did, however, consider the IPCC Guidelines to be appropriate for smaller-scale application. The American Forest & Paper Association (AF&PA) (EPA-HQ-OAR-2010-0560-0279.1) noted that while following IPCC Guidelines would simplify the process in that EPA would be able to follow well-established and reputable guidance, the IPCC approach is very difficult to apply on a small scale. Commenters (7: e.g., Center for Biological Diversity [CBD]) explained further that the IPCC Guidelines account for bioenergy CO<sub>2</sub> emissions at the time of “harvest” under the LULUCF sector. As a result, CO<sub>2</sub> emissions from bioenergy are not counted at the point of combustion for energy use to avoid double counting of emissions. And according to the Environmental Defense Fund (EDF), because stationary source programs as they are currently written are meant to address facility-level emissions and not the effects of land use changes, the stationary source programs would not be able account for the biogenic CO<sub>2</sub> emissions associated with land use change in the same way that the IPCC approach does.

In addition, commenters including ADAGE (an AREVA/Duke Energy advanced biopower company), FirstEnergy Corp., Oglethorpe Power Corporation, and Rollcast Energy, Inc. (ADAGE et al.) EPA-HQ-OAR-2010-0560-0446.1; pointed out that events beyond the biomass user’s control (e.g. natural disturbances) can affect sequestration and result in impacts on accounting that would greatly affect the user’s net emissions. ADAGE et al. noted further that biomass used at a specific facility likely comes from a variety of sources, such that biomass from one land area or ownership may be delivered to and used at several facilities.

### **2.1.2 Accounting for sequestration in forest products**

Commenters also responded to the CFI with comments on accounting for sequestration in forest products separately from how sequestration in forest products is accounted for under the IPCC approach. Four of the six commenters that addressed this issue (e.g., University of Idaho) stated that carbon sequestration in forest products should be considered at the national level to assess whether or not the active carbon cycle is in balance. Several commenters (4 of 6: e.g., Weyerhaeuser) also emphasized the carbon benefits of forest products, stating that wood provides long-term carbon storage, and that wood products have reduced life-cycle manufacturing emissions compared to alternative products such as concrete or steel.

### **2.1.3 Key Features of Accounting Approaches**

This section presents key features of the accounting approaches described by commenters to the CFI, and discusses comments relating to how the approaches should address the time interval for accounting, appropriate spatial/geographic scales, baseline conditions, indirect effects, and other key issues.

### **2.1.3.1 Time interval (including carbon debt and payback concept)**

Time provides one of the basic boundaries for describing GHG emissions to the atmosphere. For example, emissions are generally accounted for over a calendar year.<sup>3</sup> Determining an appropriate time interval is an important consideration of a biogenic CO<sub>2</sub> accounting approach.

A majority of commenters (5 out of 6 commenting on forest products) noted that both time and geographical scale are essential to capturing the effects of biomass carbon sequestration. According to ADAGE et al., to properly capture carbon sequestration from biomass, accounting should be done over a multi-year period. ADAGE also cited the U.S. Forest Service as saying “a decade is the shortest meaningful period for modeling forest vegetation growth.”<sup>4</sup>

While many commenters highlighted the importance of including an appropriate time dimension, very few commenters (8) provided concrete suggestions as to what time intervals would be appropriate to use in accounting for biomass carbon absorption. Of these eight, several commenters (e.g., Biomass Accountability Project EPA-HQ-OAR-2010-0560-0566, Society of American Foresters EPA-HQ-OAR-2010-0560-0095.1), who focused on forestry feedstocks, pointed out that the time frame to re-sequester carbon emissions is on the order of decades to centuries. According to CBD, this indicates that not only that biogenic CO<sub>2</sub> emissions are not carbon neutral, but also that the near-term effects of those emissions must be considered under stationary source programs. The Wilderness Society suggested that “100 years, while being arbitrary, would be a reasonable time period to use for considering carbon re-sequestration in forests. It is the time interval used to compare other climate impacts of GHG emissions with IPCC GWP<sub>s</sub>, which are used almost universally.” Some commenters (Green Power Institute, Biomass Power Association, and California Biomass Energy Alliance EPA-HQ-OAR-2010-0560-0513.1) proposed that a sufficient time period would cover the operating lifetime of the facility, plus the amount of time any indirect effects from the facility or the baseline effects would take to occur.

Commenter	Docket Number	Proposed Time Interval
Minnesota Department of Agriculture	EPA-HQ-OAR-2010-0560-0448	100 years
The Wilderness Society	EPA-HQ-OAR-2010-0560-0433.1	
Center for Biological Diversity (CBD)	EPA-HQ-OAR-2010-0560-0157.1	Few years
University of Idaho	EPA-HQ-OAR-2010-0560-0509.1	Centuries
Weyerhaeuser	EPA-HQ-OAR-2010-0560-0563.1	5 years
Green Power Institute	EPA-HQ-OAR-2010-0560-0513.1	
Biomass Power Association	EPA-HQ-OAR-2010-0560-0513.1	
California Biomass Energy Alliance	EPA-HQ-OAR-2010-0560-0513.1	Facility lifetime

<sup>3</sup> UNFCCC, 2006. Updated UNFCCC Reporting Guidelines on Annual Inventories Following Incorporation of the Provisions of Decision 14/CP.11. United Nations Framework Convention on Climate Change. Available online at: <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

<sup>4</sup> USDA Forest Service, *Biomass to Energy: Forest Management for Wildfire Reduction, Energy Production, and Other Benefits* (Jan. 2010).

The comments outlined below address the concept of carbon debt and payback. Carbon debt refers to the net greenhouse gas implications of conversion of lands with substantial carbon stocks to intensive production of an annual feedstock.

Commenters, such as the Carbon Work Group EPA-HQ-OAR-2010-0560-0163.1, University of Michigan EPA-HQ-OAR-2010-0560-0066.1, Pacific Forest Trust EPA-HQ-OAR-2010-0560-0031.1, and the University of California–Berkeley EPA-HQ-OAR-2010-0560-0074.1, provided insight on the complexity of the carbon debt and related payback cycle (how carbon sequestered by the regenerating forest is ‘paying back’ the debt). The concept of carbon debt is complex and depends on numerous factors such as how efficiently the biomass is being converted to energy (e.g., conventional electric power plant vs. combined heat and power), according to Southern Environmental Law Center (SELC) (EPA-HQ-OAR-2010-0560-0455.1). SELC also points out that the carbon payback period is further complicated by variations in forest management strategies and natural disturbances that may upset the carbon balance. These two factors combine to create a large possible distribution of carbon debt and payback timescale estimates. Commenters provided timescales of a few years to hundreds of years depending on the scenario (see the table above for details).

### **2.1.3.2 Appropriate spatial/geographic scale**

Determining an appropriate spatial or geographical scale is another important consideration of a biogenic CO<sub>2</sub> accounting approach. Some commenters (including the University of Idaho EPA-HQ-OAR-2010-0560-0509.1, Missouri Forest Products Association EPA-HQ-OAR-2010-0560-0036.1, Utility Air Regulatory Group EPA-HQ-OAR-2010-0560-0271.1, Carbon Work Group EPA-HQ-OAR-2010-0560-0163.1, and AF&PA EPA-HQ-OAR-2010-0560-0279.1) explained that if the spatial scale is small, it may not incorporate enough standing trees absorbing CO<sub>2</sub> to offset a facility’s emissions. NAFO highlighted that “the quality of estimates of carbon stocks decline and become much more volatile as the geographic scale at which they are measured gets smaller.”

Commenters (see table below) proposed various spatial or geographical scales for EPA to consider for an accounting approach. Six of the ten commenters providing comments on this issue preferred looking at carbon sequestration at the national level as opposed to smaller regional or facility scales. Those in favor of a national scale approach noted the following:

- CO<sub>2</sub> is a global pollutant, so sequestration of it should be considered at a similar, large-scale level.
- Smaller-scale analyses are not capable of capturing harvests that occur over large areas and long periods of time.
- A large area is needed to support a biomass facility and for every acre of biomass harvested, many other acres that will support the facility’s bioenergy supply chain in the future are growing and sequestering carbon.
- Nationally and regionally, U.S. forests are being sustainably managed.

On the other hand, commenters in favor of a smaller-scale approach noted that the chosen scale:

- Should cover areas with relatively uniform ecosystem type and management practices.

- Should be based on a single facility's fuel-shed, or the area from which the facility receives its biomass fuel, in order to ensure that the effects of the biomass project on its local fuel-shed are taken into account, such that any changes in biomass stock will be associated with the sustainable/unsustainable practices of that facility.
- Should take into account the multiple drivers that vary at the local level, including urban development, ecosystem health, and forest management history.

Commenter	Docket Number	Proposed Spatial/Geographical Scale
University of Idaho	EPA-HQ-OAR-2010-0560-0509.1	Landscape level (at minimum, several hundred thousand acres)
Environmental Defense Fund	EPA-HQ-OAR-2010-0560-0326.1	Regional level
Missouri Forest Products Association	EPA-HQ-OAR-2010-0560-0036.1	
Utility Air Regulatory Group	EPA-HQ-OAR-2010-0560-0271.1	
Weyerhaeuser	EPA-HQ-OAR-2010-0560-0563.1	
Treated Wood Council	EPA-HQ-OAR-2010-0560-0055.1	National level
Georgia Pacific	EPA-HQ-OAR-2010-0560-0193.1 and EPA-HQ-OAR-2010-0560-0323.1	
NAFO	EPA-HQ-OAR-2010-0560-0261.1	
Green Power Institute	EPA-HQ-OAR-2010-0560-0513.1	
Biomass Power Association	EPA-HQ-OAR-2010-0560-0513.1	
California Biomass Energy Alliance	EPA-HQ-OAR-2010-0560-0513.1	Fuel-shed

### **2.1.3.3 Life-cycle analysis/ boundaries of accounting**

The system boundaries defined by an accounting framework can influence biogenic CO<sub>2</sub> emission estimates. A life-cycle analysis compiles and evaluates the inputs, outputs and potential environmental impacts of a product system throughout its life cycle.

Commenter	Docket Number	Proposed Accounting Boundaries
BioFuelwatch	EPA-HQ-OAR-2010-0560-0173.1	
National Farmers Union	EPA-HQ-OAR-2010-0560-0190.1	
Clean Air Task Force	EPA-HQ-OAR-2010-0560-0432.1	
Wisconsin DNR	EPA-HQ-OAR-2010-0560-0453	
Southern Environmental Law Center	EPA-HQ-OAR-2010-0560-0455.1	Full life cycle
Society of American Foresters	EPA-HQ-OAR-2010-0560-0095.1	
Growth Energy	EPA-HQ-OAR-2010-0560-0091.2	
University of Idaho	EPA-HQ-OAR-2010-0560-0509.1	
State of Maine Department of Environmental Protection	EPA-HQ-OAR-2010-0560-0519.1	
Council of Western State Foresters	EPA-HQ-OAR-2010-0560-0561.1	Avoided alternative fates

Biomass Accountability Project et al.	EPA-HQ-OAR-2010-0560-0566	Smokestack
Save America's Forests	EPA-HQ-OAR-2010-0560-0517.1	
Georgia Pacific	EPA-HQ-OAR-2010-0560-0193.1 and EPA-HQ-OAR-2010-0560-0323.1	Forest growth/drain ratio
Carbon Work Group	EPA-HQ-OAR-2010-0560-0163.1	Attributional and consequential life-cycle analysis
University of Michigan	EPA-HQ-OAR-2010-0560-0066.1	Annual Basis Carbon Accounting (ABC) <sup>a</sup>

<sup>a</sup> The ABC accounting boundary is described below.

The nine commenters (see table above) who recommended using a life-cycle analysis approach suggested a complete supply chain life-cycle analysis (including emissions from land use, transportation, and combustion) to assess the CO<sub>2</sub> emissions from biomass combustion. These commenters stated that using a life-cycle analysis highlights the large impact that production energy and end-of-life management has on biomass emissions. The commenters also stated that the life-cycle analysis should include the carbon balance in all forest pools—including soils—that are affected by tree harvesting.

The Carbon Work Group (EPA-HQ-OAR-2010-0560-0163.1) recommended using an attributional life-cycle analysis for individual pathways, and consequential life-cycle analysis for evaluating the effects of policies, market dynamics, predictive, and inherently challenging secondary non-linear and indirect effects.

NAFO (EPA-HQ-OAR-2010-0560-0261.1) and the Renewable Fuels Association (EPA-HQ-OAR-2010-0560-0194.1) commented that a life-cycle analysis is inappropriate under this context because it holds parties responsible for impacts beyond those that can be attributed to their own actions (e.g., emissions arising from land management activities including biofuel production).

Professor DeCicco from the University of Michigan (EPA-HQ-OAR-2010-0560-0066.1) proposed an annual basis carbon (ABC) accounting framework. Under this framework, emissions from all sources are estimated and credited to the locations where they normally occur on an annual basis. In the case of biomass, the carbon sequestration is credited at the location at which it occurs, such as a forest or farm. Emissions from biomass combustion are estimated at the respective location of combustion and in the sectors where they occur. If biogenic CO<sub>2</sub> emissions are properly accounted for at each location where emissions occur, then any net CO<sub>2</sub> sequestration associated with the production of bioenergy can be reported and credited through an accounting method that tracks carbon sequestration and CO<sub>2</sub> emissions in product supply chains. Professor DeCicco also stated that if properly followed, an ABC approach will avoid a net accumulation of bioenergy-related “carbon debt” since all emissions (direct or indirect) will be either accounted for or mitigated on an annual basis.

#### **2.1.3.4 Baseline conditions**

The baseline (or reference) is any datum against which change is measured. Such a datum serves as the “reference” against which other conditions or changes can be compared. In order to account for biogenic CO<sub>2</sub> emissions and sequestration, commenters suggested that accounting methodologies should be compared to what would occur under a business-as-usual, or baseline, scenario.

Of the comments received on baseline conditions, commenters, most notably the EDF (EPA-HQ-OAR-2010-0560-0326.1), stated that baseline conditions should be developed based on historic trends in forest stocks which are in turn based on the current management conditions and other demands for biomass that would influence carbon stock changes. EDF stated that baseline conditions should be disaggregated by regions of economically and biologically similar conditions and should be evaluated over time.

#### **2.1.3.5 Indirect effects**

Twenty-two comments were received on different types of “indirect effects” that can impact biogenic CO<sub>2</sub> emissions and whether indirect effects could or should be included in an accounting framework for those emissions. Fourteen commenters (e.g., Green Power Institute, Biomass Power Association, and California Biomass Energy Alliance EPA-HQ-OAR-2010-0560-0513.1) stated that while some accounting methodologies (e.g., Searchinger and Hamburg<sup>5</sup>) account for the indirect effects of biomass energy, they overlook the indirect effects of the alternative fuel option, petroleum. These commenters stated that this methodology unjustly places more ‘carbon burden’ on biofuels. In addition, other commenters (e.g., Florida Sugar Industry EPA-HQ-OAR-2010-0560-0192.1) noted that stationary source programs do not currently account for indirect effects at the facility level, and the same approach should be followed in accounting for biogenic CO<sub>2</sub> emissions. In a similar vein, Valero Energy Corporation (EPA-HQ-OAR-2010-0560-0221.1) pointed out that indirect effects are by definition a large-scale concept that attempts to address impacts at a global scale. Permitting a single facility is done on a smaller scale without accounting for potential global impacts, and as a result, attempting to incorporate indirect effects to permitting would generate unreasonable results. Commenters, including the Carbon Work Group (EPA-HQ-OAR-2010-0560-0163.1), also highlighted that indirect effects are difficult to assess and monitor, which would lead to highly uncertain results difficult to incorporate into the accounting approach.

While some commenters claimed that a full life-cycle analysis is necessary to properly account for biogenic CO<sub>2</sub> emissions, very few commenters (7: including the Renewable Fuels Association EPA-HQ-OAR-2010-0560-0194.1, Carbon Work Group EPA-HQ-OAR-2010-0560-0163.1, and Biofuelwatch EPA-HQ-OAR-2010-0560-0173.2) addressed clearly the issue of indirect effects. The National Farmers Union (EPA-HQ-OAR-2010-0560-0190.1) expressed that the indirect emissions from bioenergy feedstocks are as important as direct emissions to completely account for greenhouse gas emissions and that production and management practices differ among feedstock types. As a result, indirect emissions associated with fuel consumption, applications of fertilizer and crop management products, and harvesting methods will also vary, and therefore, should be recognized. In this way, the National Farmers Union commented that better management practices will be rewarded and detrimental practices will be debited.

