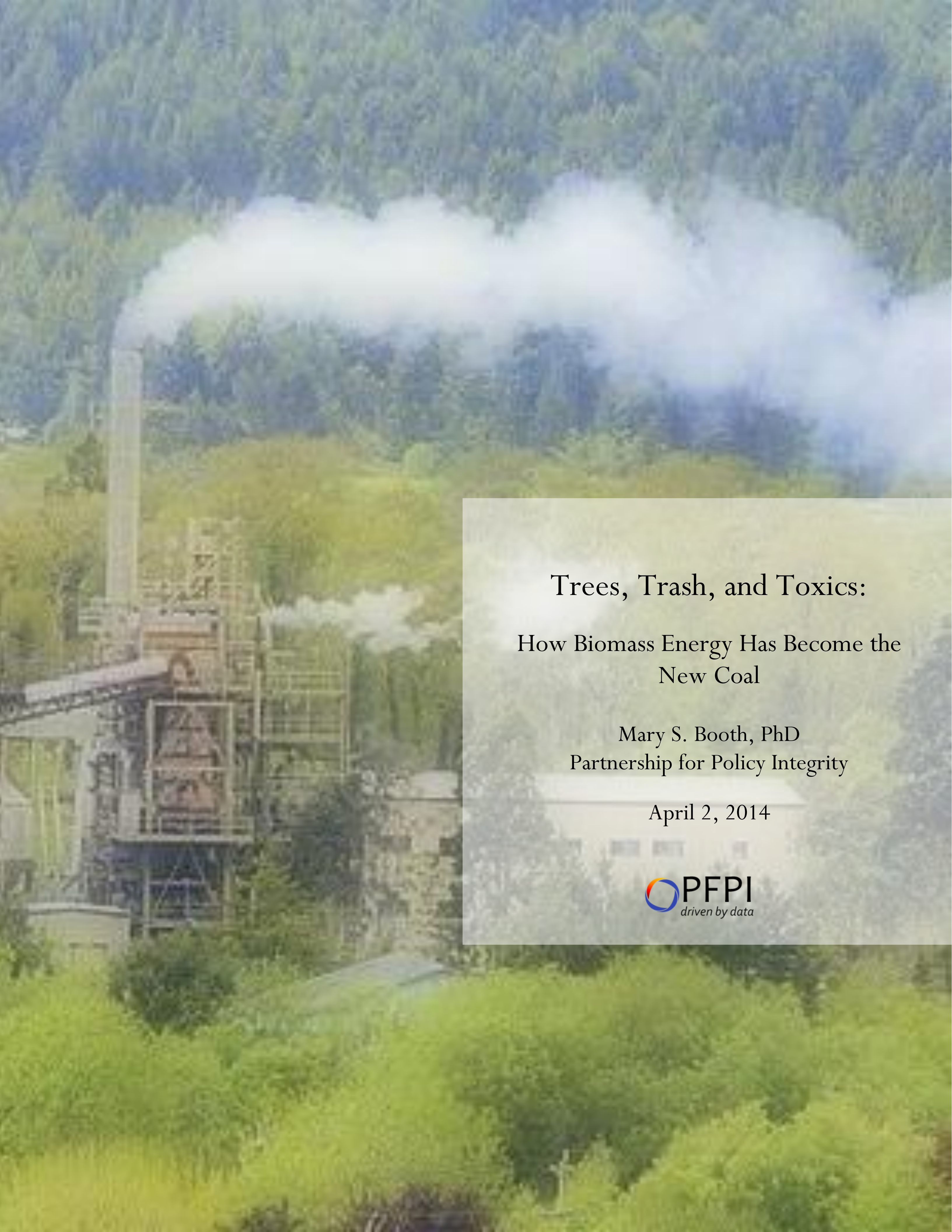

Trees, Trash, and Toxics:

How Biomass Energy Has Become the New Coal

Mary S. Booth, PhD
Partnership for Policy Integrity

April 2, 2014

PFPI
driven by data

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Cover photo from Jim Driscoll, "Blue Lake Power plant smokes out city." Eureka Times Standard. 4/30/2010. http://www.times-standard.com/localnews/ci_14990142

"District Air Pollution Control Officer Rick Martin said that an inspector was at the plant most of Thursday morning. Martin said the smoke was wood smoke and may be annoying, but it was not dangerous. "We don't really have the authority to shut them down unless it's an imminent danger to public health," Martin said, "and it's not a danger to public health."

For some, it was at least unbearable. Resident Curtis Thompson said that thick, brown smoke had been pouring out of the plant's stack since 7 a.m. Thursday, and it got bad enough that he drove his child out of the area."

Executive Summary

Highlights

The biomass power industry is undergoing a new surge of growth in the United States. While bioenergy has traditionally been used by certain sectors such as the paper-making industry, more than 70 new wood-burning plants have been built or are underway since 2005, and another 75 proposed and in various stages of development, fueled by renewable energy subsidies and federal tax credits. In most states, biomass power is subsidized along with solar and wind as green, renewable energy, and biomass plant developers routinely tell host communities that biomass power is "clean energy."

But this first-ever detailed analysis of the bioenergy industry reveals that the rebooted industry is still a major polluter. Comparison of permits from modern coal, biomass, and gas plants shows that a even the "cleanest" biomass plants can emit > 150% the nitrogen oxides, > 600% the volatile organic compounds, > 190% the particulate matter, and > 125% the carbon monoxide of a coal plant per megawatt-hour, although coal produces more sulfur dioxide (SO_2). Emissions from a biomass plant exceed those from a natural gas plant by more than 800% for every major pollutant.

Biomass power plants are also a danger to the climate, emitting nearly 50 percent more CO_2 per megawatt generated than the next biggest carbon polluter, coal. Emissions of CO_2 from biomass burning can theoretically be offset over time, but such offsets typically take decades to fully compensate for the CO_2 rapidly injected into the atmosphere during plant operation.

Compounding the problem, bioenergy facilities take advantage of gaping loopholes in the Clean Air Act and lax regulation by the EPA and state permitting agencies, which allow them to emit even more pollution. Electricity generation that worsens air pollution and climate change is not what the public expects for its scarce renewable energy dollars.

<u>Our examination of 88 air emissions permits from biomass power plants found:</u>

- Although biomass power plants emit more pollution than fossil fueled plants, biomass plants are given special treatment and are not held to the same emissions standards. A double standard written into the Clean Air Act allows biomass power plants to emit two and a half times more pollution (250 tons of a criteria pollutant) than a coal plant (where the threshold is 100 tons) before being considered a "major" source that triggers protective measures under the Clean Air Act's Prevention of Significant Deterioration (PSD) program – even though the pollutants, and their effects, are the same.

- Almost half of the 88 biomass facilities we analyzed avoided PSD permitting altogether by claiming they will be "synthetic minor" sources, even though in many cases their size indicates that they should be regulated as major sources of pollution, subject to the PSD program. Minor source permits are issued by the states and contain none of the protective measures required under federal PSD permitting. Despite the widespread use of this endrun around pollution restrictions, the EPA chooses not to review most state-issued minor source permits.

- The biomass power industry is increasingly burning contaminated fuels, blurring the lines between renewable energy that has been portrayed as "clean," and waste incineration. While most biomass power plants burn forest wood as fuel, the majority of the permits we reviewed also allowed burning waste wood, including construction and demolition debris. EPA rules allow biomass plants to emit more heavy metals and other hazardous air pollutants (HAPs) than both coal plants and waste incinerators, and again, the use of "synthetic minor" status is widespread, with facilities of all sizes claiming to be minor sources for HAPs with little support, verification, or proof. An EPA rollback on regulation that allows more contaminated wastes to be burned as biomass, rather than disposed of in waste incinerators with more restrictive emissions limits on air toxics, will only increase toxic emissions from the bioenergy industry.

Because of this perfect storm of lax regulation and regulatory rollbacks, biomass power plants marketed as "clean" to host communities are increasingly likely to emit toxic compounds like dioxins; heavy metals including lead, arsenic, and mercury; and even emerging contaminants, like phthalates, which are found in the "waste-derived" fuel products that are being approved under new EPA rules. Permissive emission standards for biomass plants mean that these pollutants can be emitted at higher levels than allowed from actual waste incinerators. As such, it is not a stretch to conclude that biomass plants being permitted throughout the country combine some of the worst emissions characteristics of coal-fired power plants and waste incinerators, all the while professing to be clean and green.

Detailed findings

Biomass power plants are disproportionately polluting not just because of their low efficiency (in converting heat to electrical output) and high emissions inherent in burning wood for energy, but also because the bioenergy industry exploits and actually depends on important loopholes in the Clean Air Act and its enforcement, loopholes that make bioenergy far more polluting than it would be if it were regulated like fossil fuels. Our review of 88 air permits of biomass power plants tabulated information on facility size, fuel use, pollution control technology, and allowable emissions. Some of the facility permits were issued under the Prevention of Significant Deterioration (PSD) program in the Clean Air Act, which requires "major sources" of pollution to reduce emissions by conducting a the Best Available Control Technology (BACT) analysis, and also requires facilities to conduct air quality modeling that assesses whether they will violate EPA's air quality standards and threaten health.

We contrasted permits that had gone through PSD with permits for "minor" sources, which are issued by the states and local agencies with little to no EPA (and public) oversight and contain none of the measures that PSD permits require to nominally protect air quality. We found that permits issued by states allowed biomass power plants to emit about twice as much pollution as plants with permits issued under the PSD program, and that state-issued minor source permits also dodged controls on high rates of emissions, for instance during plant startup and shutdown when pollution controls are frequently bypassed. Periods of intense emissions from facilities can present an elevated health risk because even short episodes of elevated air pollution are associated with acute adverse health effects such as asthma attacks, heart attacks, and stroke.

Loophole 1: Biomass plants can emit more pollution before triggering federal permitting

The biggest factor allowing bioenergy facilities to receive lax state-level minor source permits instead of PSD permits is a key loophole in the Clean Air Act that gives special treatment to biomass plants. While fossil-fueled power plants are considered major sources that are required to go through PSD if they emit 100 tons of a pollutant per year, a biomass plant is allowed to emit 250 tons of a pollutant before PSD permitting applies. The pollutants regulated by the law are the same – they have the same effect on health – but bioenergy plants are allowed to emit two and a half times the pollution of a fossil fueled plant before PSD permitting is triggered. As all but five (94 percent) of the 88 facilities for which we have permits in our database would emit more than 100 tons of a criteria pollutant, this single loophole is responsible for nearly doubling the amount of pollution that the emerging bioenergy industry is allowed to emit (because in general, minor source emissions limits are about twice the limits set in PSD permits).

The fix: Burning biomass for electricity produces as much or more of key pollutants as coal – so biomass should be regulated like coal. EPA has the authority to require that biomass plants be added to the list of pollution sources where PSD permitting is triggered at 100 tons. Biomass power plants are big, polluting facilities that emit hundreds to thousands of tons of pollution each year. They should be regulated accordingly.

Loophole 2: EPA's free pass for bioenergy CO_2 lets large power plants avoid regulation

When EPA began regulating CO_2 under the Clean Air Act, this provided an opportunity to reduce pollution from the bioenergy industry, had EPA chosen to take it. Under the implementation of the Tailoring Rule, if a facility was a major source for CO_2 (emitting 100,000 tons per year), PSD permitting would be triggered, including air quality modeling and a best available technology (BACT) analysis not just for CO_2, but criteria air pollutants as well. Since nearly every biomass power plant larger than about 8 MW has the potential to emit at least 100,000 tons of CO_2 per year, the decision by EPA to exempt bioenergy CO_2 emissions from regulation under the Clean Air Act for a period of three years greatly increased the potential for pollution from the emerging bioenergy industry. This exemption provides the majority of recently permitted biomass plants another means to avoid the protections afforded by PSD permitting. Although EPA's exemption for bioenergy CO_2 emissions was found to be unlawful by the U.S. Court of Appeals, the Agency has not implemented the Court's decision and reversed the exemption.