#### **2.1.3.6 Other key features/considerations**

Commenters also provided other important points on accounting for biogenic CO<sub>2</sub> emissions to be considered when developing an accounting approach. Other key features and/or considerations of an accounting framework that commenters highlighted include:

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<sup>5</sup> Searchinger et al., *Fixing a Critical Climate Accounting Error*, Science, Vol. 326, October 23, 2009, pgs. 527-528

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- The International Standards Organization's (ISO) LCA standards require that accounting begin at the point where materials are extracted or removed from the environment. In the case of biomass combustion, an LCA should begin with the uptake of CO<sub>2</sub> by trees, as opposed to the point of harvest as suggested in the Manomet Study.<sup>6,7</sup> (AF&PA EPA-HQ-OAR-2010-0560-0279.1).
- On a per energy-unit basis, most biomass actually produces more CO<sub>2</sub> emissions than fossil fuels. (University of Idaho EPA-HQ-OAR-2010-0560-0509.1, World Temperate Rainforest Network EPA-HQ-OAR-2010-0560-0076.1).
- Some states have renewable portfolio standards that rely heavily on bioenergy. Further, bioenergy is a more reliable and consistent form of renewable energy than other sources (e.g., wind, solar). (Carbon Work Group EPA-HQ-OAR-2010-0560-0163.1).
- The CDM concept of “additionality” could be used in the accounting methodology to account for carbon sequestration at the appropriate spatial and temporal scale.<sup>8</sup> (Green Power Institute EPA-HQ-OAR-2010-0560-0085.1).
- Imports and exports of key commodities such as timber products can be a source of carbon emission leakage (the unintended consequence of increasing emissions outside of the boundaries of the accounting approach) and can have a substantial contribution to a facility’s carbon balance. (Oak Ridge National Laboratory EPA-HQ-OAR-2010-0560-0027.1).

#### **2.1.4 Comparison with Fossil Energy**

Some commenters (e.g., Massachusetts Forest Watch EPA-HQ-OAR-2010-0560-0068.1, Center for Biological Diversity EPA-HQ-OAR-2010-0560-0157.1) acknowledged that CO<sub>2</sub> emitted from combustion of a fossil source and a biomass source share the same physical characteristics and climate-forcing properties, but other commenters (including Green Power Institute, Deere & Co., and the Missouri Forest Products Association) stated that biogenic CO<sub>2</sub> emissions are distinct from fossil CO<sub>2</sub> emissions. While three commenters (University of Idaho EPA-HQ-OAR-2010-0560-0509.1, World Temperate Rainforest Network EPA-HQ-OAR-2010-0560-0076.1, Center for Biological Diversity EPA-HQ-OAR-2010-0560-0157.1) pointed out that biomass produces more CO<sub>2</sub> emissions per unit of energy than many fossil fuels (e.g., coal), seventeen commenters focused on biomass carbon benefits as compared to fossil fuels.

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<sup>6</sup> See paragraphs 4.2.3.3.2 and 4.2.3.3.3 of ISO 14044 available for purchase at:  
[http://www.iso.org/iso/iso\\_catalogue/catalogue\\_tc/catalogue\\_detail.htm?csnumber=37456](http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=37456)

<sup>7</sup> In the CFI, among other publications EPA referenced the Manomet Center for Conservation Sciences Study: *Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources*.

<sup>8</sup> CDM states that “A CDM project activity is additional if anthropogenic emissions of greenhouse gas by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (3/CMP.1 Annex, paragraph 43).” .

Some comments, including those from National Solid Waste Management Association (EPA-HQ-OAR-2010-0560-0251.1), stated that biomass carbon is part of the short, or active, carbon cycle, while fossil carbon is part of the long carbon cycle. This means that while facilities combust procured biomass for energy, there is live biomass simultaneously absorbing carbon emissions. Conversely, when fossil fuels are combusted, they add to the amount of carbon in atmosphere and are not a part of the active cycle (i.e., the natural process of making coal doesn't sequester carbon). In addition, commenters noted that biomass that would otherwise burn or decompose still contributes carbon emissions without the added benefit of offsetting fossil fuels when that biomass is used to create energy.

Commenters (e.g., The Wilderness Society EPA-HQ-OAR-2010-0560-0433.1) stated that emissions from biogenic sources per unit of useful energy are typically higher than those from fossil fuels, and this difference would be reflected in reporting if all emissions were reported regardless of source. The Wilderness Society also commented that emissions from biogenic sources could be permitted to internally offset a portion of their emissions that do not result in a net increase of atmospheric GHGs.

### **2.1.5 Comparison among Bioenergy Sources**

A subset of commenters, including The Biotechnology Industry Organization (EPA-HQ-OAR-2010-0560-0277.1), stated that all bioenergy sources should be considered carbon neutral because combustion of biogenic fuels and materials does not appreciably add to atmospheric carbon concentration. Biomass Accountability Project et al. (EPA-HQ-OAR-2010-0560-0566) and Save America's Forests (EPA-HQ-OAR-2010-0560-0517.1) commented that if EPA were to distinguish between bioenergy sources, it would create a "regulatory nightmare," since the number of biomass types is endless and incinerators often use a mix of biomass types. In addition, commenters, including Energy Recovery Council (EPA-HQ-OAR-2010-0560-0426.1), pointed out that developing countries can receive Clean Development Mechanism (CDM) carbon offsets for combusting biomass for energy use and that holding U.S. facilities to a different standard would be unreasonable.

The subset of commenters (e.g., County Sanitation Districts of Los Angeles County (EPA-HQ-OAR-2010-0560-0264.1), Florida State University and University of Illinois Chicago (EPA-HQ-OAR-2010-0560-0045.1), Environment Northeast (EPA-HQ-OAR-2010-0560-0280.1) that recommended considering bioenergy sources as distinct feedstocks highlighted the difference between residual biomass sources and newly harvested biomass. For example, affiliates from Florida State University and University of Illinois Chicago (EPA-HQ-OAR-2010-0560-0045.1) suggested that dead-wood, sawmill residues, discarded harvest wood products, municipal and industrial solid waste would otherwise produce CO<sub>2</sub>, and potentially CH<sub>4</sub>, if they were not used to produce energy. In this way, their carbon emissions would occur regardless if they are used for energy production or not, and therefore, should be considered carbon neutral. On the other hand, unsustainably-managed forest lands created for energy production, alter the land use where the baseline fate could have been carbon sequestration.

County Sanitation Districts of Los Angeles County (EPA-HQ-OAR-2010-0560-0264.1) highlighted that waste residuals used as bioenergy will also likely have smaller associated transportation emissions because they are generally generated locally and do not have a land use impact since they are not competing for acreage.

Commenters also provided metrics by which to classify biomass feedstocks. Proposed metrics included:

- Amount of fossil fuel energy required to prepare the feedstock for use and the net energy available from the biomass' use. (Missouri Forest Products Association EPA-HQ-OAR-2010-0560-0036.1).
- A carbon neutrality classification. If the feedstock: 1) does not add new carbon to the active carbon cycle, 2) does not change the partitioning of carbon within the active carbon system in a way that increases the warming potential of the carbon in the atmosphere, 3) is sustainably harvested, and 4) is either carbon neutral or positive for atmospheric greenhouse-gas forcing, compared with not using the biomass for energy production; then the feedstock should be considered carbon neutral. (Green Power Institute EPA-HQ-OAR-2010-0560-0085.1).
- Efficiency of energy production. (Carbon Work Group EPA-HQ-OAR-2010-0560-0163.1).
- Growing patterns, energy conversion process, and their associated direct emissions. (National Farmers Union EPA-HQ-OAR-2010-0560-0190.1).
- Indirect emissions from the production of bioenergy feedstocks. (National Farmers Union EPA-HQ-OAR-2010-0560-0190.1).
- Time period required for feedstock to pay back carbon debt. (The Forest Guild EPA-HQ-OAR-2010-0560-0516.1).
- Carbon content and heat value of feedstock. (University of Idaho EPA-HQ-OAR-2010-0560-0509.1).

Kentucky Corn Growers Association (EPA-HQ-OAR-2010-0560-0562.1) recommended that EPA readily adopt the definition of renewable biomass from the Food, Conservation and Energy Act of 2008 enacted January 3, 2008 (also known as the 2008 Farm Bill), when creating the bioenergy CO<sub>2</sub> accounting approach.<sup>9</sup> The Wilderness Society (EPA-HQ-OAR-2010-0560-0433.1) recommended EPA create carbon intensity factors that would classify biomass into the following categories based on their commonalities:

1. Wood residues (including mill, clean construction, and post-consumer residual waste and urban tree trimmings);
2. Logging residues from commercial timber operations;
3. Fuel reduction thinnings from restoration treatments designed to reduce the frequency or intensity of fire;
4. Annual and short-rotation biomass crops; and

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<sup>9</sup> "Food, Conservation, and Energy Act of 2008." H.R. 6124, p. 1103. Available online at: [http://www.usda.gov/documents/Bill\\_6124.pdf](http://www.usda.gov/documents/Bill_6124.pdf).

5. Whole tree chips from expanded harvest operations.

The Wilderness Society also stated that the carbon intensity factor should be between zero (biogenic emissions cause no net increase in atmospheric GHGs), and one (all biogenic emissions represent a net increase in GHGs). This carbon intensity factor would then be multiplied by the total biogenic emissions from that fuel type to estimate the net biogenic emissions subject to regulatory limits.

### **2.1.6 Classification of Renewable or Sustainable Feedstocks**

Some commenters stated that all biomass should be considered either “renewable” or “sustainable,” and therefore, should be considered carbon neutral. Save America’s Forests (EPA-HQ-OAR-2010-0560-0517.1) pointed out that forty-three states have Renewable Portfolio Standards that consider all types of biomass as a renewable source of energy, much like wind and solar energy. Several commenters, notably the Treated Wood council (EPA-HQ-OAR-2010-0560-0055.1), International Paper (EPA-HQ-OAR-2010-0560-0059.1), and NAFO (EPA-HQ-OAR-2010-0560-0261.1), indicated that at the national level, forests are an increasing carbon stock, which would indicate that U.S. forests on a whole are managed sustainably.

Those commenters (e.g., the Forest Guild EPA-HQ-OAR-2010-0560-0516.1, Council of Western State Foresters EPA-HQ-OAR-2010-0560-0561.1, Biomass Accountability Project et al. EPA-HQ-OAR-2010-0560-0566, AF&PA EPA-HQ-OAR-2010-0560-0279.1, EDF EPA-HQ-OAR-2010-0560-0326.1) who provided more insight into “sustainable” as a term recommended that EPA rely on state-level Best Management Practices (BMPs), sustainable harvesting programs, and third-party certification programs to classify biomass, and in particular forests, as sustainably sourced. The programs that commenters highlighted include the work of:

- The Forest Stewardship Council
- The Sustainable Forestry Initiative
- The American Tree Farm System
- The Council for Sustainable Biomass
- The Forest Guild (Biomass Retention and Harvesting Guidelines for the Northeast)<sup>10</sup>
- The Natural Resource Conservation Service: Forest Management Plans
- The National Forest Management Act
- The Federal Land Policy Management Act

Biomass Accountability Project et al. (EPA-HQ-OAR-2010-0560-0566) pointed to the State of New York’s criteria for a sustainable resource, which states that forests must be “maintained in a forested state for a time period of 100 years,” accompanied by a forester-approved “timber harvest plan,” or certified by an entity such as the Forest Stewardship Council (FSC) or Sustainable Forestry Initiative (SFI).

More generally, commenters, including CBD (EPA-HQ-OAR-2010-0560-0157.1) and EDF (EPA-HQ-OAR-2010-0560-0326.1), highlighted that biomass should be classified as “sustainable” or

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<sup>10</sup> The Forest Guild Biomass Working Group, May 2010. Available online at: [http://www.forestguild.org/publications/research/2010/FG\\_Biomass\\_Guidelines\\_NE.pdf](http://www.forestguild.org/publications/research/2010/FG_Biomass_Guidelines_NE.pdf).

“renewable” as long as the feedstock is harvested in a manner that minimizes damage to the natural ecosystem. A few commenters (most notably The Wilderness Society EPA-HQ-OAR-2010-0560-0433.1), specified that a sustainable harvest would be maintained if removals do not exceed regrowth over the long term and an area’s carbon stocks are at least as high as what would occur under the previous land use (if there is land-use change).

Plum Creek Timber Company (EPA-HQ-OAR-2010-0560-0434.1) noted, however, that bioenergy is not produced in isolation from other products and that each product has a different carbon storage implication. For biomass destined for combustion, the carbon impact might correspond to fossil fuel emissions avoided in the immediate future, but for forest products, carbon storage occurs for over a longer time period, perhaps three or more times the length of a timber rotation. An accurate viewpoint of the carbon profile for a sustainable forest would then consider all products rather than the energy product alone.

## **2.1.7 Other Biogenic Sources of CO<sub>2</sub>**

Some commenters presented information to distinguish between biogenic CO<sub>2</sub> sources related to stationary source programs. Comments from groups like Waste Management (EPA-HQ-OAR-2010-0560-0084.1), Republic Services (EPA-HQ-OAR-2010-0560-0275.1), and Delaware Solid Waste Authority (EPA-HQ-OAR-2010-0560-0560.1) recommended that wastewater and landfill gas emissions should be considered carbon neutral. Several commenters (National Association of Clean Water Agencies EPA-HQ-OAR-2010-0560-0156.1, California Wastewater Climate EPA-HQ-OAR-2010-0560-0038.1) highlighted that wastewater treatment plants must manage sewage and exist to intercept, treat, and break down human waste to protect the environment and public health. A wide range of comments were received related to biogenic sources of CO<sub>2</sub>. This section summarizes these comments into the following topic areas:

- Incineration of solid waste in municipal waste combustors and other solid waste incinerators
- Combustion of biogas from landfills
- Wastewater management
- Manure management
- Ethanol and other fermentation processes

### **2.1.7.1 Incineration of Solid Waste**

Six commenters (Solid Waste Association of North America (SWANA) EPA-HQ-OAR-2010-0560-0078.1, Waste Management (WM) EPA-HQ-OAR-2010-0560-0084.1, Local Government Coalition for Renewable Energy EPA-HQ-OAR-2010-0560-0087.1, State of California – California Energy Commission (CEC) EPA-HQ-OAR-2010-0560-0454.1, Covanta Energy EPA-HQ-OAR-2010-0560-0540.1 and Biomass Accountability Project EPA-HQ-OAR-2010-0560-0566) believe that to be consistent with many existing federal, state and international policies and programs, EPA should treat GHG emissions generated through the combustion of biomass or biogenic-derived fuels (including those generated in WTE facilities) as carbon neutral, thus not subject to Title V or PSD permitting.

Three commenters (Save America's Forests EPA-HQ-OAR-2010-0560-0517.1, Global Alliance for Incinerator Alternatives (GAIA) EPA-HQ-OAR-2010-0560-0520, and Biomass Accountability Project EPA-HQ-OAR-2010-0560-0566) explained that biogenic sources of CO<sub>2</sub> from WTE facilities should not be considered carbon neutral and should be treated as any other CO<sub>2</sub> emissions for permitting purposes.

### **2.1.7.2 Combustion of Biogas from Landfills**

Several commenters (Florida State University (FSU), University of Illinois Chicago (UIC) EPA-HQ-OAR-2010-0560-0045.1, WM EPA-HQ-OAR-2010-0560-0084.1, Delaware Solid Waste Authority (DSWA) EPA-HQ-OAR-2010-0560-0560.1, Fresno-Clovis Regional Wastewater Reclamation Facility EPA-HQ-OAR-2010-0560-0263.1, Los Angeles County Sanitation District and Republic Services EPA-HQ-OAR-2010-0560-0264.1) believe that to be consistent with many existing federal, state and international policies and programs, EPA should exclude all biogenic emissions of CO<sub>2</sub> in determining permitting applicability under Title V and PSD.

Three commenters (Eco-Cycle Inc. EPA-HQ-OAR-2010-0560-0428, Save America's Forests EPA-HQ-OAR-2010-0560-0517.1, and Biomass Accountability Project EPA-HQ-OAR-2010-0560-0566) stated that biogenic sources of CO<sub>2</sub> emissions from landfill gas combustion should not be considered carbon neutral and should be treated as any other CO<sub>2</sub> emissions for permitting purposes.

Commenters from Florida State University and University of Illinois Chicago (EPA-HQ-OAR-2010-0560-0045.1) stated that landfill gas extraction separates the available carbon and energy from the biomass in the bulk of the MSW. The commenters from Florida State University and University of Illinois Chicago commented that this is supported by data compiled by Dr. Morton Barlaz (North Carolina State University) and Jeff Chanton (Florida State University) that reflects measurement of the radiocarbon (<sup>14</sup>C) in the MSW. Organic materials in the landfill consist of a two-component mixture of recently fixed biogenic carbon and fossil carbon compounds. The relative proportions can be distinguished by their <sup>14</sup>C content, as biogenic materials are 100% modern carbon while petroleum-derived materials contain fossil carbon with no <sup>14</sup>C. The commenters stated that data indicate the average for 49 samples is 74% modern, indicating that the organic fraction of the waste consists of 74% biogenic recently-fixed carbon. The composition of CH<sub>4</sub> generated and recovered from landfills is 100% modern carbon or greater (Hackley et al., 2005), indicating that an effective “biochemical” separation of biogenic carbon occurs during the biodegradation, formation and collection of the landfill gas.

Further, Florida State University and University of Illinois Chicago (EPA-HQ-OAR-2010-0560-0045.1) pointed out that developing countries through CDM and developed countries through the Joint Implementation program (JI) received credits for combusting landfill gas. It was also noted that biogas and biomass are included in EPA's Green Power Partnership as forms of green energy, while other countries, including Germany, Sweden, Canada, India, and New Zealand, are developing policies for the use of bioenergy.

Waste Management (EPA-HQ-OAR-2010-0560-0084.1) covered the following issues in their response:

- If EPA chooses to regulate CO<sub>2</sub> as a GHG, to provide a scientifically accurate, mass-balance calculation of carbon flows in a landfill, carbon sequestration in the landfill must be netted

out (or subtracted from total GHG emissions) for any PSD analysis of a landfill's potential to emit GHG emissions.

- The entire waste sector contributes only about two percent of total U.S. GHG emissions and therefore, landfills will be disproportionately impacted by the GHG PSD permitting requirement.
- For landfill gas-to energy projects, the only significant GHG emissions are biogenic CO<sub>2</sub> emissions and by subjecting these projects to permitting and control requirements of the PSD program, the outcome will be to thwart such environmentally beneficial projects. Commenter states the projects are beneficial because they both convert a high global warming potential GHG, CH<sub>4</sub>, to less potent CO<sub>2</sub>, and also produce renewable energy.
- If EPA were to require the purchase of carbon offsets to “net out” the emissions of biogenic CO<sub>2</sub>, the Agency would literally be requiring CO<sub>2</sub> emission offsets for the installation of a pollution control device that is required to be installed at those U.S. MSW landfills subject to the New Source Performance Standards program for the purpose of preventing the release of collected CH<sub>4</sub> and other organic compounds to the atmosphere by reducing them to CO<sub>2</sub>.
- The Tailoring rule will disproportionately affect local government and private entities who have invested considerable resources in development of renewable energy and organics management infrastructure, such as composting, anaerobic digestion or MSW gasification projects.
- The commenter cited 11 federal, state and international policies, programs, and protocols that consider biogenic CO<sub>2</sub> emissions as carbon neutral.

The DSWA stated that the Endangerment Finding dated December 15, 2009, on which the authority to regulate GHGs through the CAA rests, does not mention biogenic CO<sub>2</sub> emissions. According to the commenter, this omission of biogenic CO<sub>2</sub> emissions in the finding should nullify the authority to regulate biogenic emissions through the CAA. Additionally, the commenter states that the Endangerment Finding Technical Support Document indicates that reducing CH<sub>4</sub> emissions from the landfill actually reduces the anthropogenic GHG effect. The commenter also stated that landfills are a significant carbon sink and GHG inventory accounting methods should include sequestration of biogenic carbon as part of the net calculation used to determine contribution of GHG to the environment from landfills.

The DSWA recommended that EPA exclude landfill fugitive emission from calculations of potential to emit due to inaccuracy associated with estimating the quantity of fugitive emissions.

Eco-Cycle Inc. (EPA-HQ-OAR-2010-0560-0428) stated that the rule is unfair and favors the competition to the recycling and composting industry. The commenter recommended that all GHG emissions from combustion of MSW be counted and that credit be given to composting for improving carbon sequestration in soils.

Commenters Fresno-Clovis Regional Wastewater Reclamation Facility (EPA-HQ-OAR-2010-0560-263.1) and Los Angeles County Sanitation District (EPA-HQ-OAR-2010-0560-0264.1) stated that an important characteristic of biogas fuels, such as digester and landfill gas, compared to other

renewables, is that they are available for use 24/7 to help “shape and firm” other sources of intermittent renewable power, such as solar and wind.

Biomass Accountability Project and Save America’s Forests stated that landfill gas should be treated just like any other stationary source under the CAA.

### **2.1.7.3 Wastewater Treatment**

Five commenters, Fresno-Clovis Regional Wastewater Reclamation Facility (EPA-HQ-OAR-2010-0560-263.1), California Wastewater Climate (EPA-HQ-OAR-2010-0560-0038.1), Southern California Alliance of Publicly Owned Treatment Works (SCAP) (EPA-HQ-OAR-2010-0560-0053.1), National Association of Clean Water Agencies (NACWA) (EPA-HQ-OAR-2010-0560-0156.1), and East Bay Municipal Utility District (EBMUD) (EPA-HQ-OAR-2010-0560-0081.1), believe that to be consistent with many existing federal, state and international policies and programs, EPA should treat GHGs generated from municipal wastewater treatment or wastewater generated from biogenic sources as carbon neutral, thus not subject to Title V or PSD permitting.

The NACWA believes accounting of GHG emissions from municipal wastewater treatment processes should consider carbon input and carbon sequestration associated with management of the resulting biosolids. NACWA commented that, “the dissolved and particulate organic carbon in wastewater is generally unstable and can be lost to the atmosphere, but becomes more stable when incorporated in microorganisms. The treatment process results in an overall net sequestration of carbon in the sludge or biosolids. When biosolids are beneficially utilized through land application, though some of the carbon is lost, the recalcitrant carbon fraction, which accounts for 15-20 percent of total biosolids carbon, is estimated to have a lifetime in soil of about 60 years. In addition, land application of biosolids also sequesters carbon in crop and microbial biomass that builds up in the soil. Most cultivated soils are carbon neutral (i.e., there is no gain (carbon sink) or loss (carbon source)). Recent studies indicate that soils in the Midwest can become carbon sinks when biosolids are applied and that the rate of such carbon sequestration is the highest of other typical methods of managing agricultural soils.”

Sound Resource Management Group (EPA-HQ-OAR-2010-0560-0262.1) stated that research indicates that neither WTE nor LFGTE are carbon neutral, noting that the CO<sub>2</sub> released from these facilities will not be sequestered many decades or even a century.

The Fresno-Clovis Regional Wastewater Reclamation Facility (EPA-HQ-OAR-2010-0560-0263.1), SCAP (EPA-HQ-OAR-2010-0560-0053.1), NACWA (EPA-HQ-OAR-2010-0560-0156.1) and California Wastewater Climate (EPA-HQ-OAR-2010-0560-0038.1) stated that biogas contains approximately 40% CO<sub>2</sub> and 60% CH<sub>4</sub>. The commenter stated that biogas and biomass at wastewater facilities have significantly lower carbon implications when compared to other commercial biomass energy production. The commenter supported this claim with:

- There is a very small transportation-related GHG contribution to get the fuel to ‘market.’
- There is no competing land use impact because wastewater treatment plants are already in place and here to stay.
- Sewage is a “must manage” waste.

The National Solid Waste Management Association (EPA-HQ-OAR-2010-0560-0251.1) stated that there are not accepted or approved methodologies for determining site specific sources of biogenic

CO<sub>2</sub> at solid waste management facilities. As a result, a standardized approach and reliable and accurate testing methods need to be developed.

#### **2.1.7.4 Manure Management**

The National Steering Committee Carbon Work Group (EPA-HQ-OAR-2010-0560-0163.1) stated that given the need to substitute bioenergy for fossil energy wherever advantageous net carbon reductions will be achieved, there are several means to effectively define “additional” in an operationally efficient manner that also incent maximum net positive change. The National Steering Committee Carbon Work Group stated that, “Generally this suggests the use of standardized additionality eligibility criteria in preference to project specific tests and record keeping. Development of performance standards are one effective and often used approach. Livestock anaerobic digesters for manure management are an example. Since just a tiny fraction of animal agriculture operations currently employ digesters, a declaration that all digesters are additional and eligible for carbon credits can accelerate this form of bioenergy. A temporal threshold is another strong tool. Given that carbon sequestration has been a global focus since at least 1990 (the original Kyoto Protocol and UNFCCC baseline year) bioenergy accounting policy might, for example, stipulate that all biomass grown since 1990 is additional.”

Sempra Energy Utilities for Southern California Gas Company (SCG) and San Diego Gas and Electric (SDG&E) (EPA-HQ-OAR-2010-0560-0511.1) stated that production and combustion of biomethane is considered renewable bioenergy and requested that it should also be considered carbon neutral.

#### **2.1.7.5 Ethanol and Other Fermentation Processes**

American Baker’s Association (ABA) (EPA-HQ-OAR-2010-0560-0113.1) stated that emissions from yeast fermentation during bread making are carbon neutral and should not be counted as industrial emissions. These emissions are similar to that resulting from natural respiration of animals and other biological emissions, none of which are considered as regulated emissions under climate legislation.

Valero Energy Corporation (EPA-HQ-OAR-2010-0560-0221.1) noted that about one-third of the mass of corn entering a dry-mill plant is converted to ethanol, one-third to distillers grain, and one-third to CO<sub>2</sub>. Furthermore, biogenic emissions account for the majority of GHG emissions from corn ethanol plants.

Growth Energy (EPA-HQ-OAR-2010-0560-0091.2) stated that because field-to-wheels carbon emissions directly relate to the determination of carbon intensity of produced fuel ethanol, EPA should consider carbon models that include only new carbon and exclude recycled/neutral carbon. Utilizing full LCA carbon modeling will ensure state-of-the-art CO<sub>2</sub>e control technology is installed on new and “major” modification ethanol plants. Full field-to-wheels carbon modeling that follows international practices must be a vital element of a carbon emission inventory effort. EPA should embrace modeling of unique characteristics of distinct ethanol plants rather than the generic pathway approach and recognize outputs of any carbon model that meets appropriate standards (ISCC was given as example).

The Corn Refiners Association (EPA-HQ-OAR-2010-0560-0138.1), the Biotechnology Industry Organization (EPA-HQ-OAR-2010-0560-0277.1), Osage Bio Energy, LLC (EPA-HQ-OAR-2010-0560-0034.1), National Corn Growers Association (EPA-HQ-OAR-2010-0560-0189.1), National

Farmers Union (EPA-HQ-OAR-2010-0560-0190.1), Renewable Fuels Association (EPA-HQ-OAR-2010-0560-0194.1), and Valero Energy Corporation (EPA-HQ-OAR-2010-0560-0221.1) also provided information regarding fermentation emissions from ethanol. Commenters noted that the fermentation process produces “very pure” CO<sub>2</sub> and is attractive for use in food and industrial applications. When this CO<sub>2</sub> is captured for food and industrial applications, it displaces other sources of non-biogenic or fossil CO<sub>2</sub> and therefore should be considered carbon neutral. One commenter justified biofuels carbon neutrality as a whole, when they stated that biofuels production occurs on an annual basis, so the carbon cycling process is very rapid.

Regarding CO<sub>2</sub> emissions from livestock, one comment from a private citizen noted that accounting for these emissions would be contingent on how EPA calculates baseline conditions. The commenter stated, “If the baseline assumes that land would remain in its present use for feed for existing livestock demand, then the emissions should not be counted. If the baseline assumes that in the absence of the human decision to consume livestock there would be forest regeneration, then the emissions should be counted.”

### **2.1.8 Biomass Under PSD/BACT**

EPA received comments, as requested through the CFI, related to PSD/BACT. Issues related to biogenic CO<sub>2</sub> emissions in the PSD program will likely be addressed in future rulemakings, as explained in the Background. As a result, those comments are only briefly summarized in this section.

Several comments to the CFI suggest that biogenic CO<sub>2</sub> emissions could simply be excluded or included in PSD/BACT requirements, and if included, several comments summarized how biogenic CO<sub>2</sub> emissions could be considered under PSD/BACT. One set of comments (National Association of Clean Water Agencies EPA-HQ-OAR-2010-0560-0156.1) indicated that many existing methodologies for GHG reporting and carbon trading exempt biogenic CO<sub>2</sub> emissions from reporting because they are considered to be part of the natural carbon cycle, and that these emissions should therefore be excluded from PSD/BACT permitting requirements.

Six commenters (Solid Waste Association of North America (SWANA) EPA-HQ-OAR-2010-0560-0078.1, Waste Management (WM) EPA-HQ-OAR-2010-0560-0084.1, Local Government Coalition for Renewable Energy EPA-HQ-OAR-2010-0560-0087.1, State of California – California Energy Commission (CEC) EPA-HQ-OAR-2010-0560-0454.1, Covanta Energy EPA-HQ-OAR-2010-0560-0540.1 and Biomass Accountability Project EPA-HQ-OAR-2010-0560-0566) explained that to be consistent with many existing federal, state and international policies and programs, EPA should treat GHG emissions generated through the combustion of biomass or biogenic-derived fuels as carbon neutral, thus not subject to Title V or PSD permitting.

A different set of comments (Center for Biological Diversity) indicated that CO<sub>2</sub> emissions warm the atmosphere in the same way regardless of their original source, whether fossil or biogenic, and that all emissions, not just fossil, should therefore be included in PSD/BACT requirements.

Commenters also provided information on special considerations EPA should take into account. For example, some stakeholders stated that CO<sub>2</sub> emissions from biogenic waste (including residuals and MSW) should be considered carbon neutral, since this waste would otherwise decompose into CO<sub>2</sub> or potentially CH<sub>4</sub>, which has 21 times the warming effects of CO<sub>2</sub>, if placed in anaerobic conditions. Commenters also stated that in taking biogenic CO<sub>2</sub> emissions into account under

PSD/BACT, the agency should consider the life-cycle emissions associated with different biomass feedstocks, and create sustainability standards or weighting factors related to the warming effects of each feedstock.

## **Part B: Classification/Evaluation of Accounting Approaches**

Part B provides information on the classification of various accounting approaches presented by commenters, including case-by-case, categorical exclusion, contingent exclusion, feedstock based and other approaches. The accounting approaches are defined in the section below, followed by an explanation of how each classification was determined.

The accounting approaches submitted by the commenters and the various features of each approach are summarized in Table 2-1 through 2-5. These tables describe “key features”—i.e., how each approach addresses boundaries, baseline conditions, temporal resolution, feedstock categorization, biomass coefficients and leakage.

While most of the commenters provided enough information to classify the approach into the five categories outlined above (the four categories plus the “other category”), not all of the commenters gave significant details for how their approach would address baseline or the time scale of the approach.

### **2.2 Case-by-Case**

Some commenters (see Table 2-1) suggested that analysis of stationary source program applicability should rely on a case-by-case, facility-specific assessment of the net emissions associated with the intended biomass fuels. A case-by-case approach would require facility-level accounting for the emissions associated with the full chain of fuel production and use. Commenters indicated that this type of facility-specific approach would be the most scientifically sound approach for assessing the carbon cycle impact of specific biomass fuels. However, other commenters noted that the case-by-case approach, in which a complete analysis would be conducted for each permit application, would likely be prohibitively time-consuming and complex for facilities and permitting authorities.