The fix: EPA should regulate bioenergy CO_2 now. Once in the PSD program, the best available control technology analysis stage provides an opportunity to discuss how biomass facilities can reduce their net emissions of CO_2.

Loophole 3: State regulators help biomass power plants avoid more protective permitting

One of the main loopholes allowing biomass plants to avoid PSD permitting is the claim of "synthetic" minor source status for nitrogen oxides and carbon monoxide. Facilities are granted a state-level minor source permit if they claim they will emit less than 250 tons of each pollutant per year, and thus get to escape PSD provisions that would limit pollution emissions, require use of best available control technology, and require air quality modeling to ensure a facility won't violate EPA's health standards for air pollution. In our database, the majority of facilities ranging in size from 6 MW to 60 MW opted for synthetic minor status, requiring the facility to emit less than 250 tons of CO, NOx, PM, and SO_2 per year to comply.

For small facilities, the 250 ton per year cap in a synthetic minor permit means they can emit far more pollution than necessary, given their size; for large plants, the cap requires they must meet unrealistically low emissions rates in order to emit less than 250 tons per year. In one case, where citizen petitioners protested a 24 MW plant in Hawaii that had been granted synthetic minor status, EPA agreed that the facility's emission limits were unenforceable and that the plant should likely be regulated as a major source. However, even though many other permits have been issued that appear to be even less enforceable than the Hawaii permit, EPA has opted to not get involved with most state-issued synthetic minor source permits, and as a result the permits continue to be issued with impunity. Currently, the majority of biomass power plants now proposed or under construction are still able to avoid even the minimal protections that PSD permitting provides.

The fix: If Loophole 1 were fixed, and PSD permitting was triggered at 100 tons of emissions, most biomass plants would have to go through PSD permitting. Likewise, if EPA implemented the U.S. Court of Appeals decision and regulated bioenergy CO_2 under the Clean Air Act, most plants would need to go through PSD permitting because most emit more than 100,000 tons of CO_2. Beyond those fixes, EPA should subject every power plant permit to federal oversight – especially those from states like Georgia, where regulators routinely issue synthetic minor source permits with the most minimal of conditions. It is going to take meaningful federal oversight to ensure that bioenergy permit contain emissions limits that are federally enforceable, as the Clean Air Act requires.

Loophole 4: Most biomass plants have no restrictions on hazardous air emissions

In the 88 bioenergy permits we examined, we found almost no accountability for emissions of hazardous air pollutants (HAPs), a group of especially toxic pollutants that includes hydrochloric acid, dioxins, carcinogens like benzene and formaldehyde, and heavy metals like arsenic, lead, and cadmium. Emissions of HAPs from biomass burners are barely regulated. A part of the Clean Air

Act known informally as the "boiler rule" sets the "Maximum Available Control Technology" (MACT) emissions standards for hydrochloric acid (HCl), as well as PM and CO, which serve as proxies for HAPs that are treated by EPA as being co-emitted with these pollutants. However, MACT standards for emissions of HCl, PM, and CO are only set for "major" sources of HAPs, which are defined as facilities that emit more than 10 tons per year of any one HAP or more than 25 tons of all HAPs per year. Minor sources that *claim* to emit below these thresholds are only required to meet an extremely lax standard for particulate matter – no emissions standards for HAPs are set directly. Thus, it's not surprising that most facilities claim to be minor sources for HAPs, no matter what their size.

The term "maximum available control technology" is in fact a profound misnomer, as the standards that are set for emissions under MACT are often far greater than what can be accomplished using pollution control technologies that are readily available today, especially for particulate matter. Under the biomass MACT rule, a major source biomass plant using a stoker boiler is allowed to emit more than 27 times the particulate matter of a coal boiler , and EPA rules allow most biomass plants to emit more than 10 times the particulate matter of a commercial and industrial waste incinerator. The rules for waste incinerators limit emissions of specific HAPs, including some heavy metals, but the rules for biomass plants do not contain any such limits. As more and more contaminated fuels are being burned as biomass, the lack of limits on emissions of HAPs is bound to increase emissions of the most toxic compounds from so-called "clean" bioenergy.

The fix: The EPA should make the so-called Maximum Available Control Technology standard meaningful, by setting standards as the Clean Air Act requires – standards that require the maximum degree of reduction of each HAP that is "achievable," considering cost and other statutory factors. At a minimum, without regard to cost, they must reflect the emission level that the cleanest sources have achieved – sources that are using emission control technologies that are effective and available, such as high-efficiency fabric filters that dramatically reduce particulate matter emissions. The biomass MACT should be made at least as protective as the standards for waste incinerators and coal boilers – especially given that facilities can be classified as biomass boilers even when burning up to 90% coal, and when burning highly contaminated wastes.

Loophole 5: The biomass industry lowballs estimates of toxic emissions to avoid regulation

In our database of 88 permits, 59% of facilities claimed they were minor ("area") sources for HAPs, including the **116 MW Gainesville Renewable Energy plant in Florida**. As with criteria pollutants, this non-major or area source designation is granted so easily by state permitting agencies, companies essentially have to volunteer to be regulated as major sources. Companies support their claim to be minor sources by using industry-supplied emission factors for HAPs, rather than EPA-sanctioned factors, to calculate their projected emissions during the permitting process. These industry-provided factors are in many cases orders of magnitude lower than EPA-sanctioned factors, but the organization that provides the emission factors, the National Council of Air and Stream Improvement (NCASI) will not divulge the data upon which they are based.

To test whether the industry emission factors for HAPs are valid, we compared the industry emission factor for hydrochloric acid, a HAP emitted in large quantities by biomass burning, with actual emissions data from 46 operating plants. We found that the industry factor significantly underestimates HCl emissions from real plants, suggesting that biomass power plants that use industry emission factors to claim minor source status for emissions of air toxics should probably in many cases be regulated as major sources.

The fix: The EPA and the states should require that HAPs emissions are estimated at the permitting stage based on emissions factors that are transparently derived, with a generous margin for error that assumes emissions are likely to spike at the very times (such as startup and shutdown) when they are least likely to be measured. Most facilities are probably major sources for HAPs, and should be regulated as such.

Loophole 6: Weak testing requirements mean air toxics limits aren't enforceable

We found that the lack of accountability for plants claiming to be "synthetic" minor sources for HAPs continues once plants are operating, because many permits only require minimal testing for hazardous air pollutants. Because emissions testing and enforceable limits don't even come into effect until several months after a facility starts operating, people living in the vicinity of a plant may have to undergo months of excessive and unknown pollution emissions while the facility ramps up. According to EPA, a permit that lacks testing requirements for HAPs is unenforceable, and thus invalid, but EPA has failed to exercise oversight over state-issued permits that claim area source status for HAPs.

The fix: A recent decision by EPA on a bioenergy facility in Hawaii makes it clear that if a facility wants to be regulated as a synthetic minor source (for criteria pollutants or HAPs) it must conduct testing that represents its true emissions, including during startup and shutdown. The permit must be written to require such testing, otherwise it is not federally enforceable, and is thus invalid. For limits to be truly enforceable, there should be ongoing monitoring with results revealed in real time, so that states and citizens can know when and if a facility is violating its permit.

Loophole 7: EPA rules blur the line between biomass facilities and incinerators

Lax regulation of biomass burners compared to waste incinerators is especially significant because new EPA rules make it easier to burn contaminated materials in biomass burners. EPA's "waste" rule allows garbage and other waste materials including plastics, tires and other wastes to be burned with minimal emissions controls and with no obligation to report emissions of heavy metals and other air toxics. The EPA admits that the new rules mean that wastes that are just as contaminated as the dirtiest coals available can be burned as biomass with no special provisions or disclosure. EPA has also announced that it is likely to remove any requirement that construction and demolition debris, which includes wood treated with copper-chromium-arsenate preservatives, be tested for contamination, trusting that industry "sorting" procedures will effectively remove contaminated material before it is burned as fuel. Since biomass plants do not have to meet any actual emissions standards for heavy metals, dioxins, or carcinogenic organic HAPs like benzene and formaldehyde, EPA's deregulation of contaminated fuels means that many facilities will be able to burn these materials with no accountability. Indeed, a large proportion of permits in our database granted permission for biomass plants to burn "waste" wood and other materials as fuel.

Under the waste rule, the EPA has also been granting "comfort letters" to companies that process garbage and industrial wastes into fuel products. Once EPA has signed off on these materials as "non-hazardous," they can be burned in a variety of boilers, even area source biomass boilers that are minimally regulated. An example is provided by SpecFUEL fuel cubes made by Waste Management. Contamination data on these cubes reveal high levels of fluorine, as well as phthalates, a chemical implicated in altering reproductive function that will soon be banned in the European Union. EPA approved SpecFUEL as a non-hazardous fuel product, enabling it to be burned in biomass plants that have no emission limits on air toxics.

The fix: The EPA needs to put people first – not the bioenergy industry, which has an inexhaustible appetite for contaminated fuels, particularly those that generate "tipping fees" for their disposal. The EPA should ensure that it does not create a loophole for unregulated incineration and that it protects public health by ensuring that all waste burners – including those that label themselves biomass units – meet the protective standards that Congress enacted for waste burning.

Overall, our assessment of the state of air permitting in the biomass power industry found that even as facilities routinely sell host communities on the idea a biomass plant is "clean" and safe, they appear to be misrepresenting actual emissions, while avoiding using the best pollution controls and performing air quality modeling. Our review found that EPA's rollback of regulation on biomass power combined with the loopholes inherent in the Clean Air Act leave communities unprotected from this growing and increasingly polluting industry.

Every permit we examined, even those that went through PSD, takes advantage of at least some of the Clean Air Act and regulatory loopholes we describe. From the 88 permits we included in the main analysis, the report provides detailed information on the following facilities:

Sierra Pacific, Anderson, CA
DTE Stockton, Stockton, CA
Plainfield Renewable Energy, Plainfield, CT
Montville Power, Uncasville, CT
Gainesville Renewable Energy, Gainesville, FL
Green Energy Partners, Lithonia, GA
North Star Jefferson, Wadley, GA
Piedmont Green Power, Barnesville, GA
Hu Honua, Pepe'ekeo, HI
ecoPower, Hazard, KY

Verso Bucksport, Bucksport, ME
Burgess Biopower, Berlin, NH
Lyonsdale Biomass, Lyons Falls, NY
ReEnergy Black River, Fort Drum, NY
Biogreen Sustainable Energy, La Pine, OR
Evergreen Community Power/United Corrstack, Reading, PA
Nacogdoches Power, Sacul, TX
EDF Allendale, Allendale, SC
Dominion Energy, Southampton, Altavista, and Hopewell, VA
Nippon Paper, Port Angeles, WA
Port Townsend Paper Company, Port Townsend, WA

Introduction: Biomass power, the renewable energy that pollutes

The biomass energy industry has always been highly polluting, as many communities where facilities are located can attest. Inherently high-emitting and poorly regulated, the industry's track record was revealed by a 2012 Wall Street Journal article reporting that nearly 80% of the facilities investigated by the paper had been cited by state or federal regulators for violating air pollution or water pollution standards at some time in the last five years.[1] Despite this history, however, biomass energy receives multiple renewable energy tax credits and subsidies. The availability of these incentives, which are worth millions of dollars per year to an individual facility, has driven a surge in biomass power plant proposals around the country (Figure 1), with more than 70 utility-scale wood-burning power facilities built or underway since 2005, and another 75 proposed and in various stages of development.[2] Some of these are new power plants, and some are old coal-fired power plants that are being re-fired with biomass, such as **Dominion Energy's three 51 MW coal plants in Virginia, the Altavista, Hopewell, and Southampton facilities**, which Dominion has rescued from mothballs to convert into "renewable energy generating assets."[3]

Figure 1. The biomass power industry is growing rapidly

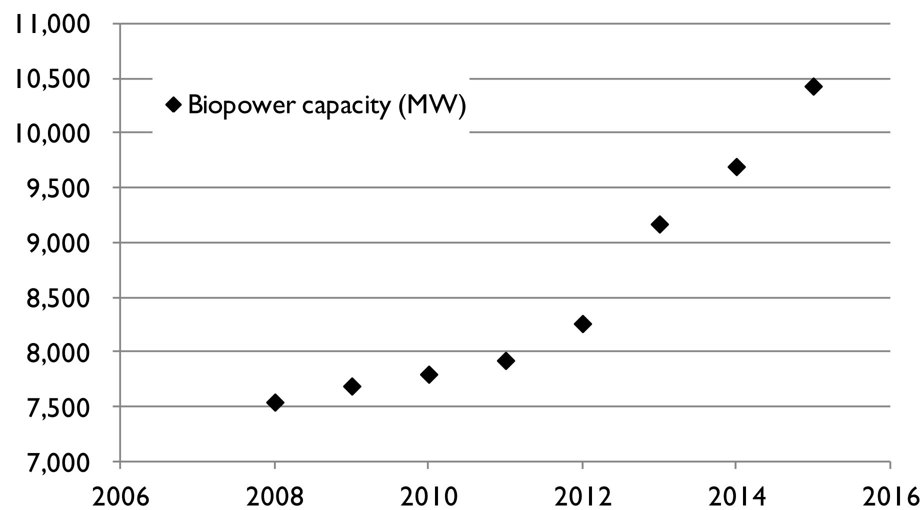

Figure 1. Actual and projected growth in the biopower industry from 2008 (built capacity for the 2008 industry from Energy Information Administration;[4] built capacity and proposed capacity from 2008 onwards from Forisk, Wood Bioenergy US database, December 2013). Not all proposed facilities will be built.