### **2.3 Categorical Exclusion**

Some commenters (see Table 2-2) suggested that a categorical exclusion for all bioenergy and biogenic sources would be appropriate. Using this approach, no emissions from any such sources would be counted for stationary source program applicability. According to commenters supporting this option, the rationale for such an exclusion rests on the idea that all biological sources are part of the “active carbon cycle,” in which CO<sub>2</sub> is cycled between the land and atmosphere on a relatively short timeframe.

### **2.4 Contingent Exclusion**

Some commenters (see Table 2-3) also suggested that a categorical exclusion for all bioenergy and other biogenic sources is too simplistic but would be appropriate with an added contingency. For example, all bioenergy and other biogenic emissions could be excluded from stationary source program applicability as long as forest land in the United States remains a net carbon sink, such that sequestration remains greater than emissions at the national scale. Some commenters (e.g. State of Washington) suggested that this contingency might be expressed at a State scale, such that all

facilities that emit CO<sub>2</sub> from bioenergy or other biogenic sources would be excluded from applicability as long as the forest land within that State acts as a net carbon sink.

## **2.5 Feedstock-Based**

Another accounting approach provided by commenters was based on the idea that feedstocks are different, and that the net impact of bioenergy and other biogenic emissions may be traceable to the feedstock that is used. For example, commenters (see Table 2-4) indicated that it would be preferable to distinguish various categories of woody biomass feedstocks, such as wood process and logging residues, forest treatment thinnings, biomass crops, and whole-tree chips from expanded harvest operations. Various other feedstock categorizations for different types of material were also proposed.

## **2.6 Other Approaches**

Commenters (see Table 2-5) also recommended other approaches for accounting for biogenic CO<sub>2</sub> emissions that do not fall under the four accounting approach categories described above (e.g., University of Michigan recommends using annual basis carbon (ABC) accounting, and the Environmental Defense Fund recommends adjusting a facility's total emissions for smokestack emissions derived from bioenergy based on an average adjustment factor for a common woodshed or agricultural supply region).

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## 2.7 Key Features of Accounting Approaches Presented in CFI Comments

As described above, Table 2-1 through 2-5 present the accounting approaches suggested by the commenters. The tables include the main commenter number, the stakeholder category of the commenter, boundaries of the alternative accounting approach, baseline conditions, spatial boundaries, time interval, feedstock categorization, indirect effects, biomass coefficients, and other considerations. If an accounting approach did not have a key feature presented in the following tables, and N/A is used and denotes not available based on the comment/information provided.

**Table 2-1: Key Features of Case-by-Case Analysis Approaches Described by Commenters**

Main Commenter	Stakeholder Category of Commenter	Boundaries of the Accounting	Baseline Conditions	Spatial boundaries	Temporal Resolution/ Time Interval for Accounting	Feedstock Categorization	Indirect Effects and Leakage Deductions	Development of Biomass Coefficients	Other Impacts and Considerations
Placer County (CA) Air Pollution Control District	State and Local	Processing, Transport, Energy Recovery	Energy sourced from fossil fuels; Biomass burning and in field decay	N/A	N/A	N/A	N/A	N/A	N/A
Treated Wood Council	Forest Products	Life-cycle Analysis	None defined	National	50–100 years	Energy required to prepare bioenergy feedstock for use	N/A	N/A	Incentivize carbon efficient energy products
Clean Air Task Force	Environmental	Life-cycle Analysis	Energy sourced from fossil fuels or other renewables	Facility-level carbon flow	< 20–30 years	Case-by-case feedstock categorization as "clean fuel" under BACT	Account for ILUC credits and debits	N/A	Biomass produces more CO <sub>2</sub> per unit of energy

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**Table 2-2: Key Features of Categorical Exclusion Approaches Described by Commenters**

Main Commenter	Stakeholder Category of Commenter	Boundaries of the Accounting	Baseline Conditions	Spatial boundaries	Temporal Resolution/ Time Interval for Accounting	Feedstock Categorization	Indirect Effects and Leakage Deductions	Development of Biomass Coefficients	Other Impacts and Considerations
Renewable Fuels Association	Biofuel Industry	Active carbon cycle	Energy sourced from fossil fuels	National	Annual crop production	Biomass/Fossil Fuel	Increased fossil fuel reliance	N/A	New ethanol facilities will be required to use biomass or natural gas for process energy under the RFS2 regulatory program.
National Alliance of Forest Owners	Forestry	Active carbon cycle	Energy sourced from fossil fuels	National	N/A	Biomass/Fossil Fuel	N/A	N/A	Bioenergy is a reliable and consistent source of renewable energy, unlike wind or solar power.
American Forest and Paper Association (AF & PA)	Forestry Product Industry	Active carbon cycle	Energy sourced from fossil fuels	National	Long term accounting of carbon sequestration from forest growth	Biomass/Fossil Fuel	ILUC from forest to more economically viable uses (e.g., development)	N/A	ISO LCA standards require that accounting begin at material extraction, or the uptake of CO <sub>2</sub> by trees.
California Air Resources Board	Other	N/A	None defined	State-level	N/A	Reporting exclusions: biogas from waste; biodiesel; ethanol; MSW; biomethane; and fugitives from: geothermal, hydrogen fuel, and petroleum/natural gas systems	N/A	N/A	Biogenic emissions reporting required for entities that cannot establish biomass-derived fuel validity according to CA's Mandatory Reporting Rule.
Waxman-Markey	Other	N/A	None defined	National	N/A	Wood waste, removed invasive species, pre-commercial thinnings and organic matter available on a recurring basis	N/A	N/A	N/A

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**Table 2-3: Key Features of Contingent Exclusion Approaches Described by Commenters**

Main Commenter	Stakeholder Category of Commenter	Boundaries of the Accounting	Baseline Conditions	Spatial boundaries	Temporal Resolution/ Time Interval for Accounting	Feedstock Categorization	Indirect Effects and Leakage Deductions	Development of Biomass Coefficients	Other Impacts and Considerations
Society of American Foresters	Forestry	Life-cycle Analysis	None defined	National	Long term accounting of carbon sequestration from forest growth	Biomass/Fossil Fuel	N/A	N/A	The substitution value of wood products and energy should be included.
The National Rural Electric Cooperative Association	Utilities	Life-cycle Analysis	None defined	N/A	Biomass growth through its combustion	Biomass/Fossil Fuel	Carbon sequestration credit	N/A	N/A
Green Power Institute	Other	Fuel-shed	None defined	Fuel procurement area	Facility lifetime plus major delayed effects that the facility and its alternatives would entail	3 Tiers: 1. All biomass is carbon neutral 2. Carbon balance for biomass is GHG forcing neutral or positive 3. GHG forcing is positive therefore qualifies as an offset	N/A	N/A	Forest thinning can lead to immediate carbon emission but a long-term storage of CO <sub>2</sub>
State of Washington	State and Local	Active carbon cycle	None defined	State-level	Long term accounting of carbon sequestration from forest growth	Biomass/Fossil Fuel	N/A	N/A	<ul style="list-style-type: none"> <li>• Project-specific accounting in cases where natural disaster causes net forest carbon emissions.</li> <li>• BACT represent maintenance of stable or increasing carbon stocks.</li> <li>• Amend the MRR to incorporate LULUCF reporting.</li> </ul>

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**Table 2-4: Key Features of Feedstock-Based Approaches Described by Commenters**

Main Commenter	Stakeholder Category of Commenter	Boundaries of the Accounting	Baseline Conditions	Spatial boundaries	Temporal Resolution/ Time Interval for Accounting	Feedstock Categorization	Indirect Effects and Leakage Deductions	Development of Biomass Coefficients	Other Impacts and Considerations
25x'25 National Steering Committee: Carbon Work Group	Other	Life-cycle Analysis	None defined	N/A	Start at first growth of biomass	Additional/Non-additional sources	N/A	Default look-up values	N/A
Minnesota Department of Agriculture	State and Local	Carbon emissions and retention by feedstock	None defined	Regions	100 years	Broken down by sector, biomass type, rotation length, growing habits, and regional considerations	N/A	GWP <sub>s</sub> based on IPCC Approach	Limit the analysis to the live portion of the forest; changes in very slowly changing secondary carbon reservoirs like soils are too speculative
The Wilderness Society	Environmental	Active carbon cycle including ILUC	Carbon from lands managed for biomass within the region.	Uniform ecosystems and management practices	20–40 years at stand-level, 100 years at stand- or regional-level	Waste, logging residues, thinnings, Short-rotation biomass crops, materials from dedicated harvesting of live vegetation	Include C debit from land use change.	Value between 0 and 1. Factors include alternative use of feedstock, load sourced from whole trees, harvesting practices, local conditions for fires, and LUC patterns	N/A
NextGen Energy Board	State and Local	N/A	None defined	N/A	100 years	Short rotation biomass, long rotation biomass, residuals, bio-processing	N/A	GWP calculations	N/A

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**Table 2-5: Key Features of Alternative Approaches Described by Commenters**

Main Commenter	Stakeholder Category of Commenter	Boundaries of the Accounting	Baseline Conditions	Spatial boundaries	Temporal Resolution/ Time Interval for Accounting	Feedstock Categorization	Indirect Effects and Leakage Deductions	Development of Biomass Coefficients	Other Impacts and Considerations
University of Michigan, School of Natural Resources	Academia	Annual basis carbon (ABC) accounting: sequestration tallied at their location, and emissions tallied at their locations and in their sectors	None defined	Individual emission and sequestration sites	Annual or near-annual basis	None	Separate mitigation program policy to account for indirect effects	Fuel and Feedstock Accounting Standards based on emissions from the supply chain	Focus on facility emissions and production data rather than facility products and assumed processes to avoid feedstock classifications
Environmental Defense Fund	Environmental	Not specified	Current management conditions of the land and other demands for biomass	Fuel procurement area	5–10 years	None	Include ILUC, carbon storage in wood products, and product substitution	Calculated based on the incremental change in carbon stocks due to bioenergy production over the relevant land base and time frame	Carbon credit should only be given based on additionality

# Appendix A: Background on Treatment of Biogenic CO<sub>2</sub> Emissions in Clean Air Act Programs

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## PSD and Title V Programs

New Source Review (NSR) requires stationary sources of air pollution to get permits before they start construction. NSR is also referred to as construction permitting or preconstruction permitting. The Prevention of Significant Deterioration (PSD) is one component of the NSR program. PSD applies to new major sources or major modifications at existing sources for pollutants where the area the source is located is in attainment or unclassifiable with the National Ambient Air Quality Standards (NAAQS). It requires the following:

1. installation of the "Best Available Control Technology (BACT)";
2. an air quality analysis;
3. an additional impacts analysis; and
4. public involvement.

The Title V permit program requires all “major sources” and some smaller “area sources” to obtain operating permits after the sources have begun to operate. These permits are intended to assure sources’ compliance with applicable CAA requirements by including all pollution-control requirements from federal or state regulations that apply to the source in one central document.

More information about these programs can be found at <http://www.epa.gov/nsr/psd.html> and <http://www.epa.gov/airquality/permits/>

## Tailoring Rule

On June 3, 2010, EPA published the final Prevention of Significant Deterioration (PSD) and Title V Greenhouse Gas Tailoring Rule (referred to as the Tailoring Rule; 75 FR 31514), setting thresholds for GHG emissions that define when permits under these programs are required for new and existing industrial facilities. Beginning January 2, 2011, sources already subject to PSD or Title V permitting programs were required to determine the best available control technology (BACT) for their GHG emissions, but only for GHG increases of 75,000 short tons per year (tpy) or more of total GHGs, on a carbon dioxide equivalents (CO<sub>2</sub>e) basis and any increase on a mass basis.

Beginning July 1, 2011, the PSD permitting requirements apply to new construction projects that emit GHGs of at least 100,000 tpy on a CO<sub>2</sub>e basis even if they do not exceed the permitting thresholds for any other pollutant. Modifications at existing facilities with baseline emissions of at least 100,000 tpy on a CO<sub>2</sub>e basis and that increase GHG emissions by at least 75,000 tpy, and any amount on a mass basis, are subject to PSD permitting requirements, even if they do not significantly increase emissions of any other pollutant. In addition, facilities that emit at least 100,000 tpy CO<sub>2</sub>e will be subject to Title V permitting requirements based on their GHG emissions even if permitting requirements do not apply based on emissions of any other pollutant.

More information about this rule can be found here: <http://www.epa.gov/NSR/actions.html#2010>

## **Deferral for CO<sub>2</sub> Emissions from Bioenergy and Other Biogenic Sources**

The final Deferral for CO<sub>2</sub> Emissions From Bioenergy and Other Biogenic Sources Under the Prevention of Significant Deterioration (PSD) and Title V Programs was published July 20, 2011 (76 FR 43490). This rule defers for a period of three (3) years the consideration of CO<sub>2</sub> emissions from bioenergy and other biogenic sources (hereinafter referred to as "biogenic CO<sub>2</sub> emissions") when determining whether a stationary source meets the PSD and Title V applicability thresholds, including those for the application of BACT. Stationary sources that combust biomass (or otherwise emit biogenic CO<sub>2</sub> emissions) and construct or modify during the deferral period will avoid the application of PSD to the biogenic CO<sub>2</sub> emissions resulting from those actions. This deferral applies only to biogenic CO<sub>2</sub> emissions and does not affect non-GHG pollutants or other GHGs (e.g., methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O)) emitted from the combustion of biomass fuel.

More information about this rule can be found here: <http://www.epa.gov/NSR/actions.html#2011>.

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**Table A-1: Key Action Dates Related to Biogenic CO<sub>2</sub> Emissions in PSD and Title V**

FR Notice	Date	Title	Description of Outcome	Emission Sources Included (by NAICS Code as applicable)
75 FR 31514	June 3, 2010	Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule: Final Rule	Biomass combustion and other biogenic CO <sub>2</sub> emissions are not excluded from the application of PSD and Title V.	11, 21, 2211, 2212, 2213, 311, 312, 313, 314, 315, 316, 321, 322, 32411, 32414, 32419, 3251, 3252, 3253, 3254, 3255, 3256, 3259, 3261, 3262, 32552, 32592, 32591, 325182, 32551, 3271, 3272, 3273, 3274, 3279, 3311, 3312, 3313, 3314, 3315, 3321, 3322, 3323, 3324, 3325, 3326, 3327, 3328, 3329, 3331, 3332, 3333, 3334, 3335, 3336, 3339, 3351, 3352, 3353, 3359, 3361, 3362, 3363, 3364, 3365, 3366, 3369, 3371, 3372, 3379, 3391, 3399, 5622, 5629, 6221, 6231, 6232, 6233, 6239, 8122, 8123, 8141, and non-residential (commercial) <sup>a</sup>
75 FR 41173	July 15, 2010	Call for Information: Information on Greenhouse Gas Emissions Associated with Bioenergy and Other Biogenic Sources.	EPA received 630 unique comments on approaches to accounting for biogenic CO <sub>2</sub> emissions.	Any interested parties
NA	August 3, 2010	National Alliance of Forest Owners (NAFO) Petition for Reconsideration	NAFO requests reconsideration of the Tailoring Rule related to treatment of biogenic CO <sub>2</sub> emissions.	221, 321, 322, 562213, 112, 221320, 5622212, 325193, 311, 312 <sup>b</sup>
NA	January 12, 2011	NAFO Petition for Reconsideration Granted	EPA grants NAFO's request for reconsideration of the Tailoring Rule related to treatment of biogenic CO <sub>2</sub> emissions.	Same as above
76 FR 15249	July 20, 2011	Deferral for CO <sub>2</sub> Emissions From Bioenergy and Other Biogenic Sources Under the Prevention of Significant Deterioration (PSD) and Title V Programs: Final Rule	The rule defers for 3 years the application of PSD and Title V to biogenic CO <sub>2</sub> emissions sources.	221, 321, 322, 562213, 112, 221320, 5622212, 325193, 311, 312 <sup>b</sup>

<sup>a</sup> These North American Industry Classification System (NAICS) codes include: Agriculture, fishing, and hunting; mining; utilities (electric, natural gas, other systems); manufacturing (food, beverages, tobacco, textiles, leather); wood product, paper manufacturing; petroleum and coal products manufacturing; chemical manufacturing; rubber product manufacturing; miscellaneous chemical products; nonmetallic mineral product manufacturing; primary and fabricated metal manufacturing; machinery manufacturing; computer and electronic manufacturing; electrical equipment, appliance, and component manufacturing; transportation equipment manufacturing; furniture and related product manufacturing; miscellaneous manufacturing; waste management and remediation; hospitals/nursing and residential care facilities; personal and laundry services; residential/private households; and non-residential (commercial).

<sup>b</sup> These NAICS codes correspond to affected facilities including: electric utilities burning biomass fuels; wood products manufacturing; wood pellet fuel manufacturing; pulp and paper manufacturing; solid waste combustors and incinerators; animal production manure management operations; sewage treatment facilities; solid waste landfills; ethanol manufacturing; and food/beverage processors burning agricultural biomass residues, using fermentation processes, or producing/using biogas from anaerobic digestion of waste materials.

## Appendix B: Summary of Non-Unique Comments

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**Table B-1: List of Non-Unique Commenters and Affiliation.**

Docket No. EPA-HQ-OAR- 2010-0560	Commenter Name and Affiliation	Number of Times Submitted
0642	Mass comment campaign sponsored by Verso Paper Company	6
0450.1	Mass comment campaign sponsoring organization unknown	4
0114	Mass comment campaign sponsoring organization unknown	159
0043	Mass comment campaign regarding Rothschild, WI	9
0062	Mass comment campaign sponsoring organization unknown	3
0063	Mass comment campaign sponsored by Friends of the Earth	79
0065	Mass comment campaign sponsoring organization unknown	90
0142	Mass comment campaign sponsoring organization unknown	9

### Docket No. EPA-HQ-OAR-2010-0560.0642: Sponsored by Verso Paper Company

Dear Administrator Jackson,

I am writing to urge you to recognize that biomass is carbon neutral and is a renewable resource.

I am the spouse of an employee at Verso Paper Corp.'s Sartell Mill located in Sartell, MN . The Sartell Mill brings in wood from sustainably managed forests to make paper for catalogs and magazines. Some of this wood, mostly wood waste, is used to produce green energy allowing our mill to use less fossil fuel. Verso is careful to source wood from well-managed forests, most of which is third party certified, because we understand the long-term value of preserving our renewable resource.

The Intergovernmental Panel on Climate Change (IPCC), established by the United Nations, cites that biomass should be accounted for as carbon neutral. And, according to the U.S. Forest Service (USFS), the U.S. carbon cycle is in balance. I understand that part of the process to convert biomass to energy results in carbon emissions. However, the USFS and IPCC studies show that these carbon emissions are more than offset by the natural carbon sink provided by U.S. forestlands.

The pulp and paper mills in Minnesota, largely located in rural areas, represent some of the last high-paying manufacturing jobs available. As the U.S. Environmental Protection Agency (EPA) regulates U.S. manufacturing companies' emissions, it is important for you to remember that we cannot afford to operate at a cost disadvantage versus our global competitors. Many European countries already recognize that biomass is a carbon neutral fuel source. And, in fact, some European companies are importing American wood as feedstock for their pellet plants because they have made it a priority to move toward biomass as a good source of green energy. Pulp and paper mills need to keep America's wood in our country and use it to our economic advantage, which will help us achieve greater energy independence from fossil fuels.

As the EPA continues to develop regulations for U.S. companies, once again, I encourage you to view biomass as carbon neutral and as a renewable resource. Your attention to this letter is much appreciated.

**Docket No. EPA-HQ-OAR-2010-0560.0450.1**

Dear Administrator Jackson:

On August 16, President Obama said, "We expect our commitment to clean energy to lead to more than 800,000 jobs by 2012. And that's not just creating work in the short term, that's going to help lay the foundation for lasting economic growth."

Yet, the EPA's Tailoring Rule would actually deter job creation in the renewable biomass energy sector.

The permitting requirements under the final Greenhouse Gas Tailoring Rule, set to take hold in January, would effectively dismantle the burgeoning biomass industry, which uses wood products grown in sustainable forests as a replacement for carbon-intensive fossil fuels.

Long-standing domestic and international law recognizes that biomass energy production is carbon neutral, but the Tailoring Rule reverses course, giving businesses little incentive to continue investment in renewable biomass energy.

It's not just green biomass jobs on the line. The EPA's new requirements will punish America's forests, which support 2.9 million workers and add \$115 billion to the economy every year.

America especially rural America, where many forests are located, needs jobs right now. Please follow precedent and exclude sustainable biomass producers from costly PSD permitting requirements.

**Docket No. EPA-HQ-OAR-2010-0560.0114**

Dear Administrator Jackson,

Please exclude the biomass energy industry from the Environmental Protection Agency Tailoring Rule on carbon emissions (Docket ID No. EPA-HQ-OAR-2010-0560).

Our country needs to both grow our economy and nurture our domestic renewable energy sources. But the Environmental Protection Agency's Tailoring Rule—set to take effect in January—threatens to hurt both goals by threatening to impose new, unnecessary regulations on the current use of biomass for energy.

Wood products grown in America's sustainable forests can replace carbon-intensive fossil fuels. In fact, these very forests, 90 percent of which are certified by third parties as being sustainable, absorb 15 percent of all U.S. emissions and help to serve as our best shields against greenhouse gases. But the Tailoring Rule would effectively dismantle this burgeoning industry by contradicting the long-

standing U.S. policy that has long recognized the carbon-neutral nature of renewable biomass energy.

Please defend and preserve the beauty of our forests they keep the air from becoming more polluted, and must keep on being the lungs of our planet!

I urge you to exclude renewable biomass energy from the tailoring rule to protect the industry and the jobs it creates.

**Docket No. EPA-HQ-OAR-2010-0560.0043: Regarding Rothschild, WI**

Please stop the biomass plant in Rothschild, WI, and elsewhere.

Trees are burned at unsustainable rates and trees are needed to capture the CO<sub>2</sub> from our modern activities.

The air pollution created by biomass plants is unhealthy for children, the aged, those with breathing difficulties and everyone in general.

In the Rothschild plant alone, sulfur is expected to rise from one ton to five tons with particulate matter going from 20 tons to 46 tons. According to the WI DNR Rothshild already has the fourth dirtiest air in the state of Wisconsin.

We can and must do better. Let's go with alternative fuels (rather than gas, oil, and coal) and remember that trees are also fossil fuels and are very polluting when burned. Let's put the emphasis on CLEAN renewable fuels.

**Docket No. EPA-HQ-OAR-2010-0560.0062**

I support EPA's decision in the Tailoring Rule that the greenhouse gas emissions from biomass combustion must be accounted for in Clean Air Act permitting for stationary sources.

Because there are various types of biomass, they cannot all be judged as one source and we cannot assume that none of them contribute to global warming.

We need accurate accounting principles so we know whether each energy source is helpful or harmful to the climate. Please don't let dirty biomass producers get away with trashing the climate under the guise of clean energy.

Thank you for your leadership on this issue. I look forward to your response.

**Docket No. EPA-HQ-OAR-2010-0560.0063: Sponsored by Friends of the Earth**

Dear Administrator Jackson,

The following message was composed by Friends of the Earth, and I whole-heartedly endorse it:

I appreciate the opportunity to provide information on the carbon impact of biomass (Docket ID No. EPA-HQ-OAR-2010-0560).

The EPA is obligated to regulate these emissions under the Clean Air Act and cannot legally exempt emission from biomass or assume carbon neutrality. There is no legal or scientific justification to exempt the emissions from burning biomass.

A wide range of factors affect the net CO<sub>2</sub> impact of production of and emissions from biomass fuels, and thus they should not be universally considered carbon neutral. Specifically, research has shown that for many biomass projects, carbon neutrality, if achieved at all, only occurs after years or decades (1). The burning of biomass materials releases CO<sub>2</sub> into the atmosphere immediately, while the process of reforestation is multi-year at minimum. During this time gap between combustion and reuptake, biomass burning can contribute substantially to greenhouse gas (GHG) emissions. To adequately respond to global warming, we need to reduce net GHG emissions immediately.

Perhaps more importantly, even the long-term carbon neutrality of biomass fuels is questionable and subjective at best. Some experts have even found the GHG emissions from biomass burning to exceed emissions from coal (2). Others have pointed out that treating biomass as carbon-neutral is inappropriate when the sustainability of the production of the biomass is unverified (3). It is especially difficult to verify harvesting and replanting practices when materials may be sourced globally. Considering biomass as carbon-neutral then incentivizes deforestation while treating the harvested materials as though they don't contribute to climate change (4–5). Such a practice would no doubt result in large-scale unsustainable land conversion practices.

Finally, there is wide variation in bioenergy systems and a range of factors that must be accounted for when considering the carbon benefits or disbenefits of biomass. These include but are not limited to accounting for the impact of alternative uses of the land, the impacts of the fuels displaced, the type of mass being burned and replanted, the harvesting practices and the potential for materials to be either sourced or used outside of regulated boundaries (6–10). This variation can yield a great deal of uncertainty in calculating net carbon impacts, which can be exploited to overestimate the benefits of burning biomass materials (11).

Given all of these apparent risks, I strongly urge the EPA not to count biomass emissions as carbon neutral. Failing to consider the actual net emissions of biomass harvesting and burning creates dangerous incentives for fuels that, in many if not most cases can do more harm than good, while creating loopholes for the global forest industry to degrade and destroy natural forests that serve as vital carbon sinks. It is my hope that in crafting GHG regulations, the EPA will be mindful of the fact that even if emissions reach "arithmetic" neutrality over time – which is unlikely in the case of any large scale biomass project given that burning will necessarily outpace the growth of new forests – this does not imply that they cause no harm.

Thank you for the opportunity to submit comments on this issue.

#### References:

(1) Marland, G. and B. Schlamadinger (1995). "Biomass fuels and forest-management strategies: How do we calculate the greenhouse-gas emissions benefits?" Energy 20(11): 1131–1140.

(2) Manomet Center for Conservation Sciences. 2010. Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy

Resources. Walker, T. (Ed.). Contributors: Cardellichio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah, D., and Walker, T. Natural Capital Initiative Report NCI-2010-3. Brunswick, ME.

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(5) \*Searchinger, T., R. Heimlich, R. A. Houghton, F. Dong, A. Elsasser, J. Fabiosa, S. Tokgoz, D. Hayes and T.-H. Yu (2008). "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land Use Change." Science 319(5867): 1238–1240.

(6) Anderson-Teixeira, K. J. and E. H. Delucia (2010). "The greenhouse gas value of ecosystems." Global Change Biology 9999(9999).

(7) Levasseur, A., P. Lesage, M. Margni, L. Deschénes and R. Samson (2010). "Considering Time in LCA: Dynamic LCA and Its Application to Global Warming Impact Assessments." Environmental Science & Technology.

(8) O'Hare, M., R. J. Plevin, J. I. Martin, A. D. Jones, A. Kendall and E. Hopson (2009). "Proper accounting for time increases crop-based biofuels' greenhouse gas deficit versus petroleum." Environmental Research Letters 4(2): 024001.

(9) Schlamadinger, B., M. Apps, F. Bohlin, L. Gustavsson, G. Jungmeier, G. Marland, K. Pingoud and I. Savolainen (1997). "Towards a standard methodology for greenhouse gas balances of bioenergy systems in comparison with fossil energy systems." Biomass and Bioenergy 13(6): 359–375.

(10) Marland, G. and B. Schlamadinger (1997). "Forests for carbon sequestration or fossil fuel substitution? A sensitivity analysis." Biomass and Bioenergy 13(6): 389–397.

(11) Gustavsson, L., T. Karjalainen, G. Marland, I. Savolainen, B. Schlamadinger and M. Apps (2000). "Project-based greenhouse-gas accounting: guiding principles with a focus on baselines and additionality." Energy Policy 28(13): 935–946.

## **Docket No. EPA-HQ-OAR-2010-0560.0065**

EPA's greenhouse gas rules must fully account for all greenhouse gas emissions from incinerators that burn "biomass" and from "waste to energy" facilities. Industry claims that burning biomass and garbage is "carbon neutral" are not supported by science or common sense.

The industry effort to distinguish "biological" or "biogenic carbon" from carbon emitted by burning fossil fuels is a false distinction. So much carbon has already been taken from underground fossil stores and added to above ground "carbon pools" that ecosystems are saturated and unable to re-

sequester or cycle it all, already. Compromising our stressed ecosystems by burning trees and garbage for electricity will make climate change worse and harm human health.

Please ensure that CO<sub>2</sub> emissions from biomass and waste to energy incinerators are fully accounted for in the Tailoring Rule.

**Docket No. EPA-HQ-OAR-2010-0560.0142**

The Honorable Jackson

As America wrestles with the worst economic climate since the Great Depression, our government must jumpstart, not stall, innovation. Unfortunately, the Environmental Protection Agency's (EPA) treatment of family-owned forests and renewable biomass energy producers in the final Greenhouse Gas Tailoring Rule kills green jobs instead of creating them.

Our country's forests are an economic success story, supporting 2.9 million workers and pumping \$115 billion into the economy. Yet, the EPA's plan would virtually destroy the burgeoning woody biomass energy business and send American jobs to other countries.

Since many economies, particularly rural economies, rely on the woody biomass energy business, I urge you to reconsider the treatment of forests and biomass energy development before implementing new mandates in January.

The woody biomass energy business doesn't simply provide jobs; it provides green jobs. Members of Congress and past Administrations have joined scientists in recognizing the carbon neutrality of biomass energy. Trees absorb 800 million metric tons of carbon per year, which equals about 15 percent of U.S. emissions—far more carbon than what is released by biomass energy production.

The EPA even stated in 2007 that there is "scientific consensus...that the carbon dioxide emitted from burning biomass will not increase CO<sub>2</sub> in the air if it is done on a sustainable basis."

Furthermore, statistics show the sustainability of U.S. forestland and the EPA acknowledges that these forests are the nation's most significant carbon sinks. In fact, 90 percent of industrial forests are certified by third parties as sustainable.

By reversing years of government policy and sidestepping Congress's will, the EPA could ironically impede investment in renewable energy production and give an upper hand to major foreign foresters, such as China and Indonesia, that have little regard for the environment.

There is no justification for lumping family-run forests and biomass producers with big polluters. Worse, onerous regulations will make sustainable forests more expensive to operate and prime candidates for sale for non-forest uses. The Tailoring Rule could harm forest health and increases the risk of wildfires, according to a recent letter from the Western Governors' Association. Clearly, this was not the EPA's intent.

Please exclude woody biomass from PSD permitting requirements and help avoid a long list of unintended consequences.