Building a biomass plant and generating electricity by burning wood is costly. According to the EPA, the levelized cost of generating electricity from biomass in 2011 dollars per megawatt-hour is \$97 - \$130, whereas the cost of onshore wind is \$70 - \$97 and the cost of natural gas combined

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[1] Justin Schenk and Ianthe Dugan. Wood-fired plants generate violations. Wall Street Journal, July 23, 2012.
[2] Forisk, Wood Bioenergy US database, December, 2013
[3] Our report and letter to the Securities and Exchange Commission on bioenergy "greenwashing" by Dominion, Southern Company, and Covanta can be found at http://www.pfpi.net/investors-to-sec-please-scrutinize-bioenergy-claims
[4] Energy Information Administration. Existing generating units in the United States by State, Company, and Plant, as of December 31, 2008.

cycle technologies is $59 - $86, depending on the cost of gas.[5] Recently built and proposed biomass power plants provide examples of the costliness of biopower – for instance, the Southern Company's **116 MW (gross) Nacogdoches plant in Sacul, Texas**, the sister facility to the equally large **Gainesville Renewable Energy Center in Florida**, raised rates for Austin Power customers, and only operated for a few months before being paid to idle, as the utility was able to purchase cheaper power from wind and natural gas sources. The Gainesville plant raised rates for its regional customers, as well. In Kentucky, testimony from state hearings on the renewable power purchase agreement between Kentucky Power and the proposed **58 MW (net) ecoPower biomass plant in Hazard** indicates that electricity from the plant would raise the average residential electricity bill almost $125 per year in one of the poorest regions of the country, eastern Kentucky.[6]

While a single biomass plants can emit over a million tons of carbon dioxide a year, facilities aren't ever required to demonstrate these emissions are offset.

Additional costs for renewable power aren't necessarily unusual, but in the case of biomass power, developers and proponents justify extra expense by claiming that biomass power provides "clean" and "low carbon" baseload power, as if bioenergy were comparable to wind and solar. That such claims are misleading is increasingly apparent. Of late, the myth of bioenergy as "climate-friendly" is increasingly crumbling as new science and modeling demonstrate that wood-fired power plants increase CO_2 emissions over years to decades, even relative to fossil-fueled power plants.[7] The sheer amount of wood required by these facilities is an indication of their emissions, as forest wood is converted to CO_2 at about a 1:1 rate.[8] For instance, combined demand at the **three converted Dominion coal plants** will be about 2.4 million tons per year, with commensurate CO_2 emissions, and a single facility like the **116 MW Gainesville Renewable Energy plant in Florida** can emit over a million tons of CO_2 per year. The air permit for the **70 MW (gross) Burgess BioPower plant in Berlin, New Hampshire** states it will burn close to a million tons of trees a year, consuming "whole logs" at a rate of 113 tons per hour,[9] the equivalent of clear-cutting more than one acre of New Hampshire's forests every hour. While resequestration of the CO_2 emitted by this and other biomass plants being built around the country will require multiple decades, carbon offsets are never actually required to be obtained or demonstrated by these plants.

When policy-makers are given a chance to review the forest and greenhouse gas impacts from biomass energy, they may conclude that it is not worth the costs. For instance, the Vermont Public Service Board recently denied a certificate of "public good" to the **proposed 35 MW North**

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[5] 40 CFR Parts 60, 70, 71, et al. Standards of Performance for Greenhouse Gas Emissions From New Stationary Sources: Electric Utility Generating Units; Proposed Rule. Federal Register Vol. 79, No. 5 Wednesday, January 8, 2014

[6] Commonwealth of Kentucky, before the Public Service Commission: Application of Kentucky Power concerning the renewable energy purchase agreement with ecoPower Generation-Hazard, LLC. Case No. 2013-00144. Volume I of court transcript.

[7] For a review, see PFPI report to the Securities and Exchange Commission on bioenergy "greenwashing," at http://www.pfpi.net/wp-content/uploads/2013/11/PFPI-report-to-SEC-on-bioenergy-Nov-20-2013.pdf

[8] Burning one ton of wood at 45% moisture content, considered an industry standard, emits 1.008 tons of CO_2.

[9] New Hampshire Department of Environmental Services. Final Temporary/NSR/PSD Air permit for Laidlaw Berlin BioPower, July 26, 2010.

Springfield Sustainable Energy wood burning plant in Vermont, stating that the project would interfere with the State's ability to meet statutory goals for reducing greenhouse gases and that "*the evidentiary record supports a finding that the Project would release as much as 448,714 tons of CO2e per year, and that sequestration of those greenhouse gases would not occur until future years, possibly not for decades, and would not occur at all in the case of forest-regeneration failures*."[10] In Massachusetts, new rules eliminate state renewable energy subsidies for low-efficiency utility-scale biomass plants, because their excessive and long-lasting net CO_2 emissions interfere with the state's goals of reducing CO_2 emissions from the power sector.[11]

Major loopholes in the Clean Air Act and its enforcement let biomass power plants emit more pollution than coal.

With the recent intense focus on greenhouse gas emissions from the bioenergy industry, however, less attention has been paid to emissions of conventional air pollutants and impacts on air quality. As for claims of carbon neutrality, which often rely on simply not counting CO_2 emissions from biomass power plants, claims that bioenergy is "clean" are usually not supportable. In fact, even bioenergy facilities employing modern controls like those used at coal plants are disproportionately polluting, primarily because burning wood is inherently polluting and biomass plants are very inefficient, extracting relatively little "useful" energy for the pollution they emit. However, also important to bioenergy pollution impacts is the fact that the preeminent law for protecting air quality in the United States, the Clean Air Act, contains major loopholes allowing biomass power plants to pollute more than fossil-fueled facilities. Compounding this, a pattern of lax enforcement and rollbacks on regulation by EPA and the states has widened these loopholes.

We wanted to develop a picture of the modern biomass power industry, how it is shaped by regulation, and how it is shaping regulation. To explore these questions, we collected recently issued air permits from biomass power plants, tabulating data on pollution controls, fuel use, permitted emissions, and other factors. We focused on recent permits because we assumed they would restrict pollution emissions to lower levels than typical for the bioenergy industry as a whole, which has traditionally been very polluting. Our analysis ultimately included 88 permits, which, when analyzed as a group, revealed systematic patterns that would not be apparent if permits were analyzed individually. What emerges from our analysis is a picture of an industry that despite loudly and continually proclaiming itself clean and green, is in many respects still one of the dirtiest corners of the energy industry, an industry where avoidance of pollution restrictions is tolerated, and even encouraged, by state and federal regulators. This report explains our findings.

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[10] State of Vermont Public Service Board. Docket No. 7833 Petition of North Springfield Sustainable Energy Project LLC, for itself and as agent for Winstanley Enterprises, LLC, for a certificate of public good, pursuant to 30 V.S.A. Section 248, authorizing the installation and operation of a 25-35 MW wood-fired biomass electric generating facility to be located in the North Springfield Industrial Park in Springfield, Vermont, to be known as the "North Springfield Sustainable Energy Project" Order entered: 2/11/2014. Available at http://www.pfpi.net/wp-content/uploads/2014/02/7833-VT-PSB-on-NSSEP.pdf

[11] State of Massachusetts 225 CMR 14.00 – Renewable Energy Portfolio Standard, Class I. A summary of the regulations is available at http://www.mass.gov/eea/energy-utilities-clean-tech/renewable-energy/biomass/renewable-portfolio-standard-biomass-policy.html.

The physical reasons why bioenergy pollutes more than coal

Any power plant that burns fuel will emit numerous air pollutants, but there are two key factors that make biomass power plants emit as much or more pollution than modern coal or gas-fired power plants. First is the inherent composition of biomass fuels, including their chemical makeup and their energy content. Taking carbon as a main example, biomass power plants emit more CO_2 than fossil fueled plants (Table 1) because wood and other types of biomass are carbon-rich, but not particularly energy-rich, particularly relative to natural gas. This means that burning biomass releases more CO_2 per unit energy inherent in the fuel (pounds of CO_2 released per million Btu energy content, lb/MMBtu) than fossil fuels. Just as important, however, is that biomass power plants are much less efficient than gas and coal-fueled plants, in part because biomass fuels tend to have relatively high moisture content,[12] and it takes significant energy to boil off excess water before "useful" energy can be generated. Lower efficiency means that more fuel is required to generate a given amount of electrical energy from a biomass power plant, and burning more fuel releases more pollution.

Table 1. Biomass power plants emit more CO_2 than coal or gas plants

Technology	Fuel CO_2 emissions (lb/MMBtu heat input)	Facility efficiency	MMBtu required to produce one MWh	Lb CO_2 emitted per MWh
Gas combined cycle	117.1	45%	7.54	883
Gas steam turbine	117.1	33%	10.40	1,218
Coal steam turbine	206	34%	10.15	2,086
Biomass steam turbine	213	24%	14.22	3,029

Table 1: CO_2 emissions from biomass power plants versus fossil-fuel power plants.[13] The relatively low inherent energy density of biomass fuels, combined with the low efficiency of bioenergy plants, mean that per megawatt-hour (MWh), a biomass power plant emits about 145% the CO_2 of a coal plant, and 340% the CO_2 of a combined cycle natural gas plant.

The low efficiency of biopower plants increases their relative conventional pollutant emissions, as well.[14] To illustrate this, Table 2 gives an example of filterable particulate matter[15] emissions from a 500 MMBtu/hr coal boiler, and a biomass boiler of the same size, both with a permitted

[12] Typical moisture content for green wood chips, a very common fuel for bioenergy facilities, is around 45%, meaning by weight, the fuel is almost one-half water.

[13] Fuel CO_2 per heat content data are from EIA, Electric Power Annual, 2009: Carbon Dioxide Uncontrolled Emission Factors. Efficiency for fossil fuel facilities calculated using EIA heat rate data (http://www.eia.gov/cneaf/electricity/epa/epat5p4.html); biomass efficiency value is common average value for utility-scale facilities; however, the smaller the facility, the lower the efficiency.