## Appendix C: Summary of Unique Comments

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**Table C-1: List of Unique Commenters and Affiliation.**

<b>Docket No. EPA-HQ-OAR-2010-0560</b>	<b>Commenter Name and Affiliation</b>
0023	Tom Harrington
0026	Maria Zannes, EEC Research Associate, Earth Engineering Center (EEC) of Columbia University
0027.I	Gregg Marland, Oak Ridge National Laboratory
0028	Mark Lyman, President, West Salem Machinery Co. Inc. (WSM)
0029.I	Greenpeace, submitted by Kyle Ash and Larry Edwards
0030.I	Michael J. Mack, Jr., John Deere Co. Worldwide Construction & Forestry Division
0031.I	Anton A. Chiono, Policy Analyst, Submitted on behalf of The Pacific Forest Trust
0034.I	John W. Warren, CEM, Director, Government Relations and Project Development, Osage Bio Energy, LLC
0035.I	Steven A. Brink, Vice President, Public Resources, California Forestry Association (CFA)
0036.I	Steven Jarvis, Executive Director, Missouri Forest Products Association (MFPA)
0037	Chuck Roady, VP & GM, Submitted on behalf of F.H. Stoltze Land & Lumber Co.
0038.I	California Wastewater Climate Change Group (CWCCG), submitted by Jacqueline Kepke
0039	Bonnie Bortel, Private Citizen
0041 and 0367	Geoffrey Brown, Private Citizen
0042	Josh Schlossberg
0044.I	State of Iowa, Catharine Fitzsimmons, Chief Air Quality Bureau, Iowa Department of Natural Resources (Iowa DNR).
0045.I	Jeffrey Chanton, Distinguished Research Professor, John Winchester Professor of Oceanography, Florida State University and Jean Bogner, PhD, Research Professor, Department of Earth & Environmental Sciences, University of Illinois Chicago
0046	K. McIntosh, Process Manager, Androscoggin Mill – Verso Paper Corporation
0047	Michael J. Glodowski, Pulp Business Manager, Androscoggin Mill – Verso Paper Corporation
0048	Mark Conner, Mill Manager, Androscoggin Mill – Verso Paper Corporation

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<b>Docket No.</b>	<b>Commenter Name and Affiliation</b>
<b>EPA-HQ-OAR-2010-0560</b>	
0053.I	John Pastore, Executive Director, Southern California Alliance of Publicly Owned Treatment Works (SCAP)
0054.I	Thomas J. Christofk, Air Pollution Control Officer, Placer County (California) Air Pollution Control District
0055.I	Treated Wood Council (TWC), submitted by Jeffrey T. Miller
0056.I	Christopher Lish, Private Citizen
0057 and 0089	John Smith, Private Citizen
0059.I	David M. Kiser, Vice President, Environmental, Health, Safety and Sustainability, International Paper
0060	Bill Gupton, Chair, Submitted on behalf of the Central Piedmont Group of the NC Chapter of the Sierra Club
0061.I	Christy Sammon, Director of Government and Regulatory Affairs, Submitted on behalf of Southeastern Lumber Manufacturers Association
0064.2	Gary T. Crawford, Chief Executive Officer, Eco-Power Generation
0066.I	Lecturer at U. of Michigan, submitted on his own behalf
0067	Barbara Warren, Executive Director, Citizens' Environmental Coalition
0068.I	Chris Matera, P.E., Massachusetts Forest Watch, Northampton, Massachusetts
0070.I	Farzie Shelton, Lakeland Electric (FL)
0071	Peter C. Sikora, Submitted on behalf of Giustina Resources
0072.I	John H. Diesch, Senior VP of Operations, Submitted on behalf of Rentech Inc.
0073	Elijah Morrison, Private Citizen
0074.I	William Stewart and Gary Nakamura, Forestry Specialists, Submitted on behalf of University of California, Berkeley
0075.I	Matthew Wolfe, Principal, Madera Energy, Inc.
0076.I	Pat Rasmussen, Coordinator, Submitted on behalf of World Temperate Rainforest Network
0077	Clarke Kahlo, Private Citizen
0078.I	Solid Waste Association of North America, submitted by John H. Skinner, Ph.D., on behalf of Solid Waste Association of North America.
0079.I	Edward Niblock, Director of Government Affairs, Submitted on behalf of Fibrowatt, LLC
0080.I (and 0137.I)	Cathy S. Woollums, Senior Vice President, Environmental Services and Chief Environmental Counsel, Submitted on behalf MidAmerica Energy Holdings Company
0081.I	David R. Williams, Director of Wastewater, Submitted on behalf of East Bay Municipal Utility District
0082.I	Shannon Binns & Joshua Martin, Submitted on behalf of the Environmental Paper Network

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<b>Docket No.</b> <b>EPA-HQ-OAR-2010-0560</b>	<b>Commenter Name and Affiliation</b>
0083.I	Douglas J. Fulle, Oglethorpe Power Corp.
0084.I	Carter Lee "Kerry" Kelly, Director, Federal Public Affairs, Waste Management (WM)
0085.I	Gregg Morris, Director, Green Power Institute
0086.I	Representative Larry Seaquist 26 <sup>th</sup> Legislative District of the State of Washington House of Representatives
0087.I	John R. "Doc" Holladay, Local Government Coalition for Renewable Energy
0090	Marion Huxtable, Member, Port Townsend Air Watchers
0091.2	Tom Bius, Chief Executive Officer (CEO), Growth Energy
0095.I	Erica Rhoad on behalf of Society of American Foresters (SAF)
0097	Michaelann Bewsee
0098	Sandra L. Herndon
0100	Polly S. Tarpley
0104	John Stainthorp
0105	Terry Wells
0110	Mark Hirshman
0113.I	Rasma I. Zvaners, Policy Director, Submitted on behalf of the American Bakers Association
0117	Tom Parrett
0118	Judith Castiano
0119	Bob Peckman
0124	Emmanuel Roux
0126	Deborah Soper
0127	Carol Fulcher Hepburn
0131.I	Scott P. Jones, CEO, Forest Landowners Association, Inc.
0132	Judith Canepa
0133.I	Brian J. Kernohan, Director of Policy, Forest Capital Partners, LLC
0134.I	Timothy Lee, Vice President of Legal and Public Affairs, Center for Individual Freedom (CFIF)
0135.I	Michale D. Ferguson, Indeck Energy Services
0136.I	Eric Carlson, Empire States Forest Products Association
0138.I	Audrae Erickson, President Submitted on behalf of the Corn Refiners Association
0141	Dr. Edo McGowan
0143	J. Gordon
0145	John Smith
0151	Linda Yow
0152	Peyton Bland

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<b>EPA-HQ-OAR-2010-0560</b>	
0153	John Witte
0156.I	Chris Hornback, Senior Director, Regulatory Affairs, Submitted on behalf of the National Association of Clean Water Agencies
0157.I	Kevin P. Bundy, Senior Attorney, Submitted on behalf of the Center for Biological Diversity
0163.I	Nathan L. Rudgers, 25X'25 National Steering Committee Member, Chair, Carbon Work Group
0173.I	Rachael Smolker, Biofuelwatch
0175	Tom Hougham
0176	Fran Prescott
0177	Steve Piragis
0179	Gary Greene, Private Citizen
0180	Matt Merritt, Private Citizen
0188	Sheri Staley, Private Citizen
0189.I	Darrin Ihnen, National Corn Growers Association (NCGA)
0190.I	Roger Johnson, President, National Farmers Union (NFU)
0191.I	Margaret E. Sheehan (Biomass Accountability Project), on behalf of Anti Biomass Incineration and Forest Production Campaign, Biomass Accountability Project, Stop Spewing Carbon Campaign, and Energy Justice Network et al. (total of 75 groups).
0192.I	David A. Buff., Golder Associates Incorporated on behalf of The Florida Sugar Industry (FSI)
0193.I (and 0323.I)	Traylor Champion, VP, Environmental Affairs, Submitted on behalf of Georgia Pacific
0194.I	Bob Dinneen, President & Chief Executive Officer (CEO), Submitted on behalf of Renewable Fuels Association
0195	Representative Lynn Kessler, 24 <sup>th</sup> Legislative District – State of Washington House of Representatives
0196	Representative Kevin Van De Wege, 24 <sup>th</sup> Legislative District – State of Washington House of Representatives
0203	Erin Harris
0205	Larry Lambeth
0207	David Reisner
0215	Nancy Goren, Private Citizen
0216	David Payne, Private Citizen
0217	Tina Clarke, Private Citizen
0219	Dr. Tom Neilson, Private Citizen

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<b>EPA-HQ-OAR-2010-0560</b>	
0221.I	Jim Gillingham, Valero Energy Corp.
0222.I	Chris M. Hobson, Chief Environmental Officer, Senior VP of Research & Environmental Affairs, Submitted on behalf of the Southern Company.
0222.2	Chris M. Hobson, Chief Environmental Officer, Senior Vice President, Research and Environmental Affairs, Southern Company [Southern]
0223.I	Christine O. Gregoire, Govenor and Peter Goldmark, Commissioner of Public Lands, State of Washington
0232	Steven Booher, Private Citizen
0244	Duff Badgley, Private Citizen
0247	Megan E. Drimal, Private Citizen
0251.I	Edward W. Repa, Ph.D. Director Environmental Programs, Submitted on behalf of National Solid Wastes Management Association
0256	Jeff Beardmore, Private Citizen
0257	Lois Kiraly
0258.I	Eric Myers, Submitted on behalf of Duke Energy Business Services, LLC
0259	Heidi K Omerza, Council Member, Submitted on behalf of the City of Ely
0260.I	Caroline Choi, Executive Director, Environmental Services and Strategy, Submitted on behalf of Progress Energy
0261.I	David P. Tenny, President and CEO, National Alliance of Forest Owners
0262.I	Dr. Jeffrey Morris, Sound Resource Management Group, Inc.
0263.I	Steven A. Hogg, Assistant Director of Public Utilities, Submitted on behalf of the City of Fresno
0264.I	Gregory M. Adams, Assistant Departmental Engineer, Air Quality Engineering , Technical Services Department, Los Angeles County Sanitation Districts
0265.I	C.L. "Butch" Otter and Christine O. Gregoire, Western Governor's Assoc.
0266.I	Duplicate of 0265.I
0267.I	Chris Reynolds, Vice President of Operations, Submitted on behalf of Phoenix Renewable Resources
0268.I	Brandon Ogilvie, Manager, IN Group Companies, LLC
0269.I	Thomas A. Love, Inland Empire Utilities Agency
0271.I	Utility Air Regulatory Group (UARG), submitted by Norman W. Fichthorn, Allison D. Wood, James W. Rubin, and Aaron M. Flynn, Hunton & Williams LLP, on behalf of UARG
0272.I	David Mickey, Blue Ridge Environmental Defense League
0273.I	Cheryl Johcox and Nathan Johnson, Buckeye Forest Council
0275.I	Niki Wuestenberg, Manager, Air Compliance, Republic Services

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<b>Docket No.</b> <b>EPA-HQ-OAR-2010-0560</b>	<b>Commenter Name and Affiliation</b>
0276	Brad S. Hicks, President and Chief Executive Officer (CEO), The Chamber of Medford/Jackson County
0277.I	Stephanie Batchelor, Biotechnology Industry Organization (BIO)
0278.I	Carol Whitman, Ph.D., Sr. Principal, Energy & Environmental Policy, Submitted on behalf of the National Rural Electric Cooperative Association.
0279.I	Reah Hale, American Forest & Paper Association's response to the EPA Call for Information: Information on GHG Emissions Associated with Bio-energy and Other Biogenic Sources
0280.I	Ellen B. Hawes, Forestry Policy Analyst and Peter Shattuck, Carbon Markets Policy Analyst, Environment Northeast (ENE)
0281.I	Michele L Somerday, Manager, Energy Policy, Submitted on behalf of FirstEnergy
0282	Jefferson H. Mayo, Ph.D., Director of Asset Management and Administration/Senior Vice President, RMK Timberland Group
0283	Philip Cantino
0288	Bart Bouricius
0293	John McCrossan, Private Citizen
0294	Darlene Kramer
0296	Sandra Kosterman
0300	Gail Gray
0302	Monte Martin
0303	John Terninko
0305	James Herron
0312	Dick Glick
0324.I	Fran Post, Private Citizen
0325.I	David J. Zaber, President and Resource Ecologist, Submitted on behalf of the Habitat Education Center
0326.I	Environmental Defense Fund (EDF), submitted by Steven Hamburg, Chief Scientist, on behalf of EDF
0360	Neil Tangri, Private Citizen
0362	Jan Kennedy, Private Citizen
0363	David Mcwethy, Private Citizen
0364	Linda Greene, Private Citizen
0365	Marian Cooley, Private Citizen
0366	O'Neill D. Louchard, Private Citizen
0368	Edward Mainland, Private Citizen
0369	Christopher W. Peniyar, Private Citizen
0370	Bernard Windham, Private Citizen
0371	Tom Kruzen, Private Citizen
0372	Melode Brewer, Private Citizen

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0373	Stephen Boyd, Private Citizen
0374	Janet Kennedy, Private Citizen
0381	Shawn Sargent
0392	Ross Petersen
0395	Todd Myers, Environmental Director, Submitted on behalf of the Washington Policy Center
0396	Paul Stamets, Private Citizen
0397	Lynne Pledger
0398	William A. H. Sammons, M.D.
0399	Lucille Bertuccio, President of the Center for Sustainable Living
0401	Pete Pasterz
0402	Tracey DeMiero
0403	Helen Lauritzen
0404	Dave Spencer
0407	Claudia Hurley, Private Citizen
0412	Lois Strum, Private Citizen
0424.1	John Stuhlmiller, Director of Government Relations, Submitted on behalf of Washington Farm Bureau
0425	Dennis Haldeman, Private Citizen
0426.1	Energy Recovery Council (ERC), submitted by Ted Michaels, President, on behalf of ERC
0427.1	Biomass Power Association (BPA), submitted by Robert Cleaves, President, on behalf of BPA; and Natural Resources Defense Council (NRDC), submitted by Frances Beinecke, President, on behalf of NRDC
0428	Eric Lombardi, Executive Director, Submitted on behalf of Eco-Cycle Inc.
0429	Gloria Griffith
0430.1	James Turnure, Manager, Environmental Policy, Submitted on behalf of Xcel Energy
0431	Samantha Chirillo, Co-Director, Submitted on behalf of Cascadia's Ecosystem Advocates
0432.1	Clean Air Task Force (CATF), Conservation Law Foundation, Natural Resources Council of Maine, Natural Resources Defense Council, Sierra Club, Southern Environmental Law Center
0433.1	Ann Ingerson, Resource Economist, The Wilderness Society
0434.1	Mike Jostrom, Director Renewable Resources, Submitted on behalf of the Plum Creek Timber Company
0435.1	Saritha Peruri, Manager of Business Development, Submitted on behalf of Ceres
0446.1	Frederick R. Eames, Hunton & Williams, Submitted on behalf of ADAGE

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0447.I	Brad Mitchell, Submitted on behalf of the Massachusetts Farm Bureau Federation, Inc.
0448	Gene Huguson, Commissioner, Minnesota Department of Agriculture, et al.
0449.I	Steven W. Koehn, President, Submitted on behalf of the National Association of State Foresters
0451.I	Russel K. Samara, Principal, Biomass Combustion Systems, Inc.
0452.I	Manning Feraci, Vice President of Federal Affairs, National Biodiesel Board (NBB)
0453	Suzanne Bangert, Administrator. Air & Waste Division. Wisconsin Department of Natural Resources (DNR).
0454.I and 0454.2	Dan Pellissier, Deputy Cabinet Secretary, Office of the Governor, State of California- Joint comments from three agencies: California Energy Commission (CEC), California Department of Forestry and Fire Protection (CAL FIRE), and California Air resources Board (CARB)
0455.I	Frank Rambo & David Carr, Southern Environmental Law Center, on behalf of Georgia ForestWatch (GFW), Wild Virginia (WV) and the Southern Environmental Law Center (SELC) (collectively referred to as "Commenters")
0456.I	Ernesto J Serrano, Director-Technical Services and Practices, Submitted on behalf of the United States Steel Corporation
0458	Dwight Fellman
0465	Nancy Lowell
0467	Karen Burroughs
0507.I	Stephen H. Kaiser, Private Citizen
0508	Richard Rosen, Ph.D, President, American Ag Energy, LLC
0509.I	Jay O'Laughlin, Ph.D., Professor of Forestry and Policy Sciences, Director of Policy Analysis Group, College of Natural Resources, University of Idaho
0510.I	Stephen A. Sears, Principal, Berkshire Renewable Power LLC
0511.I	Lisa Gomez, Director, Environmental Services, Sempra Energy Utilities for Southern California Gas Company (SCG) and San Diego Gas and Electric (SDG&E)
0512.I	Louis A. Zeller, Science Director, Blue Ridge Environmental Defense League
0513.I	Robert F. Cleaves, President and CEO, Biomass Power Association (BPA) and W. Phillip Reese, Chairman, California Biomass Energy Alliance (CBEA)
0514.I	Joe Seymour, Program Associate, Biomass Thermal Energy Council (BTEC)
0515.I	Brad Cooley, Director, Environmental Engineering, GDF SUEZ Energy Generation NA, Inc. (GSEGNA)