[14] This fact is often obscured because emissions of conventional pollutants are often expressed on a "heat input" basis (pounds of pollutant per million Btu of heat input to the boiler, lb/MMBtu), rather than on an "output" basis, as is done for CO_2 (pounds of CO_2 per megawatt-hour, lb/MWh). One important exception is emission rates set for coal plants greater than 25 MW in size, which (as discussed below) are regulated under EPA's "Electric Generating Unit" (EGU) rules with rates that are set on a pounds per megawatt-hour basis.

[15] Filterable particulate matter is the portion of particulate matter that can be largely (but not completely) controlled by a fabric filter or an electrostatic precipitator.

emissions level of 0.012 lb/MMBtu,[16] a common value seen in many biomass facility air permits. Both facilities would emit 26 tons of particulate matter per year, calculated on a heat input basis, but because the biomass plant doesn't produce as much energy as the coal plant, it emits 41.6% more particulate matter on an electrical output basis, expressed as pounds of pollution per megawatt-hour (MWh) of energy.

Table 2: Biomass power's lower efficiency increases particulate matter emissions

Fuel	Boiler size (MMBtu/hr)	Efficiency	MMBtu heat input/yr	PM rate (lb/MMBtu)	Tons PM/yr	MWh/yr	lb PM/MWh
Biomass	500	24%	4,380,000	0.012	26	307,999	0.17
Coal	500	33%	4,380,000	0.012	26	423,498	0.12

Table 2: The lower efficiency of biomass power plants increases their emissions per megawatt-hour.

The inherently polluting nature of bioenergy affects how air permits are written, and how much pollution a biomass plant is allowed to emit. Figure 2 shows allowable emissions on an output basis (lb/MWh) from three air permits, a coal plant, a biomass plant, and a natural gas plant.

Figure 2: Even with modern emissions controls, biomass power plants emit more pollution than coal or gas

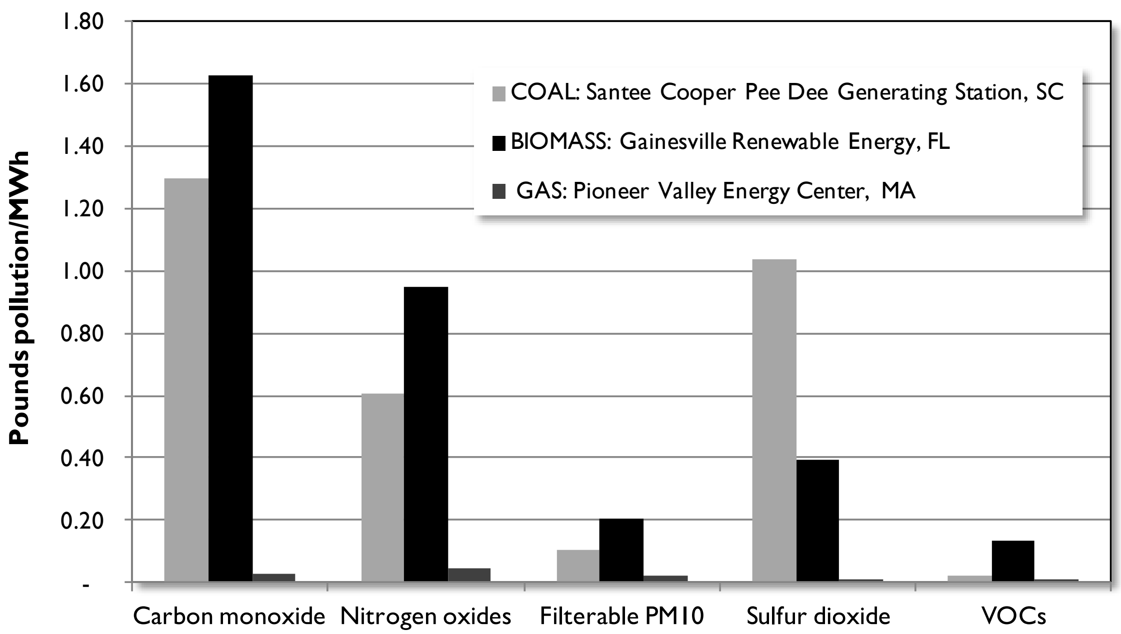

Figure 2. Allowable emission rates (in pounds per megawatt-hour) from three recently issued permits.[17]

[16] Lb/MMBtu = pounds of pollution emitted per unit boiler capacity in million Btu per hour
[17] South Carolina Bureau of Air Quality. December 16, 2008. PSD, NSPS (40CFR60), NESHAP (40CFR63) Construction Permit for Santee Cooper Pee Dee Generating Station (1,320 MW, coal). Florida Department of Environmental Protection. December 28, 2010. Final air construction permit for Gainesville Renewable Energy Center (100 MW, biomass). Massachusetts Department of Environmental Protection. June, 2010. Conditional permit to construct issued to Pioneer Valley Energy Center (431 MW, gas).

Even when a biomass plant is using best available control technology, emissions of key pollutants exceed those of modern coal and gas plants.

All three facilities went through a Best Available Control Technology analysis (BACT, described further below), meaning that their emissions are relatively well-controlled compared to other facilities of their type. However, emissions from the biomass plant exceed those from the fossil fueled plants for all pollutants except sulfur dioxide, for which biomass emissions exceed gas, but not coal. Relative to the coal plant and the gas plant, respectively, allowable emissions at the biomass plant are126% and 5639% for carbon monoxide; 157% and 2015% for nitrogen oxides; 197% and 863% for filterable PM_{10}; 38% and 3514% for sulfur dioxide; and 655% and 1535% for volatile organic compounds.[18]

How the Clean Air Act regulates pollution from power plants

The Clean Air Act is the main federal law regulating emissions from power plants and other stationary source facilities. While the Clean Air Act can regulate any pollutant, the main pollutants it governs are the so-called "criteria" pollutants (particulate matter, carbon monoxide, nitrogen oxides, sulfur dioxide, ozone, and lead); hazardous air pollutants (HAPs), the group of 187+ pollutants that are considered especially toxic by EPA; and greenhouse gases, including CO_2.

A key regulatory tool in the Clean Air Act is the New Source Review (NSR) process, which requires new or modified stationary sources like power plants to obtain a preconstruction permit that sets allowable pollution emission rates and other conditions of operation.[19] The restrictiveness of these permits varies, based on how much pollution a facility is anticipated to emit (larger sources are regulated more tightly than smaller sources) and the existing air quality in the area (facilities located where air pollution already exceeds EPA's health standards are more tightly regulated).

Preconstruction permits can be issued according to one of three permitting subprograms under New Source Review:

- The "Prevention of Significant Deterioration" (PSD) program applies to facilities of a certain size located in areas that meet the National Ambient Air Quality Standards (NAAQS), the health standards that EPA sets for the criteria air pollutants PM, CO, NO_x, SO_2, ozone, and lead. While state air permitting agencies write these permits, they must do so in accordance with EPA regulations, and EPA and the public may provide comments and input on certain permits.

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[18] A potential but currently suspended permit revision filed in February 2014 seeks to regulate the facility under the major source boiler rule. If the plant is re-permitted as a major source for HAPs, allowable filterable PM emissions will decrease under the major source MACT for bubbling fluidized bed boilers, from of 0.015 lb/MMBtu to 0.0098 lb/MMBtu (Gainesville Renewable Energy Center. Initial Title V air operation permit application filed with Florida Department of Environmental Protection. February 10, 2014). This change would reduce permitted emissions from 89 tons to 58 tons of filterable PM per year, but filterable PM emissions per MWh would still be 128% those from the coal plant.

[19] New source review permits are "preconstruction permits," and differ from Title V permits, which set out the terms by which facilities are expected to operate and meet the emissions limits specified in the NSR permit.

- The “Nonattainment New Source Review” (NNSR) program applies in areas where pollution exceeds the NAAQS. Permits issued under this program may also receive EPA and public review like the PSD permits above.
- The “Minor Source” program applies to facilities that are anticipated to not emit enough pollution to be included under the PSD or NNSR programs. Unlike PSD and NNSR permits, minor source permits are expected to meet certain minimal Clean Air Act requirements but are otherwise solely administered by local or state-level air permitting agencies with little if any EPA or public oversight.

As we demonstrate below, facilities that go through the PSD and NNSR process tend to have much lower allowable emissions than minor source facilities that simply get a permit from the state.[20] The difference can mean biomass power plants that receive state-issued minor source permits are allowed to emit far more pollution than they would be otherwise if they were held to more rigorous standards. This permitting scheme clearly incentivizes bioenergy facilities to seek “minor source” status in order to avoid more stringent limits.

The commonsense components of a federal air permit

While permits issued under the PSD or NNSR program may sound like they could be quite rigorous, in fact, the requirements of the programs are merely commonsense, including measures to reduce pollution as by using effective emission controls and operating the plant properly, air quality simulation modeling to make sure that a facility’s emissions won’t increase air pollution above EPA’s health thresholds, and provisions to allow citizen involvement and ensure environmental damage is minimized.

BACT Analysis. Under the PSD program, major sources undergo a Best Available Control Technology (BACT) analysis to determine the most effective emissions controls for each pollutant.[21] If a new facility exceeds the threshold for one pollutant, then it required to go through a BACT analysis for *all* criteria pollutants that exceed a specified emissions threshold. The BACT analysis doesn’t truly require the “best” control technology, however, because a facility can reject technologies as being too expensive. Nonetheless, facilities that go through BACT analyses tend to have lower allowable emissions than facilities that don’t. BACT is a moving target, because as permits are written with lower emission rates, achievable via better and improved controls, these rates in turn become the new BACT standard for subsequent facilities.

Under the NNSR program, when a power plant is being built in a location that already has an acknowledged air quality problem, known as a “non-attainment” region, facilities are

[20] Certain states have strong air permitting requirements that meet and even exceed what would be required under the PSD process. For instance, both Massachusetts and Vermont have fairly rigorous state-level air permitting requirements.
[21] In a BACT analysis, the applicant and state must consider, among other things, clean fuels and environmental impacts of the source permit issuing authorities must consider “alternatives” to the proposed project in addition to a proposed project’s air quality and other environmental impacts. BACT permitting does allow cost considerations. LAER does not.

supposed to use the technology that delivers the Lowest Achievable Emission Rate (LAER). Unlike BACT, a LAER analysis is not supposed to consider technology cost. Facilities being built in non-attainment regions are also required to obtain emission offsets for pollutants that exceed the NAAQS.

Air Quality Modeling. Under PSD, major source facilities have to undergo air quality modeling, in which a computer model is used to simulate dispersion of pollution from a facility, adding the facility's emissions to background air pollution levels to ascertain how much the plant will increase local air pollution. Emissions from nearby facilities are also included in this analysis. The modeling usually assesses two emission rates for each pollutant – a "long term" average rate (often calculated over 30 days) to determine whether a facility will cause local air pollution to exceed the annual NAAQS, and a short-term emission rate (the concentration over a one- or three-hour period), to determine whether a plant will cause an exceedance of the short term/hourly NAAQS.[22]

Regulation of $PM_{2.5}$. The PSD program requires permit applicants to model how emissions of both filterable PM and condensable PM will affect ambient $PM_{2.5}$ levels. In contrast, plants that don't go though PSD are typically only held to the New Source Performance Standard (NSPS) for PM emissions, which simply requires that filterable PM_{10} emissions not exceed 0.03 lb/MMBtu, or even less stringent standards for existing facilities. The NSPS standards do not apply during facility startup and shutdown.

Public Involvement. An important aspect of the PSD process is that the state agency issuing the air permit is required to hold public informational meetings about the facility's impacts, not only on air quality, but on other aspects of the environment as well. The permit-issuing authority is required to consider comments submitted during the permit-approval process, which may include arguments that the facility is not needed at all. In contrast, minor sources that don't go through the PSD process simply get a state-issued permit and there is no requirement for public involvement.

EPA Oversight. While EPA will sometimes review and comment on PSD permits, helping to improve them, the Agency generally ignores state-issued minor source permits, unless asked to intervene. However, all permits, whether PSD permits or minor source permits issued by the state, are supposed to comply with federal New Source Performance Standards (NSPS), maximum emissions rates set for certain pollutants, and the National Emission Standards for Hazardous Air Pollutants (NESHAP), discussed below. All permits must be "federally enforceable" to be valid.

[22] Short term standards are generally designed to protect against acute effects of exposure, while longer-term standards are designed to protect against health effects that can result from cumulative, long-term exposure to even lower levels of pollution. Some pollutants have both annual and short-term standards, because they can be both acutely and chronically harmful at different levels. Health-based (or "primary") NAAQS tend to be based on health effects identified in both laboratory and epidemiological studies, and are subject to several rounds of review (including by the Clean Air Science Advisory Committee, comprised of leading scientists in the field).

Going through a BACT or LAER analysis, along with air quality modeling, does not ensure that a facility will not degrade air quality. In most cases, pollution emissions from federally permitted facilities are still large, and often, the provisions of an air permitting program do relatively little to reduce emissions. For instance, the **54 MW (gross) DTE Stockton biomass plant in Stockton, California**, is an old coal plant that has been refurbished to burn biomass. As a coal plant, this facility stopped operation in 2009. It is located in a highly polluted area, designated as being in "extreme" non-attainment for ozone (making the major source threshold that triggers PSD permitting 25 tons, rather than 250 tons) and non-attainment for $PM_{2.5}$.[23] Emissions from the new DTE biomass boiler triggered offset requirements for emissions of NOx, SOx, PM_{10}, and VOCs, but rather than being compelled to obtain new offsets, the facility was allowed to treat the cessation (in 2009) of previous allowable emissions from the coal plant as mostly "offsetting" biopower emissions of 107 tons of NOx, 58 tons of PM_{10}, 70 tons of SO_2, and 25 tons of VOCs – "mostly," because while the plant's emissions of SO_2 decreased with the transition to biomass from coal, emissions of PM and VOCs increased.[24] Offsets math notwithstanding, this biomass power plant thus represents what is essentially a *new* source of pollution in an already polluted region, one that is cheerfully announced by the company in a press release as a "green energy plant."[25]

What 88 air permits say about regulation of the biomass power industry

Due to the subsidies and tax incentives available for bioenergy, a large number of air permits for biomass power plants have been issued in recent years. We collected 88 preconstruction and Title V permits[26] from biomass power plants proposed in recent years and entered key data into a common database, assembling information on each facility's boiler technology, fuel use, pollution control technologies, and allowable emissions. Using this dataset, we were able to examine how much pollution facilities are being allowed to emit under PSD/NNSR permits versus state-level minor source permits, and how the biomass power industry is exploiting loopholes in the Clean Air Act and its enforcement.

We used a subset of 46 permits for new facilities to graphically compare how modern bioenergy facilities propose to control emissions, and how allowable emissions differ at "major" and "minor" source facilities. This subset included the permits we had for "greenfield" facilities that had clearly either gone through PSD permitting with a BACT analysis, or which had received minor source permits. The subset excluded facilities where an old coal plant is being retooled to burn biomass, where in some cases, an existing permit was modified but contains relic provisions from when the plant burned coal. As new facilities, the PSD and non-PSD groups can be assumed to have had equivalent opportunities to optimize facility design and adopt modern pollution controls.

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[23] EPA listings for county attainment status are at http://www.epa.gov/airquality/greenbook/ancl3.html
[24] San Joaquin Valley Air Pollution Control District. Authority to Construct Application Review, Biomass-Fired Power Plant – for DTE Stockton, LLC. April 28, 2011. The offsets calculations occur in Table 18.
[25] The company's March 13, 2014 press release is available at online.wsj.com/article/PR-CO-20140313-912116.html
[26] Some permits are for facilities that have subsequently been cancelled; some are for facilities still pending; some are for facilities that have been built.

Bioenergy emissions of criteria pollutants and CO_2: Clean Air Act loopholes

Beyond the inherently polluting nature of biomass power, key loopholes in the Clean Air Act allow biomass plants to be less regulated than coal and gas plants. Some of these loopholes are baked in to the Clean Air Act, while others are the result of recent regulatory and policy decisions by EPA. Our overview first examines loopholes affecting emissions of criteria pollutants; in the second part of the report, we discuss loopholes for emissions of hazardous air pollutants (HAPs) and loopholes that allow contaminated wastes to be reclassified as "non-waste fuel products" that can be burned in biomass plants.

Loophole 1: Biomass plants can emit more pollution before triggering federal permitting

One of the most significant loopholes for bioenergy in the Clean Air Act is the triggering threshold for consideration as a "major source" for criteria pollutants. Whereas new fossil fuel plants are considered to be a major source that triggers PSD permitting if they emit more than 100 tons of a criteria pollutant per year, bioenergy plants escape PSD unless they emit at least 250 tons of a criteria pollutant per year.[27] As we demonstrate below, biomass plants that avoid PSD permitting are allowed to emit about twice as much pollution as plants that go through PSD, and lack other protections afforded by the PSD program. Compared to coal plants and natural gas plants that are required to go through PSD if they emit 100 tons of a pollutant, biomass power plants that avoid PSD are very lightly regulated, even though the types of pollution emitted, and consequent health effects, are the same. As all but five of the 88 facilities for which we have permits in our database would emit more than 100 tons of a criteria pollutant, it appears that this single loophole, which is a relic of Clean Air Act implementation decisions made in the 1970's, is responsible for nearly doubling the amount of pollution that the emerging bioenergy industry is allowed to emit. The Clean Air Act allows the EPA Administrator to add new industries to the list of sources where the 100 ton threshold triggers PSD permitting. Given the current growth in the bioenergy industry and its potential to pollute, adding biomass power plants to that list would represent sound public policy.

Under the Clean Air Act, biomass power plants are allowed to emit 250% the pollution of a coal plant before more protective permitting is triggered.

Loophole 2: EPA's free pass for bioenergy CO_2 lets large power plants avoid regulation

The tendency for bioenergy facilities to avoid PSD permitting has been exacerbated and enabled by EPA's decision to exempt bioenergy CO_2 from regulation under the Clean Air Act. Initially, when

[27] PSD is also triggered for both new plants and existing plants undergoing "major modifications," when those modifications would cause emissions to increase by more than a certain amount. The triggering thresholds for existing facilities are the same for biomass and fossil-fueled plants.

EPA began regulating CO_2 under the Tailoring Rule in early 2011,[28] bioenergy facilities were included under the rule along with fossil-fueled plants. At that time, if a wood-burning power plant was a major source for CO_2 (emitting over 100,000 tons of CO_2 per year), *and* it was a major source for a criteria pollutant (emitting over 250 tons per year) then PSD permitting was triggered, and the facility would go through a BACT analysis for CO_2, as well as for other pollutants. However, in July of 2011, when "Step II" of the Tailoring Rule was implemented and facilities could be deemed major sources for PSD on the basis of their CO_2 emissions alone,[29] EPA bowed to pressure from the bioenergy industry and exempted bioenergy facilities from the rule for a period of three years, pending study of how biogenic CO_2 emissions should be regulated. It is important to note that although the EPA exemption of bioenergy CO_2 from counting toward PSD applicability was generally based on the assumption that greenhouse gas emissions would be offset, not one of the permits we reviewed for this report actually required demonstration that emissions be offset.

EPA's exemption for bioenergy CO_2 under the Clean Air Act has allowed many facilities to avoid requirements for more protective emissions controls.

Biomass power companies are applying for air permits at an unprecedented rate, thus the exemption of biogenic CO_2 from regulation prevented pollution restrictions from being placed on the industry just when it most needed oversight. Nearly every plant proposed in recent years is a major source for CO_2, because almost all are larger than 8 MW, which is the size of plant with a potential to emit (PTE)[30] more than 100,000 tons of CO_2. Burning one ton of green wood chips emits about one ton of CO_2, thus CO_2 emissions from fuel burned at a typical plant, such as the 49 MW plant in Figure 3, are many hundreds of thousands of tons per year, far exceeding the major source threshold. Thus, had EPA not granted the exemption, most biomass power plants would be pulled into the PSD permitting program on the basis of their CO_2 emissions alone, and would go through a BACT analysis for both

Figure 3. The massive woodchip fuel pile at a 49-MW bioenergy plant in California. (Photo credit: NREL)

[28] The Tailoring Rule set emission thresholds that trigger a facility being considered a major source for greenhouse gases. Because greenhouse gases are emitted in far larger quantities than criteria pollutants, the 250 ton threshold that applies for criteria pollutants was not a practical limit, thus, the triggering thresholds were "tailored" to adapt the regulations for greenhouse gas emissions. See http://www.epa.gov/nsr/ghgpermitting.html

[29] Under the Step II regulations, CO_2 received the same treatment as other pollutants – if a facility was "major for one," in this case CO_2, it would be "major for all," triggering a BACT analysis for all pollutants.

[30] "*Potential to emit* means the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of material combusted, stored, or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable." 40 C.F.R. § 52.21 (b)(4).

CO_2 and conventional air pollutants, as well as undergoing air quality impacts modeling. Importantly, the group of bioenergy facilities thus affected would include not only the facilities that received preconstruction permits after July 1, 2011, when Step II of the Tailoring Rule came into effect, but also those facilities that had previously received a permit but had not yet started construction by July 1. The CO_2 exemption has thus allowed most facilities with permits issued in recent years to avoid PSD permitting. No coincidence, a flurry of state-level permits were issued just before the July 1 2011 deadline when Step II permitting was to take effect, even though EPA had indicated it would grant the exemption. Of the permits we reviewed that were issued in 2011, 14 were issued before July 1, with 8 of those issued in June. A total of 6 were issued after June.

A federal court found that EPA's exemption for biomass CO_2 was unlawful, and that bioenergy emissions should count under Clean Air Act permitting

Following EPA's exemption for bioenergy CO_2, the Center for Biological Diversity with other environmental groups sued the Agency, challenging the action. In July 2013, the U.S. Court of Appeals for the District of Columbia Circuit ruled in favor of the groups, determining that EPA had unlawfully exempted bioenergy from regulation under the Clean Air Act.[31] However, rather than issuing a mandate to EPA to reverse the exemption, the court granted a long delay to the industry litigants that had joined with EPA to defend the exemption, extending the deadline for filing a petition for reconsideration or rehearing by all of the Court's active judges.[32] The three-year exemption in any case lapses in July 2014, at which point EPA will need to take some action on how biogenic CO_2 will be regulated. In the meantime, it is unclear whether the court will issue a mandate that directs EPA to reverse its policy and officially declare that facilities that are major sources for CO_2 need to go through PSD, although in any case EPA could take action without waiting for the court's mandate. When and if this happens, some bioenergy facility permits that were issued under the exemption could be re-opened and re-permitted through the PSD process. Meanwhile, there are about 60 bioenergy facilities currently planned or under construction in the U.S.[33] that are over 8 MW in capacity, the approximate threshold for a major source for CO_2 emissions. By allowing these facilities to escape PSD permitting, EPA's exemption for bioenergy CO_2 regulation allows the bioenergy capacity "in the pipeline" to be far more polluting than it needs to be.

Loophole 3: State regulators help biomass power plants avoid more protective permitting

Bioenergy developers usually want to avoid going through the PSD process, because conducting a BACT analysis and air quality impacts modeling, determining effective pollution controls, and dealing with public involvement can increase the risk that a high-emitting facility will face more

[31] *Center for Biological Diversity v. EPA*, D.C. Cir. No. 11-1101, July 12, 2013

[32] The D.C. Circuit Court essentially refrained from acting while a number of industry challenges to the Tailoring Rule itself are proceeding in the U.S. Supreme Court. Those challenges—which will determine whether the PSD program applies to greenhouse gases as a whole, not just biogenic CO_2—are being heard by the Supreme Court in February, with a decision expected in mid-2014.