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<b>Docket No.</b>	<b>Commenter Name and Affiliation</b>
<b>EPA-HQ-OAR-2010-0560</b>	
0516.I	Michael DeBonis, Executive Director, The Forest Guild
0517.I	Carl Ross, Director, Save America's Forests
0518.I	Gene Hugoson (Co-Chair, NextGen Energy Board), Commissioner, Minnesota Department of Agriculture William Glahn, Director, Minnesota Office of Energy Security Mark Holsten, Commissioner, Minnesota Department of Natural Resources Paul Eger, Commissioner, Minnesota Pollution Control Agency
0519.I	Beth Nagusky, Acting Commissioner, Climate Program, Department of Environmental Protection, Bureau of Air Quality (State of Maine)
0520	Ananda Lee Tan, North American Program Coordinator, Global Alliance for Incinerator Alternatives (GAIA)
0522.I	Richard F. McMahon, Jr., Executive Director, Energy Supply, Edison Electric Institute (EEI)
0523.I	Jim King, Vice President, Natural Resources, The Westervelt Company
0524.I	Charles Thompson, GMO Renewable Resources LLC (GMORR)
0525	Ellen Moyer
0525.I	Ellen Moyer (Attachment)
0538.I	Peter Anderson, Executive Director, Submitted on behalf of the Center for a Competitive Waste Industry
0539.I	Richard J. Plevin and Michael O'Hare, Professor, Goldman School of Public Policy, University of California (Berkeley)
0540.I	Michael E. Van Brunt, P.E., Manager, Sustainability, Submitted on behalf of Covanta Energy
0541.I	Colim Hastings, VP, Submitted on behalf of the Tri-City Regional Chamber of Commerce
0542.I	John Engen, Mayor, Submitted on behalf of the city of Missoula, Montana
0543	Bob Perschel, Forest Guild
0544.I	Rob Davis, President, Forest Energy Corporation ,Submitted on behalf of Rural Voices for Conservation Coalition (RVCC)
0546.I	Tom Martin, President & CEO, Submitted on behalf of the American Forest Foundation
0547.I	Timothy D. Searchinger, Associate Research Scholar, Princeton University. Transatlantic Fellow, The German Marshall Fund of the U.S.
0548.I	Pamela F. Faggert, VP and Chief Environmental Officer, Submitted on behalf of Dominion Resources Services, Inc.
0558	Larry Gillen, Principal Engineer, GILLENgineering
0558.I	Larry Gillen, Principal Engineer, GILLENgineering
0559.I	William H. Schlesinger, President, Cary Institute of Ecosystem Studies

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<b>Docket No.</b>	<b>Commenter Name and Affiliation</b>
<b>EPA-HQ-OAR-2010-0560</b>	
0560.1	Angela D. Marconi, Project Manager, Delaware Solid Waste Authority (DSWA)
0561.1	Arthur (Butch) Blazer, New Mexico State Forester and Chair, Council of Western State Foresters (CWSF)
0562.1	Laura Knoth, Executive Director, Kentucky Corn Growers Association (KyCGA)
0563.1	Sara Schreiner Kendall, VP (Vice President), EHS and Sustainability, Weyerhaeuser Company (Technical correction to EPA-HQ-OAR-2010-0560-0274.1)
0566	Margaret E. Sheehan, Biomass Accountability Project et al.
0566.6	Margaret E. Sheehan, Biomass Accountability Project et al. Wood-Fueled Biomass Power Plants And CO <sub>2</sub> Emissions.
0566.7	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter from Ellen Moyer to Dwayne Breger, Director, Renewable and Alternative Energy Development, Massachusetts Department of Energy Resources.
0566.8	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter from Ellen Moyer to Secretary Ian Bowles regarding Greenhouse Gas Emissions Policy and Protocol
0566.9	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter from Ellen E. Moyer to Aisling Eglington, Massachusetts Executive Office of Energy and Environment Affairs, Massachusetts Environmental Policy Act (MEPA) Office regarding Notice of Project Change (NPC), Russell Biomass Incinerator, #13635
0566.13	Margaret E. Sheehan, Biomass Accountability Project et al.: Anti-Biomass Incineration/Forest Protection Campaign
0566.14	Margaret E. Sheehan, Biomass Accountability Project et al.: Anti-Biomass Incineration/Forest Protection Campaign
0566.17	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter from William H. Schlesinger et al.
0566.18	Margaret E. Sheehan, Biomass Accountability Project et al.: Anti-Biomass Incineration/Forest Protection Campaign
0566.21	Margaret E. Sheehan, Biomass Accountability Project et al.: Anti-Biomass Incineration/Forest Protection Campaign
0566.22	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter from Charles D. Connor, President and CEO, American Lung Association; re: target widespread pollutants that can both directly harm lung health of millions of Americans and worsen global climate change
0566.23	Margaret E. Sheehan, Biomass Accountability Project et al.: Anti-Biomass Incineration/Forest Protection Campaign
0566.24	Margaret E. Sheehan, Biomass Accountability Project et al.: Written Testimony in Opposition to the Building of the Palmer Renewable Energy Biomass Plant, presented by Massachusetts Breast Cancer Coalition held at Springfield Public Health Council on November 18, 2009

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<b>Docket No.</b>	<b>Commenter Name and Affiliation</b>
<b>EPA-HQ-OAR-2010-0560</b>	
0566.25	Margaret E. Sheehan, Biomass Accountability Project et al.: MMS Testimony in Support of House No. 4458, An Act to Limit Carbon Dioxide Emissions from Renewable and Alternative Energy Sources, presented by Massachusetts Medical Society before the Joint Committee on Telecommunications, Utilitites, and Energy
0566.26	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter from William Sammons, M.D., Board Certified Pediatrician et al; re: Health Effects of Biomass Burning Under S. 1733, Clean Energy Jobs and American Power Act
0566.27	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter from R.W. (Chip) Watkins, President, North Carolina Academy of Family Physicians
0566.28	Margaret E. Sheehan, Biomass Accountability Project et al.: Letter to Leif Hockstad, Climate Change Division, USEPA from Margaret E. Sheehan, Director, The Biomass Accountability Project; Kevin P. Bundy, Senior Attorney, Center for Biological Diversity; Mike Ewall, Founder and Director, Energy Justice Network; Ananda Lee Tan, North Amerian Program Coordinator, Global Alliance for Incinerator Alternatives; Eleanor Tillinghast, President, Green Berkshires, Inc.; Chris Matera, Founder, Massachusetts Forest Watch;
0566.29	Request for Correction of Information Disseminated by the Environmental Protection Agency Regarding Emissions from Biomass Combustion in the Inventory of U.S. Greenhouse Gas Emissions and Sinks. Prepared by the Center for Biological Diversity
0566.30	Letter from Nathaniel Lawrence, Senior Attorney, National Resources Defense Council (NRDC); re: Draft Programmatic Environmental Impact Statement for the Biomass Crop Assistance Program, availability announced at 74 Fed Reg 39915 (August 10, 2009).
0566.31	Letter to Geo-Marine, Inc. from Nathaniel Lawrence, National Resources Defense Council (NRDC); National Sustainable Agriculture Coalition (NSAC); Biomass Accountability Project (BAP); re: Final Programmatic Environmental Impact Statement for the Biomass Crop Assistance Program (BCAP)
0566.32	Letter to Director of CEPD, USDA FSA CEPD from Nathaniel Lawrence, Senior Attorney, National Resources Defense Council (NRDC); re: Proposed Biomass Crop Assistance Program (BCAP) Rule, 7 CFR Part 1450
0566.34	Letter to Senator Deborah Stabenow, from Dr. Williams Sammons, Ecolaw; re: concerns about the negative effects of biomass combustion on the health of children in this country
0567.1	Margaret E. Sheehan, Biomass Accountability Project et al. Exhibit 22a: Biomass Busters, Volume I Issue 4, August 2010
0567.2	Margaret E. Sheehan, Biomass Accountability Project et al. Exhibit 22b: Biomass Busters, Volume I Issue 3, July 2010

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<b>Docket No. EPA-HQ-OAR-2010-0560</b>	<b>Commenter Name and Affiliation</b>
0568.4	Margaret E. Sheehan, Biomass Accountability Project et al. Exhibit 23: Letter to President Obama, Senator Harry Reid, and Representative Nancy Pelosi on July 29, 2010
0568.7	Margaret E. Sheehan, Biomass Accountability Project et al. Exhibit 20b: Letter to Senator Max Baucus, Chair, Finance Committee, U.S. Senate
0569.2	Margaret E. Sheehan, Biomass Accountability Project et al. Exhibit 20dd: Close the biomass loophole, in the Renewable Portfolio Standard
0569.3	Margaret E. Sheehan, Biomass Accountability Project et al. Exhibit 20e: Letter to Senators Max Baucus and Charles E. Grassley and Members of the Finance Committee, February 25, 2010
0570.1	Margaret E. Sheehan, Biomass Accountability Project et al. Attachment: Biomass Buster, Volume I Issue 2, June 2010
0570.2	Margaret E. Sheehan, Biomass Accountability Project et al. Attachment: Biomass Buster, Volume I Issue 1, May 2010
0570.3	Margaret E. Sheehan, Biomass Accountability Project et al. Attachment: Biomass Busters, Volume I Issue 5, September 2010
0572.1	Margaret E. Sheehan, Biomass Accountability Project et al.
0577	Michael Carrigan
0580.1	Laurie Burt, Commissioner, Massachusetts Department of Environmental Protection
0581	Ronald Saff
0583	Kathryn S. Blake
0602	Sheldon Rouse
0611	Cassie M. Smith
0612	Shawn Porter
0613	Marlene Pospeck
0620	Kathy Jonas, Private Citizen
0621	Joe Breskin, Private Citizen
0622	Joe Suligoy, Private Citizen
0623	Glen Ayers, Private Citizen
0624	Audrey Moore, Private Citizen
0625	Michelle McCormick, Private Citizen
0629	William and Marvalynn Cromwell, Private Citizens
0636	Sandy Sherer, Private Citizens
0639	Hazel Dawkins, Private Citizens
0641.1	Stephen A. Sears, Submitted on behalf of Berkshire Renewable Power, LLC
0643	Joseph M. Cloutier, President & CEO, Renewable Energy Fuels, LLC, RE-Gen, LLC

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## **Appendix D: Summary of References Provided by Commenters**

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**Table D-1: Bibliographic Reference to Articles, Technical Papers, and Other Reference Materials Provided by Commenters**

<b>Docket No. EPA-HQ-OAR-2010-0560</b>	<b>Affiliation</b>	<b>Bibliographic Reference</b>
0024.1	University of Maine	Greenhouse Impact Due to the Use of Combustible Fuels: Life Cycle Viewpoint and Relative Radiative Forcing Commitment
0024.2	University of Maine	Energy- and greenhouse gas-based LCA of biofuel and bioenergy systems: Key issues, ranges and recommendations
0024.3	University of Maine	LCA of domestic and centralized biomass combustion: The case of Lombardy (Italy)
0024.4	University of Maine	The feasibility of renewable energies at an off-grid community in Canada
0024.5	University of Maine	Life cycle assessment of fuels for district heating: A comparison of waste incineration, biomass- and natural gas combustion
0035.2	California Forestry Association	A Roadmap for the Development of Biomass in California. Draft Roadmap Discussion Document. Pier Collaborative Report; Report prepared by California Energy Commission; CEC-500-2006-095-D
0035.3	California Forestry Association	Forest treatment residues for thermal energy compared with disposal by onsite burning: Emissions and energy return.
0035.4	California Forestry Association	The Value of the Benefits of U.S. Biomass Power. Contract No-DE-AC36-99-GO10337. Report prepared by G. Morris, Green Power Institute for the National Renewable Energy Laboratory (NREL); NREL/SR-570-27541
0035.5	California Forestry Association	Clean and Diversified Energy Initiative; Biomass Task Force Report. Report prepared by Western Governors' Association
0035.6 and 0054.1	California Forestry Association, and Placer County (California) Air Pollution Control District	B. Springsteen, T. Christofk, S. Eubanks, T. Mason, C. Clavin, B. Storey. 2010. Emission Reductions from Woody Biomass Waste for Energy as an Alternative to Open Burning. Air and Waste Management Journal, in review. (Copyrighted)
0035.7	California Forestry Association	Biomass to Energy: Forest Management for Wildlife Reduction, Energy Production, and Other Benefits. Report prepared by Pacific Southwest Research Station, USDA Forest Service for the California Energy Commission. CEC-500-2009-080
0035.8	California Forestry Association	Bioenergy and Greenhouse Gases. Report prepared by Gregg Morris, Green Power Institute, The Renewable Energy Program of the Pacific Institute for the U.S. Forest Service

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0044.4	Iowa DNR	2009 Greenhouse Gas Emissions from Selected Iowa Source Categories, Iowa Department of Natural Resources, August 31, 2010
0054.1	Placer County (California) Air Pollution Control District	Biomass for Energy Project Reporting Protocol: GHG Emission Reduction Accounting. May 2009.
0054.1	Placer County (California) Air Pollution Control District	Forest Biomass Removal On National Forest Lands: First Progress Report. November 17, 2008.
0055.1	Treated Wood Council	Creosote Treated Ties: An End of Life Tie Evaluation, by Steve Smith and Chris Bolin; Crossties, March–April 2010, p. 8–10.
0066.2	John M. DeCicco	DeCicco, J. Addressing Biofuel GHG Emissions in the Context of a Fossil Fuel-Based Carbon Cap: Discussion Paper”, October, 2009.
0066.3	John M. DeCicco	DeCicco, J. “Toward Rational Management of GHG Emissions from Biofuels: Working Paper”. July 2010
0067.1	Citizens' Environmental Coalition	Waste Impacts Climate Change. Prepared for NY Zero Waste Alliance, managed by Citizens' Environmental Coalition.
0067.2	Citizens' Environmental Coalition	Re: Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2008
0067.3	Citizens' Environmental Coalition	Beyond Business as Usual: Investigating a Future without Coal and Nuclear Power in the United States. Prepared by Synapse Energy Economics for the Civil Society Institute.
0068.2	Massachusetts Forest Watch	Letter to The Honorable Nancy Pelosi, Speaker, U.S. House of Representatives and The Honorable Harry Reid, Majority Leader, United States Senate regarding importance of accurately accounting for carbon dioxide emissions from bioenergy in any law or regulation designed to reduce greenhouse gas emissions from energy use.
0068.3	Massachusetts Forest Watch	T.D. Searchinger, et al, Fixing a Critical Climate Accounting Error, Science 326:527–528. (October 2009) <a href="http://www.sciencemag.org/cgi/content/summary/326/5952/527">http://www.sciencemag.org/cgi/content/summary/326/5952/527</a>
0068.4	Massachusetts Forest Watch	Nunery, J. and Keeton, W. 2010. Forest carbon storage in the northeastern United States: Net effects of harvesting frequency, post-harvest retention, and wood products. Forest Ecology and Management 259: 1363–1375
0068.5 and 0158.1	Massachusetts Forest Watch, and Center for Biological Diversity	Johnson, E. 2009. Goodbye to carbon neutral: Getting biomass footprints right. Environmental Impact Assessment Review 29: 165–168.

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0068.6	Massachusetts Forest Watch	Massachusetts Environmental Energy Alliance, prepared by Mary S. Booth. (2009) Biomass Briefing, October 2009. Available at: <a href="http://www.massenvironmentalenergy.org">www.massenvironmentalenergy.org</a>
0068.7	Massachusetts Forest Watch	Mass. Study: Wood Power Worse Polluter Than Coal, Associated Press, June 11, 2000 <a href="http://www.wbur.org/2010/06/11/wood-power-plants">http://www.wbur.org/2010/06/11/wood-power-plants</a>
0068.8 and 0173.2	Massachusetts Forest Watch, and Biofuelwatch	BirdLife International. 2010. Bioenergy: a carbon accounting time bomb. June 2010. Available at: <a href="http://www.birdlife.org/eu/EU_policy/Biofuels/carbon_bomb.html">http://www.birdlife.org/eu/EU_policy/Biofuels/carbon_bomb.html</a>
0068.9	Massachusetts Forest Watch	Massachusetts Medical Society. 2009. Massachusetts Medical Society adopts policy opposing biomass power plants. News from the Massachusetts Medical Society, December 9, 2009.
0068.10	Massachusetts Forest Watch	Testimony of James K. C. Wang, M.D., F.A.C.O.G., C.C.D., Physician and President of the Hampden District Medical Society, West Springfield, Massachusetts. October 14, 2009.
0068.11	Massachusetts Forest Watch	Physicians For Social Responsibility. 2010. Physicians For Social Responsibility/Pioneer Valley Oppose Construction of Biomass Power Plants In The Pioneer Valley. February 4, 2010.
0087.2	Local Government Coalition for Renewable Energy	Kaplan, P. O., J. DeCarolis, and S. Thorneloe, 2009. Is It Better To Burn or Bury Waste for Clean Electricity Generation? Environ. Sci. Technol., 43 (6), 1711–1717.
0087.3	Local Government Coalition for Renewable Energy	Life after Fresh Kills: Policy, Technical and Environmental Considerations. Earth Engineering Center and Urban Habitat Project, Columbia University, December 1, 2001
0087.4	Local Government Coalition for Renewable Energy	Bogner, J., M. Abdelrafie Ahmed, C. Diaz, A. Faaij, Q. Gao, S. Hashimoto, K. Mareckova, R. Pipatti, T. Zhang, Waste Management, In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (eds)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
0087.5	Local Government Coalition for Renewable Energy	World Economic Forum, “Green Investing: Toward a Clean Energy Infrastructure,” January 2009, at <a href="http://www.weforum.org/pdf/climate/Green.pdf">http://www.weforum.org/pdf/climate/Green.pdf</a> .
0087.6	Local Government Coalition for Renewable Energy	UNFCCC/CCNUCC. Revision to the approved baseline methodology AM0025 version 06, AM0025 / Version 07. Sectoral Scope 01 & 13.
0087.7	Local Government Coalition for Renewable Energy	The Earth Institute at Columbia University, 2007. Global Roundtable on Climate Change. The Path to Climate Sustainability: A Joint Statement by the Global Roundtable on Climate Change. February 20, 2007

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0088.1	Local Government Coalition for Renewable Energy	Rick Brandes, Energy Recovery Branch, Office of Resource Conservation and Recovery. Presentation on EPA's Energy Recovery Inventory.
0088.2	Local Government Coalition for Renewable Energy	Themelis Nickolas, "The Role of Waste-to-Energy in the U.S.A.", Waste-to-Energy Research and Technology Council (WTERT), Paper presented at 3rd Congress of the Confederation of European WTE Plant, (CEWEP), Vienna, May 2006)
0088.3	Local Government Coalition for Renewable Energy	Psomopoulos, C.S., Bourkab, A., Themelis, N.J., "Waste-to-energy: A review of the status and benefits in USA" Waste Management 29 (2009) 1718–1724. (Copyright)
0088.4	Local Government Coalition for Renewable Energy	Brettler Berenyi, Eileen, "Recycling and Waste-to-Energy: Are They Compatible?", Governmental Advisory Associates, Inc., June 2009.
0088.5	Local Government Coalition for Renewable Energy	Powell, Jimmie, "Climate Change and Renewable Energy", Presentation by The Nature Conservatory, Covanta, February 11, 2009.
0089.1	John Smith	Walsh, Bryan, "What you can do - Sorry, That Mask Won't Help" (Copyright)
0091.1	Growth Energy	Modification of GBAMM to Include ICM/Econergy by Mike Huisenga, WSP Environment & Energy and Bill Roddy, ICM
0095.2 and 0194.2	Society of American Foresters, and Renewable Fuels Association	Attachment: Letter to Henry Waxman, House Energy and Commerce Committee; Colin Peterson, House Agriculture Committee; Nick Rahall, House Natural Resources Committee; Joe Barton, House Energy and Commerce Committee; Frank Lucas, House Agriculture Committee; and Doc Hastings, House Natural Resources Committee; from Bruce Lippke, Past President of the Consortium for Research on Renewable Industrial Materials (CORRIM), Professor Emeritus, University of Washington, et al
0095.3 and 0194.2	Society of American Foresters, and Renewable Fuels Association	Attachment: Letter to Barbara Boxer, Senate Environment and Public Works Committee; Jeff Bingaman, Senate Energy and Natural Resources Committee; Blanche Lincoln, Senate Agriculture Committee; James Inhofe, Senate Environment and Public Works Committee; Lisa Murkowski, Senate Energy and Natural Resources Committee; and Saxby Chambliss, Senate Agriculture Committee from Bruce Lippke, Past President of the Consortium for Research on Renewable Industrial Materials (CORRIM), Professor Emeritus, School of Forest Resources, University of Washington, et al

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0158.I	Center for Biological Diversity	Gregory P. Asner, et al., <i>High-Resolution Forest Carbon Stocks and Emissions in the Amazon</i> , PROC. NAT'L ACADEMY OF SCI. EARLY EDITION, available at <a href="http://www.pnas.org/content/early/2010/08/30/1004875107">http://www.pnas.org/content/early/2010/08/30/1004875107</a> (last visited Sept. 12, 2010). (Copyrighted)
0158.I	Center for Biological Diversity	Michael G. Ryan, et al., <i>A Synthesis of the Science on Forests and Carbon for U.S. Forests</i> , Ecological Society of America: Issues in Ecology, Report No. 13 (Spring 2010). (Copyrighted)
0158.I	Center for Biological Diversity	Matthew C. Hansen, et al., <i>Quantification of Global Gross Forest Cover Loss</i> , 107 PROC. NAT'L ACADEMY OF SCI. 8650 (May 11, 2010). (Copyrighted)
0158.I	Center for Biological Diversity	Jerry M. Melillo, et al., <i>Indirect Emissions from Biofuels: How Important?</i> SCIENCEEXPRESS 10.1126/science.1180251 (Oct. 22, 2009). (Copyrighted)
0158.I and 0173.6	Center for Biological Diversity, and Biofuelwatch	Wise, M., Calvin, K., Thomson, A., Clarke, L., Bond-Lamberty, B., Sands, R., Smith, S.J., Janetos, A., and Edmonds, J. 2009. Implications of Limiting CO <sub>2</sub> Concentrations for Land Use and Energy. <i>Science</i> , 324: 1183–1186. (Copyrighted)
0158.I	Center for Biological Diversity	World Res. Inst., <i>State of the World's Forests</i> (Jan. 8, 2009), at <a href="http://www.wri.org/map/state-worlds-forests">http://www.wri.org/map/state-worlds-forests</a> (last visited Sept. 12, 2010). (Copyrighted)
0158.I	Center for Biological Diversity	COMMITTEE ON STABILIZATION TARGETS FOR ATMOSPHERIC GREENHOUSE GAS CONCENTRATIONS; NATIONAL RESEARCH COUNCIL, <i>STABILIZATION TARGETS FOR ATMOSPHERIC GREENHOUSE GAS CONCENTRATIONS</i> (National Academies Press 2010) (excerpts). (Copyrighted)
0159.I and 0173.4	Center for Biological Diversity, and Biofuelwatch	Mary S. Booth, <i>Review of the Manomet Biomass Sustainability and Carbon Policy Study</i> (July 2010). Prepared for the Clean Air Task Force. 23 pp. (Copyrighted)
0159.I	Center for Biological Diversity	Tara Hudiburg, et al., <i>Carbon Dynamics of Oregon and Northern California Forests and Potential Land-Based Carbon Storage</i> , 19 ECOLOGICAL APPLICATIONS 163 (2009). (Copyrighted)
0159.I	Center for Biological Diversity	Mark E. Harmon, et al., <i>Effects of Partial Harvest on the Carbon Stores in Douglas-fir/Western Hemlock Forests: A Simulation Study</i> , 12 ECOSYSTEMS 777 (2009). (Copyrighted)
0159.I and 0566.12	Center for Biological Diversity, and Biomass Accountability Project	B. M. Depro, B. C. Murray, R. J. Alig, A. Shanks, 2008. Public land, timber harvests, and climate mitigation: Quantifying carbon sequestration potential on U.S. public timberlands. <i>Forest Ecology and Management</i> 255:1122–1134. (Copyrighted)

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0159.I	Center for Biological Diversity	Robert Jandl, et al., <i>How Strongly Can Forest Management Influence Soil Carbon Sequestration?</i> , 137 GEODERMA 253 (2007). (Copyrighted)
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0160.I	Center for Biological Diversity	CHAD HANSON, THE MYTH OF "CATASTROPHIC" WILDFIRE: A NEW ECOLOGICAL PARADIGM OF FOREST HEALTH (2010). (Copyrighted)
0160.I and 0173.5	Center for Biological Diversity, and Biofuelwatch	Giuliana Zanchi et al., <i>The Upfront Carbon Debt of Bioenergy</i> (May 2010). Joanneum Research. Austria. 54pp. (Copyrighted)
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0161.I	Center for Biological Diversity	IAN ALLISON, ET AL., <i>THE COPENHAGEN DIAGNOSIS: UPDATING THE WORLD ON THE LATEST CLIMATE SCIENCE</i> (2009). (Copyrighted)
0161.I	Center for Biological Diversity	M. den Elzen & N. Höhne, <i>Reductions of Greenhouse Gas Emissions in Annex I and Non-Annex I Countries for Meeting Concentration Stabilisation Targets</i> , 91 CLIMATIC CHANGE 249 (2008). (Copyrighted)
0161.I	Center for Biological Diversity	M. O'Hare et al., <i>Proper Accounting for Time Increases Crop-Based Biofuels' Greenhouse Gas Deficit Versus Petroleum</i> , 4 ENVTL. RESEARCH LETT. 024001 (2009). (Copyrighted)
0161.I	Center for Biological Diversity	U.S. EPA, <i>EPA Lifecycle Analysis of Greenhouse Gas Emissions from Renewable Fuels</i> (2009). (Copyrighted)

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0161.1	Center for Biological Diversity	Cal. Energy Comm'n, California Energy Demand 2010–2020: Adopted Forecast, Report No. CEC-200-2009-012-CMF (Dec. 2009) (Exec. Summ.). (Copyrighted)
0161.1	Center for Biological Diversity	Sierra Pacific Indus., Media Release, <i>Sierra Pacific Industries to Close its Loyalton, CA Power Plant</i> (Aug. 20, 2010). ,(Copyrighted)
0161.1	Center for Biological Diversity	Garrett W. Meigs, et al., <i>Forest Fire Impacts on Carbon Uptake, Storage, and Emission: The Role of Burn Severity in the Eastern Cascades, Oregon</i> , 12 ECOSYSTEMS 1246 (2009). (Copyrighted)
0161.1	Center for Biological Diversity	Garrett W. Meigs and John L. Campbell, <i>Comment on “Prescribed Fire As a Means of Reducing Forest Carbon Emissions in the Western United States”</i> 44 ENVTL. SCI. & TECH. 6250 (2010) (prepublication version). (Copyrighted)
0189.2	National Corn Growers Association	Adviento-Borbe, M.A.A., Haddix, M.L., Binder, D.L., Walters, D.T. and Dobermann, A. 2007. Soil greenhouse gas fluxes and global warming potential in four high-yielding maize systems. <i>Global Change Biology</i> , 13: 1972–1988.
0189.3	National Corn Growers Association	Renewable Fuels Association. What do biofuels displace and why does it matter?
0189.4	National Corn Growers Association	Wang, M. and Haq, Z. 2008. Letter to <i>Science</i> .
0189.5	National Corn Growers Association	McLaren, J. (StrathKirk Inc.). Water Utilization: An Analytical White Paper. Prepared for NCGA.
0194.2	Renewable Fuels Association	Attachment: two figures produced by RFA; 1. Fossil Fuel Carbon Cycle, 2. Biofuels Carbon Cycle.
0194.2	Renewable Fuels Association	Attachment: Power Point presentation by K.L. Kline, V.H. Dale, and R. Graham (Oak Ridge National Laboratory). Global Land-Use Issues. Presented at 5 <sup>th</sup> Annual Forum of the California Biomass Collaborative Bioenergy Sustainability and Lifecycle Analysis, May 29, 2008. Sacramento, CA.
0194.2	Renewable Fuels Association	Kline, K.L.(Center for Bioenergy Sustainability, Oak Ridge National Laboratory). 2010. Challenges for Bioenergy Emission Accounting (E-letter).
0194.2	Renewable Fuels Association	Dale, B. Carbon Accounting for Bioenergy (letter).
0194.2	Renewable Fuels Association	Urbanchuk, J.M. 2010. Contribution of the ethanol industry to the economy of the United States. Prepared for Renewable Fuels Association.

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0279.1	American Forest and Paper Association	<i>Environmental aspects of wood residue combustion in FPI boilers</i> , by Arun V. Someshwar, Jay P. Unwin, William Thacker, Laurel Eppstein and Barry Malmberg
0324.1	Fran Post	Fran Post, A letter to the Editor
0433.2	The Wilderness Society	Fuel treatment effects on tree-based forest carbon storage and emissions under modeled wildfire scenarios by Matthew Hurteau and Malcolm North. <i>Front Ecol Environ</i> 2009; 7, doi:10.1890/080049
0433.5	The Wilderness Society	Discussion Paper (DP8): Eastside Climate Change, Forest Health, Fire and Carbon Accounting
0433.6	The Wilderness Society	The greenhouse gas value of ecosystems by Kristina J. Anderson-Teixeira and Evan H. Delucia.
0434.2	Plum Creek Timber Company	Biomass Cofiring: A Near Term Emissions Reduction Strategy for Coal Fired Power Plants; white paper by Decker "Garman" Sullivan, submitted by Plum Creek Timber Company
0519.1	Maine DEP	Letter from David P. Littell, Commissioner, State of Maine Department of Environmental Protection to Phil Giudice, Commissioner , Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs, Department of Energy Resources dated August 12, 2010
0548.1	Dominion Resources Services	ICF International. <i>Final Report: Carbon-Neutrality of Biomass Power Generation: Scientific and Economic Analysis</i> , September 13, 2010
0566.1	Biomass Accountability Project	D. Ciplet, 2009. An Industry Blowing Smoke. Global Alliance for Incinerator Alternatives (GAIA).
0566.2	Biomass Accountability Project	B. Platt, D. Ciplet, K. M. Bailey and E. Lombardi, 2008. Stop Trashing the Climate. Institute for Local Self-Reliance. June 2008.
0566.3	Biomass Accountability Project	EPA. Appendix E: Greenhouse Gas Emissions.
0566.4	Biomass Accountability Project	Biomass Gas & Electric. Biomass Gas & Electric: About Us. Web Page. Accessed online at: <a href="http://www.biggreenenergy.com/Default.aspx?tabid=2886">http://www.biggreenenergy.com/Default.aspx?tabid=2886</a>
0566.10	Biomass Accountability Project	Draft Permit - Air Permit No. 0010131-001-AC for Gainesville, Florida Biomass
0566.11	Biomass Accountability Project	Project DEP File No. 0010131-001-AC (PSD-FL-411) 100 Megawatts (net) Woody Biomass Power Plant
0566.16	Biomass Accountability Project	G.Zhou, S. Liu, Z. Li, D. Zhang, X. Tang, Ch. Zhou, J. Yan, J. Mo, 2006. Old-Growth Forests Can Accumulate Carbon in Soils. <i>Science</i> 314:1417.

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0566.19	Biomass Accountability Project	Save America's Forests Fact Sheet: National Forests, Climate Change and Carbon Sequestration
0566.20	Biomass Accountability Project	Fact Sheet: Biomass Incineration.
0566.33	Biomass Accountability Project	Fixing BCAP (Biomass Crop Assistance Program ): Key Steps to Prompt, Prudent, and Lawful Implementation
0566.35	Biomass Accountability Project	Due Diligence on Biomass Combustion. Prepared by William A. H. Sammons, M.D.
0568.1	Biomass Accountability Project	[Exhibit 2I] USDA American Recovery and Reinvestment Act Green Energy-Wood to Energy
0568.2	Biomass Accountability Project	[Exhibit 2Ia] Florida, Mississippi Biomass Projects Move Forward
0568.2	Biomass Accountability Project	[Exhibit 2Ia] Biomass Plant Moving Ahead; PSJRA Poised for Expansion
0568.3	Biomass Accountability Project	[Exhibit 2Ib] Operating, Proposed and Expanding - Wood Incinerators in the US 2010 – Copyrighted Material
0568.6	Biomass Accountability Project	[Exhibit 16] Letter to Phillip Giudice, Commissioner, Department of Energy Resources)
0571.2	Biomass Accountability Project	[Exhibit 20d] IRS Ruling Part III - Administrative, Procedural, and Miscellaneous