[33] Forisk, Wood Bioenergy US database, December, 2013

scrutiny and questions. State permitting agencies usually help bioenergy developers avoid PSD permitting, and "PSD avoidance" is a common phrase encountered in bioenergy air permits.

A facility's status as a major or minor source is determined by its **potential to emit (PTE).** This is the number of tons of a pollutant that the facility will emit if it is operated year-round, at full boiler capacity. It is calculated as

Equation 1

$$\text{PTE (tons per year)} = \text{boiler capacity} \left(\frac{\text{MMBtu}}{\text{hr}}\right) * \text{emission rate} \left(\frac{\text{lb}}{\text{MMBtu}}\right) * 8{,}760 \text{ hrs} \div 2{,}000 \left(\frac{\text{lb}}{\text{ton}}\right)$$

To avoid PSD permitting, the biomass industry avails itself of another loophole in the Clean Air Act known as the "synthetic" minor source provision, whereby if facility caps its emissions below 250 tons of each criteria pollutant per year, it can avoid the PSD permitting process and its requirements for a BACT analysis, air quality modeling, and public involvement. States routinely allow and even encourage facilities to avoid PSD permitting by issuing air permits that cap emissions just below 250 tons – even, sometimes, when the facility's potential to emit exceeds 250 tons. Such permits frequently include credulity-straining provisions that limit a facility's emissions to 249 tons of a pollutant, as we discuss below (see Tables 4 and 5).

"Synthetic minor" facilities avoid setting emissions rates, conducting air quality modeling, or using best available control technology.

The 250-ton cap for emissions in a synthetic minor permit is supposed to include *all* annual emissions from the facility, including startup and shutdown emissions from the boiler and emissions from other sources, such as emergency generators. However, it is rare that a synthetic minor permit does a full accounting of all the emissions at a facility, or includes enforceable limits that can truly constrain facility-wide emissions once the plant is operating. As we discuss below, such permits unenforceable and thus illegal under the Clean Air Act, but because the EPA rarely reviews state-issued permits, federal enforcement is rare.

For a number of the synthetic minor permits we reviewed, the biomass boilers alone have a PTE that exceeds 250 tons of a criteria pollutant, given the size of the unit and the ability to control emissions. This would suggest that the 250-ton-per-year caps, which are required by federal law to be "federally and practically enforceable,"[34] for instance by limiting the number of hours in a year that a facility can operate, are in some (or perhaps many) cases unrealistic. In fact, in our review of tens of biomass power plant permits, very few of the synthetic minor sources we found had any limits on hours of operation, or any other limitations. Instead, state air permitting agencies simply require facilities to install continuous emissions monitors (CEMs) that track how much pollution is produced, and to report these emissions, as proof that they are emitting less than 250 tons per year of each pollutant. The presence of a CEMs has been accepted as sufficient assurance that the caps

[34] The Clean Air Act requires that "limitations, controls and requirements in operating permits are quantifiable and otherwise enforceable as a practical matter" 60 Fed. Reg. 45049 (August 30, 1995).

are federally and practically enforceable – even when it is likely that the boiler will have difficulty meeting the 250 ton per year cap, and even though a CEMs on a biomass boiler only measures emissions from that unit, and not the facility-wide emissions that are supposed to be included under the cap.

The frequent use of the synthetic minor source loophole has important implications for how biomass power plants operate, and thus for air quality. While the total tons of pollution that a plant emits annually is obviously one index of its impact on air quality, just as important is the short-term *rate* at which that pollution is emitted – the actual amount per hour. Permits issued under PSD set "short-term" (1 - 3 hrs) and "long-term" emissions limits (often, rolling 30-day averages that represent annual emissions). The PSD process also requires modeling *before* a plant is built to predict whether the plant will cause violations of the short-term and annual NAAQS. Permits that simply cap emissions below 250 tons don't contain these protective measures.

The absence of short-term emissions rates in a synthetic minor source permit threatens air quality

The absence of short-term emission limits in synthetic minor source permits is a threat to air quality. Biomass power plants are notorious for producing large slugs of air pollution over short periods, because the fuels they burn, which include wood, agricultural wastes, and wastes from the paper-making industry, are inconsistent in composition and moisture content, decreasing combustion efficiency and increasing emissions. How a plant is operated – at steady state, or in a "cycling" mode, ramping up and down periodically – also affects emissions. Most PSD air permits and a few state-level permits recognize this, setting different emissions standards for startup and shutdown versus steady-state combustion. For instance, the permit for the proposed **67 MW (gross) Greenville Power plant in Greenville, Texas**[35] states that the electrostatic precipitator for controlling PM, the selective catalytic reduction (SCR) system for controlling NOx, and the catalytic oxidation system for controlling CO and VOCs "*may not be fully operational if the boiler is operating at less than 75% of base load*."[36] The Greenville permit specifies that emission rates from the Greenville facility during startup and shutdown[37] (Table 3) can exceed those during normal operations – for instance, filterable PM emissions increase by more than 700%, compared to steady-state operation. Startup and shutdown events can take 12 - 24 hours, meaning that the total amount of pollution emitted over these periods can be significant.

However, synthetic minor permits generally don't contain limits on startup or shutdown emissions at all – importantly, the only emissions rate requirement that synthetic minor sources do have to meet, the New Source Performance Standard for new facilities that sets filterable PM standard at 0.03 lb/MMBtu, specifically exempts facilities during startup and shutdown.

[35] Maximum allowable emission rates for Permit Number 9322. Texas Commission on Environmental Quality, December 31, 2010.
[36] Construction permit source analysis and technical review for Greenville Energy, LLC. Texas Commission on Environmental Quality.
[37] Ibid.

Table 3: Emissions increase significantly during startup/shutdown

Pollutant	Normal Emissions (lb/hr)	Maintenance, Startup and Shutdown Emissions (MSS)	MSS Emissions as % of Normal Emissions
NO_x	54	54	100%
CO	54	96.8	179%
VOC	6.1	16.1	264%
PM_{10}	22.1	168.8	764%
SO_2	7.9	5.6	71%
HCl	1.53	7.65	500%
H_2SO_4	0.2	0.4	200%
NH_3	10.7	--	--

Table 3. Allowable emission for the Greenville bioenergy facility in Texas. Emissions increase significantly during non-steady state operation.

The fact that synthetic minor sources aren't required to do air quality modeling means that the effect of these short-term surges in pollutant emissions on air quality and health can't be known. Rather than requiring facilities to control emissions during these periods, permitting agencies simply rely on facilities to do the right thing to control pollution. For instance, in response to a comment expressing concerns about the absence of controls during startup and shutdown at the proposed **25 MW North Star Jefferson wood-tire burner in Wadley, Georgia,** the Georgia Air Protection Branch staff explained, "*During startup and shutdown phases, the control devices are not able to achieve desired control efficiency due to operational limitations of the systems. The annual PSD Avoidance limits for CO, SO_2, NOx and GHG include emissions during all periods of operation including startup, shutdown and malfunction; thus, there is incentive for facility to begin operation of the control devices as soon as possible to ensure compliance with the emissions limits*."[38]

Carbon monoxide (CO) emissions in "synthetic minor" versus PSD permits

Aside from carbon dioxide (CO_2), carbon monoxide (CO) is the pollutant emitted in greatest quantities by biomass burning. High moisture and variable quality of biomass fuels lead to incomplete combustion, increasing CO emissions above levels typical for fossil fuel-fired facilities. Adding more oxygen to the combustion process can help reduce CO emissions, but doing so increases formation of "thermal" NOx, making it more difficult to remain within NOx emission limits.

[38] Alaa-Eldin A. Afifi, Georgia Environmental Protection Division, Air Protection Branch. Permit narrative for North Star Jefferson Renewable Energy Facility, page 32. May 2, 2012.

Table 4: Biomass power plants with synthetic minor status for carbon monoxide

Plant	State	MMBtu	MW	Boiler	CO control	Cap rate	CO (tons/yr)
Pinal Biomass Power, Maricopa	AZ	410	30	Stoker	none	0.13	240
DTE Stockton, Stockton	CA	699		Stoker	oxid cat	0.08	248
U.S. EcoGen Polk, Fort Meade	FL	740	57	FBB	none	0.08	246
ADAGE, Hamilton Cty	FL	834	56	FBB	none	0.07	245
Green Energy Partners, Lithonia	GA	186	10	Stoker	none	0.30	249
North Star Jefferson, Wadley	GA	321	22	FBB	none	0.18	249
Greenleaf Environmental Solutions, Cumming	GA	372	25	FBB	none	0.15	250
Greenway Renewable Power, LaGrange	GA	719	50		none	0.08	249
Plant Carl, Carnesville	GA	400	25	FBB	oxid cat	0.14	249
Wiregrass, Valdosta	GA	626	45	FBB	none	0.09	247
Lancaster Energy Partners, Thomaston	GA	215	15	Stoker	none	0.26	249
Lancaster Energy Partners, Macon	GA	220	16	Stoker	none	0.26	249
Fitzgerald Renewable Energy, Fitzgerald	GA	808	60		none	0.07	249
Piedmont Green Power, Barnesville	GA	657	55	Stoker	none	0.08	227
Hu Honua, Pepe'keo	HI	407	22	Stoker	none	0.14	246
Liberty Green, Scottsberg	IN	407	32	FBB	none	0.13	225
ecoPower, Hazard	KY	745		FBB	none	0.08	240
Menominee Biomass Energy, Menominee	MI	493		FBB	none	0.11	245
Sawyer Electric Co., Gwinn	MI	560		FBB	none	0.10	245
Perryville Renewable Energy, Perryville	MO	480	33	FBB	none	0.11	225
ReEnergy Black River, Fort Drum	NY	284	19	Stoker	none	0.20	250
Biogreen Sustainable Energy, La Pine	OR	353	25		none	0.16	247
Klamath Bioenergy, Klamath	OR	459		FBB	none	0.11	230
EDF Dorchester, Harleyville	SC	275	18	Stoker	none	0.20	241
EDF Allendale, Allendale	SC	275	18	Stoker	none	0.21	250
Loblolly Green Power, Newberry	SC	675	53	Stoker	oxid cat	0.08	222
Orangeburg County Biomass, Orangeburg	SC	525	35	FBB	none	0.11	250
NOVI Energy, South Boston	VA	629	50	Stoker	none	0.09	236

Table 4. Carbon monoxide limits for some synthetic minor source permits issued in recent years. The "cap rate" is the rate at which the unit would have to operate in order to stay below the specified tons of CO per year. "FBB" is fluidized bed boiler.

This problem is acknowledged in many bioenergy air permits, where it is common to see CO limits set considerably higher than what is achievable when the boiler is operated under ideal conditions. Despite this, however, a great number of bioenergy facilities, claim synthetic minor status for CO in order to avoid having to go through PSD permitting (Table 4).

How realistic is it that relatively large facilities can keep their CO emissions at less than 250 tons per year? The average allowable emission rate for the PSD facilities in our database (i.e., those that had gone through a BACT analysis) was around 0.2 lb/MMBtu. At that emission rate, a relatively small boiler of 285 MMBtu (around18 MW) would have the potential to emit 250 tons of CO per year, suggesting that most facilities, unless they are taking exceptional measures, are likely to be major sources for CO. Of the 88 permits in our database, 53 were capped at 250 tons or below for both CO and NOx – and the majority of these had boilers larger than 285 MMBtu.

In Table 4, the "cap rate" is the emission rate that the boiler would need to achieve in order to stay below its CO limit (assuming that the boiler is the only source of CO at the facility; in fact, the 250 ton cap is supposed to include all emissions at the facility, including emissions from fossil fuels burned at startup, emergency generators, etc). The cap rate is derived by rearranging equation 1, above:

Equation 2

$$\text{cap rate}\left(\frac{lb}{MMBtu}\right) = \text{tons per year} \div \left[\text{boiler capacity}\left(\frac{MMBtu}{hr}\right) * 8{,}760\ hrs\right] * 2{,}000\left(\frac{lb}{ton}\right)$$

Only two of the facilities in Table 4 proposed to use oxidation catalysts[39] to reduce CO emissions, with the rest planning to use "good combustion practices." According to the boiler maker Babcock and Wilcox, baseline CO emissions for stoker boilers (without an oxidation catalyst) are in the range of 0.1 - 0.3 lb/MMBtu when the boiler is being operated optimally at steady-state (i.e. not during startup and shutdown).[40] Fluidized bed boilers may have lower CO emissions rates of 0.015 - 0.15 lb/MMBtu at steady state[41] (the lowest permit limit found for an operating biomass boiler in EPA's permit clearinghouse[42] is that for the **50 MW Schiller Station bioenergy facility in Portsmouth, New Hampshire**, which has a limit of 0.1 lb/MMBtu for a circulating fluidized bed boiler).

It seems unlikely that all of the facilities in Table 4 would be capable of meeting the cap rate required to actually stay below 250 tons per year, given that in order to do so, many would have to *consistently* operate at rates even lower than 0.1 lb/MMBtu (including during periods of startup and

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[39] An oxidation catalyst converts CO to CO_2 and thus reduces CO emissions. The chemical reaction is speeded by a metal catalyst, but this technology has been rarely proposed for use in biomass boilers, because installing and operating CO catalysts is expensive and because the catalyst can be fouled and deactivated by substances contained in the ash. .

[40] Bowman, J., et al. Biomass combustion technologies: A comparison of a biomass 50MW modern stoker fired system and a bubbling fluidized bed system. Presented at POWER-GEN International, December 8-10, 2009. Las Vegas, NV.

[41] Ibid.

[42] EPA's BACT Clearinghouse (http://cfpub.epa.gov/rblc/)contains permit limits for a number of facilities, but it is not comprehensive and does not contain information on recently issued permits.

shutdown, when emissions can increase – see Table 3). Facilities could shut down for part of the year to stay below 250 tons, but only a couple of the permits we reviewed contained limits on hours of operation.

EPA agrees: Synthetic minor emission caps in state-issued permits strain credulity

Our skepticism about whether facilities can meet their required cap rates is shared by the EPA. The agency rarely gets involved in state-issued air permits, but occasionally does weigh in. A letter from EPA Region IX to the Hawaii air permit issuing authority about the **23.8 MW (gross) Hu Honua coal to biomass conversion in Pepe'ekeo, Hawaii** (which has a CO emission factor of 0.17 lb/MMBtu set in the permit, but which would need to keep average emissions below 0.14 lb/MMBtu to stay below 250 tons) stated that the air permit application "*does not provide any documentation or justification of the CO emission factor,*" and that *"we have permitted two biomass facilities with stoker boilers that are approximately half the size of the proposed Hu Honua plant; yet the projected future actual CO emission and CO PTE of both facilities are much higher than Hu Honua's, and well above the 250 tpy PSD major source threshold. In sum, we have not seen any instance of a stoker boiler of the permittee's size being able to achieve the CO emission limits that the Clean Air Branch is proposing for this permit*."[43]

Hu Honua is a 22 MW plant, relatively small compared to a number of other facilities that are also claiming synthetic minor status for CO, making the implications of EPA's statements more far-reaching. When, even after the EPA letter, the Hawaii authorities issued the final permit for Hu Honua with few changes, a citizen group petitioned EPA to formally object to the permit on the grounds that it is illegal and unenforceable. In its response, EPA agreed that the Hu Honua permit limits for both CO and NOx were unenforceable, stating "*To effectively limit Hu Honua's CO and NOx PTE to less than 250 tpy, the CO and NOx emissions limits included in Section C6 of the Final Permit must apply at all times to all actual emissions, and all actual CO and NOx emissions must be considered in determining compliance with the respective limits*."[44] EPA's response makes it clear that not only must normal emissions be included, but startup and shutdown emissions and emissions during malfunctions or "upset" conditions must be counted, as well.

If a facility claims it is going to emit less than 250 tons of each pollutant to avoid PSD permitting, it needs to demonstrate this with testing and monitoring

However, while EPA was involved with the Hu Honua permit, the Agency inexplicably has not reacted to other permits with low implied CO emissions (such as the numerous facilities larger than Hu Honua listed in Table 4), most of which explicitly or implicitly exempt total facility emissions from counting toward the 250 ton total.

[43] Letter from Gerardo C. Rios, Chief, Permits office EPA Region IX, to Wilfred K. Nagamine, Manager, Clean Air Branch, Hawaii Department of Health. June 30, 2011.

[44] United States Environmental Protection Agency. In the matter of Hu Honua Bioenergy Facility, Pepeekeo, Hawaii. Permit No. 0724-01-C. Order responding to petitioner's request that the Administrator object to issuance of state operating permit. Petition No. IX-2011-1. Page 10.

The incongruity of permits that set a 250 ton cap for CO, almost no matter what the facility size, is illustrated graphically in Figure 4. The graph shows allowable CO emissions for new synthetic minor sources versus PSD-permitted sources from our permit database, in tons of CO emitted per year. Almost all the plants in Figure 4 – even the majority of the PSD-permitted plants that went through a BACT analysis – plan to use "good combustion practices" to control CO; only two of the synthetic minor sources and four of the PSD-permitted sources plan to use oxidation catalysts (highlighted). Thus, all other things being equal, as boiler capacity (in MMBtu per hour) increases, a facility's annual potential emissions (tons per year) should increase. This is the case for the permits issued under the PSD program, where achievable CO emissions rates are considered as part of a BACT analysis. However, the graph makes clear, this relationship does not apply for the group of synthetic minor sources, all of which claim they will emit 250 tons or less, no matter what their boiler capacity.

Figure 4: Projected emissions of carbon monoxide

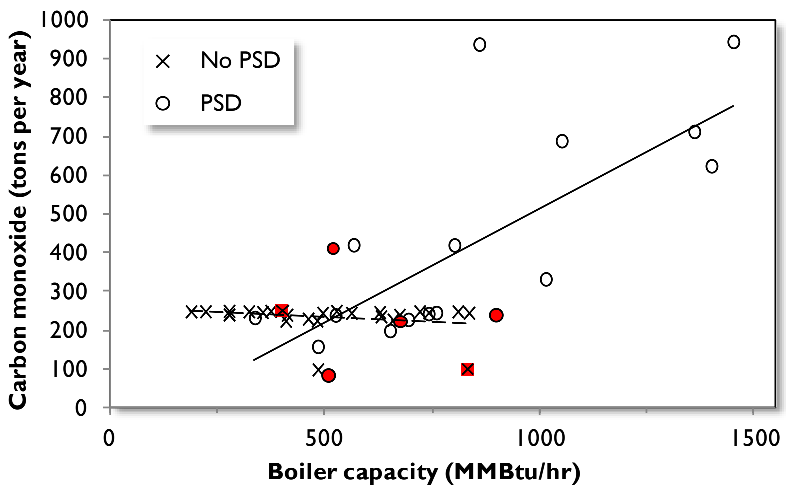

Figure 4. The relationship between permitted CO emissions for some facilities that went through PSD, versus synthetic minor sources that avoid PSD. Shaded markers represent facilities that propose to use oxidation catalysts to reduce CO emissions. Dashed line shows trend for non-PSD facilities; solid line shows trend for PSD facilities.

These data suggest that the 250 tons cap is problematic on both sides of the size spectrum. Small boilers that *could* limit their emissions below 250 tons, but nonetheless have the 250 ton cap as their only enforceable CO limit, are allowed to emit more pollution than they need to, while some large facilities that avoided PSD seem unlikely to be able to stay beneath the 250 ton cap, especially since total facility emissions (and not just boiler emissions) are supposed to be included.

Nitrogen oxide (NOx) emissions

To avoid PSD, a facility must accept a cap not only on CO, but also NOx. Table 5 the NOx limits for some of the synthetic minor source permits in our database.

Table 5: Biomass power plants with synthetic minor status for nitrogen oxides

Plant	State	MMBtu	MW	Boiler	NO_x control	Cap rate	NO_x (tons/yr)
Pinal Biomass Power, Maricopa	AZ	410	30	Stoker	SNCR	0.13	240
DTE Stockton, Stockton	CA	699	48	Stoker	SCR	0.04	108
U.S. EcoGen Polk, Fort Meade	FL	740	57	FBB	SCR	0.08	246
ADAGE, Hamilton Cty	FL	834	56	FBB	SCR	0.06	233
Green Energy Partners, Lithonia	GA	186	10	Stoker	not spec	0.03	25
North Star Jefferson, Wadley	GA	321	22	FBB	SCR	0.18	249
Greenleaf Environmental Solutions, Cumming	GA	372	25	FBB	SCR	0.02	25
Greenway Renewable Power, LaGrange	GA	719	50		SNCR	0.08	249
Plant Carl, Carnesville	GA	400	25	FBB	SNCR	0.14	249
Wiregrass, Valdosta	GA	626	45	FBB	SCR	0.09	247
Lancaster Energy Partners, Thomaston	GA	215	15	Stoker	SNCR	0.26	249
Lancaster Energy Partners, Macon	GA	220	16	Stoker	SNCR	0.26	249
Fitzgerald Renewable Energy, Fitzgerald	GA	808	60		SNCR	0.07	249
Piedmont Green Power, Barnesville	GA	657	55	Stoker	SNCR	0.08	228
Hu Honua, Pepe'keo	HI	407	22	Stoker	SNCR	0.12	210
Liberty Green, Scottsberg	IN	407	32	FBB	SNCR	0.14	245
ecoPower, Hazard	KY	745		FBB	SNCR	0.08	240
Menominee Biomass Energy, Menominee	MI	493		FBB	not spec	0.11	245
Sawyer Electric Co., Gwinn	MI	560		FBB	SNCR	0.10	245
Perryville Renewable Energy, Perryville	MO	480	33	FBB	SNCR	0.11	240
ReEnergy Black River, Fort Drum	NY	284	19	Stoker	SCR	0.20	250
Biogreen Sustainable Energy, La Pine	OR	353	25		SNCR	0.15	232
Klamath Bioenergy, Klamath	OR	459		FBB	SNCR	0.11	230
EDF Dorchester, Harleyville	SC	275	18	Stoker	SNCR	0.20	241
EDF Allendale, Allendale	SC	275	18	Stoker	SNCR	0.20	241
Loblolly Green Power, Newberry	SC	675	53	Stoker	MPCR*	0.07	222
Orangeburg County Biomass, Orangeburg	SC	525	35	FBB	SCR	0.11	250
NOVI Energy, South Boston	VA	629	50	Stoker	SCR	0.09	236

Table 5. Nitrogen dioxide limits for some synthetic minor source permits issued in recent years. "FBB" is fluidized bed boiler. "MPCR" is "multi-pollutant catalytic reactor."

While the majority of biomass permits we examined did not require external emissions controls for CO, nearly all required emissions controls for NOx – usually either Selective Catalytic Reduction (SCR) or Selective Non-Catalytic Reduction (SNCR). These controls force reducing agents (ammonia or urea) to react with the nitrogen oxides formed during combustion, converting the NOx in the flue gas to nitrogen gas (N_2). The stated efficiency of these controls varies tremendously. In our database, facilities planning to use SCR claim NOx conversion efficiencies ranging from 36 – 95%; claims for SNCR efficiency range from 45 – 73%. This wide range of claims is obviously problematic, as it seems unlikely that all claims can be met in reality.

As is the case for the 250 ton cap for CO, the NOx emission rates implied in Table 5 sometimes appear to be unrealistically low if the facility is stay under the emissions cap. For example, permit limits for the **Green Energy Resource Center in Lithonia, Georgia** seem unrealistic. The permit narrative states, "*Dekalb County is a non-attainment-area for ozone (NOx and VOC) and $PM_{2.5}$. The major source thresholds in the non-attainment area for NOx and VOC are 25 tons per year each. The potential VOC emissions are less than 25 tpy. Since the NOx potential to emit exceeds 25 tpy, the facility requests a permit limit to limit the NOx emissions to less than 25 tpy. Based on the projected emissions and control efficiencies, the facility will demonstrate through stack testing and continuous emission monitoring that the facility will be a synthetic minor source with respect to New Source Review.*"[45]

However, to meet this cap, the facility will have to keep average NOx emissions at about 0.03 lb/MMBtu, an extremely low level that is all the more extraordinary given that the company has proposed a novel emissions control system that has never been tried on a biomass energy plant before, a ceramic filter device that apparently incorporates NOx reduction capabilities. Similarly, the proposed **25 MW (net) Greenleaf Environmental Solutions plant in Cumming, Georgia**, which is also in the Atlanta non-attainment area, has an even lower NOx emissions rate it must meet – 0.015 lb/MMBtu – if it is to stay below its cap of 25 tons.

Some synthetic minor facilities are allowed to emit pollution disproportionate to their size

For synthetic minor permits at some facilities, however, the NOx emission rates required for a facility to avoid PSD may not be all that low. For instance, the permit for the **19 MW (net) ReEnergy Lyonsdale Biomass plant in Lyonsdale, New York** (which has a 290 MMBtu boiler) states that NOx emissions from the wood burning boiler are limited to 0.2 lb/MMBtu to avoid PSD.[46] This emission rate is about three times higher than NOx emission rates commonly required at coal plants and biomass plants that have gone through a BACT analysis as part of PSD permitting. This plant's permit allows it to be unnecessarily polluting, but since the facility is permitted to burn pallets and "non-recyclable fibrous material such as wax cardboard," the higher limit may be needed to accommodate surges in emissions that accompany burning waste materials.

[45] Renee Browne, Georgia Environmental Protection Division, Air Protection Branch. Permit narrative for Green Energy Resource Center, April 25, 2013.
[46] New York State Department of Environmental Conservation. Air Title V Facility Permit for Lyonsdale Biomass, Permit ID 6-2338-00012/00004. Effective date 08/16/2011.

Figure 5 shows that for facilities that go through PSD and a Best Available Control Technology analysis, annual NOx emissions tend to increase as boiler size increases, as expected. However, for the synthetic minor sources that avoid BACT, emission rates are capped around 250 tons or less.

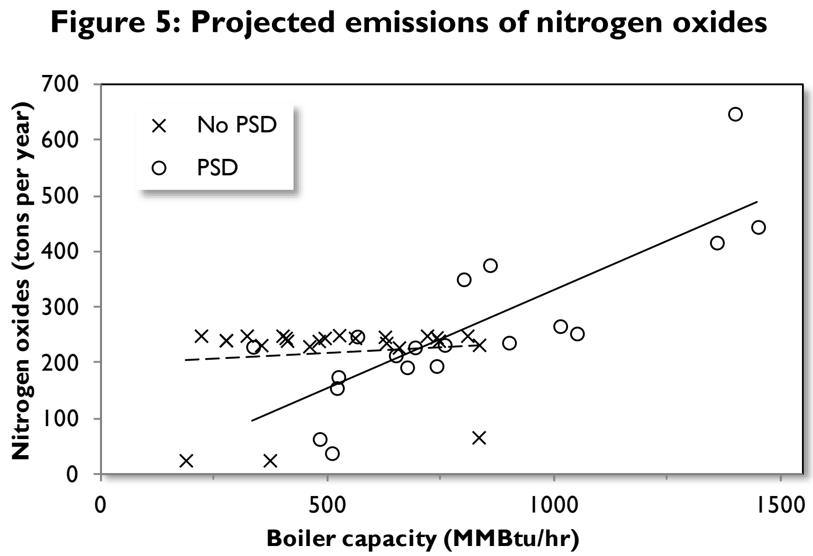

Figure 5. The relationship between permitted NO_x emissions for some facilities that went through PSD, versus synthetic minor sources that avoided PSD. Dashed line shows trend for no-PSD facilities; solid line shows trend for PSD facilities.

Although some larger synthetic minor facilities appear to be promising unrealistically low NOx emission rates, the graph makes it clear that allowable NOx emissions from smaller synthetic minor sources tend to be higher than they would be had the facility gone through a BACT analysis to determine the lowest emission levels that could be achieved.

Particulate matter (PM) emissions

All biomass power plants are large sources of particulate matter emissions; even facilities that have gone through a BACT analysis and have emission rates as low as 0.012 lb/MMBtu emit more particulate matter per MWh than a coal plant (Table 2, Figure 2). Because uncontrolled particulate matter emissions from combustion are large, all utility-scale biomass plants use some kind of particulate matter control, usually either a fabric filter ("baghouse") or an electrostatic precipitator (ESP), often in conjunction with a multiclone, which is a series of devices that use centrifugal force to spin out particles in the larger size classes.[47] Once these controls are in place, they are generally effective enough that almost no typically sized biomass plant is in danger of emitting more than 250 tons PM per year, meaning that PM is not usually a pollutant that triggers PSD for a new biomass power plant.[48] However, crucially, this assumption only holds if the plant is running normally

[47] Only one facility in our database, the Green Energy Partners plant in Lithonia, GA, is proposing to use something other than a fabric filter or ESP to control PM emissions, a ceramic filter from the TriMer corporation.

[48] However, for existing facilities undergoing a "major modification," PSD applicability is triggered when the increase in emissions caused by the modification exceeds certain triggering thresholds. The PSD major significance threshold for $PM_{2.5}$ is 10

during the whole year. Periods of startup, shutdown, and malfunctions can cause significant emissions of PM since certain controls, such as ESPs, are allowed to be non-operational during such time periods.

State-issued air permits have no limits on the most harmful forms of particulate matter

Even though all biomass plants use baghouses or ESPs, the NSPS emission limit of 0.03 lb/MMBtu that applies at most synthetic minor facilities is at least twice as high as rates of 0.012 lb/MMBtu to 0.015 lb/MMBtu that apply at facilities that have gone through a BACT analysis. When translated to tons of PM emitted per year, the allowable limits are likewise twice as high (Figure 6).

Figure 6: Projected emissions of filterable particulate matter

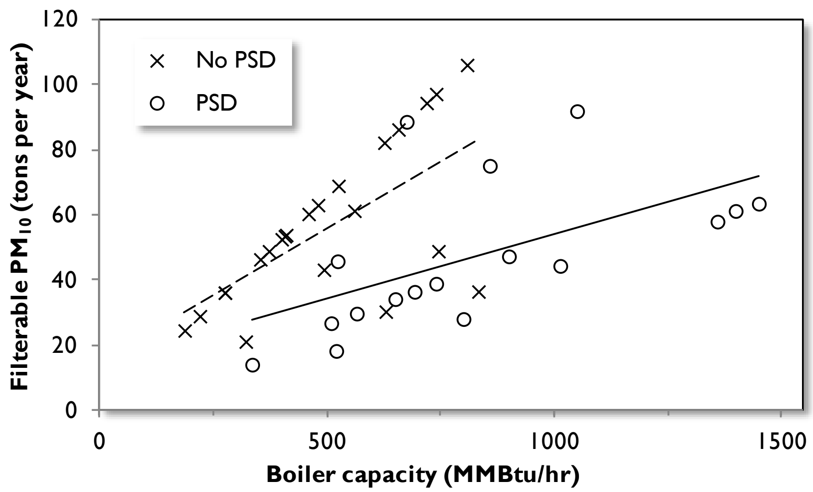

Figure 6. Allowable emissions of filterable PM_{10} for permits in our database. For nearly all the facilities that avoid PSD, the only required emission limit is the 0.03 lb/MMBtu PM_{10} limit set by the New Source Performance Standards. Dashed line shows trend for no-PSD facilities; solid line shows trend for PSD facilities. A couple of minor sources that did not go through PSD nonetheless had lower limits, pulling the dashed trendline down.

Particulate matter is a pollutant with immediate and dramatic health effects, and it is a pollutant where regulation under PSD can really reduce emissions. Particulate matter is regulated in two size classes, PM_{10}, and $PM_{2.5}$,[49] with the subscript referring to particle size or diameter in micrometers. Particulate matter is also regulated in two forms – filterable PM (the portion of PM that can be captured by a baghouse or ESP), and condensable PM (the portion of PM that condenses out of other pollutants into the atmosphere after being emitted from the smokestack). While condensable PM is considered to fall into the $PM_{2.5}$ size class, much of it is actually in the "ultrafine" size class, of 0.1 micron and below. These particles are considered the most dangerous to health, as they are so small, the penetrate deep into the respiratory system. The PSD program requires that emissions of

tpy of direct $PM_{2.5}$ emissions; 40 tpy of SO_2 emissions; or 40 tpy of NOx emissions unless demonstrated not to be a $PM_{2.5}$ precursor under paragraph (b)(50) of 40 CFR 52.21.

[49] $PM_{2.5}$ is a subset of PM_{10}.

$PM_{2.5}$, including condensable PM, be evaluated to assess a facility's impact on air quality.[50] In contrast, the only emission rate requirement included in most permits for synthetic minor facilities is the federal New Source Performance Standard (NSPS) for filterable particulate matter, which simply limits filterable PM_{10} emissions to less than 0.03 lb/MMBtu,[51] and specifically exempts facilities during periods of startup and shutdown.

Just because a facility is allowed to emit a certain amount of pollution doesn't mean it will. Fabric filter and electrostatic precipitator technologies should reduce filterable PM_{10} emissions to less than 0.03 lb/MMBtu (though emission rates can spike dramatically during startup and shutdown, when most synthetic minor facilities are specifically exempted from meeting an emissions limit – Table 3). However, because synthetic minor source permits contain no consideration or limits on condensable PM or $PM_{2.5}$, total emissions of PM are likely to greatly exceed emissions of just filterable PM. In fact, permitting agencies don't seem to have a consistent concept of the importance of condensable PM, even though it is an important part of total PM emissions. Regulation of condensable PM is chaotic. In our analysis of 23 permits where condensable PM rates were specified or could be estimated by subtracting filterable PM from total PM emissions, we determined that the ratio of allowable condensable emissions to filterable emissions varied significantly, with condensable PM rates ranging from 50% to 200% of filterable PM emission rates.

Particulate matter emissions from biomass power plants could be reduced considerably by requiring use of one of the many high efficiency filtration products that EPA certifies.[52] Table 6 shows how, for a representative 500 MMBtu/hr wood-burning boiler with an uncontrolled PM emission rate of 0.56 lb/MMBtu,[53] adding just tenths or one-hundredths of a decimal point in the efficiency of a filtration system can significantly decrease the amount of particulate matter emitted. The higher efficiency fabric filters produce a dramatic reduction in emissions even relative to the control efficiencies of 98% or 99% that are often promised in modern permits, and actually represent the "best available" technology for particulate matter control. Unfortunately, because EPA rules are so weak, with synthetic minor source permits only requiring that facilities meet the 0.03 lb/MMBtu NSPS limit for filterable PM, state-level permit writers have little regulatory basis for requiring facilities to use high-efficiency filters, even if they want to.

[50] Many permits use PM_{10} emissions as a proxy for $PM_{2.5}$, assuming that treating all PM as if it is in the smaller size class is the most conservative form of the analysis.
[51] U.S. EPA. 40 CFR Part 60. Standards of performance for electric utility steam generating units, industrial –commercial-institutional steam generating units, and small industrial-commercial-institutional steam generating units; final rule. Federal Register Vol. 71, No. 38, Feb. 27, 2006.
[52] EPA lists currently certified products at http://www.epa.gov/etv/vt-apc.html#bfp
[53] Value of 0.56 lb/MMBtu for uncontrolled PM emissions taken from Table 1 of background document to EPA's AP-42 compilation of emission factors (Eastern Research Group. Background document report on revisions to 5th Edition AP-42, Section 1.6, Wood Residue Combustion in Boilers. July, 2001).

Table 6: Synthetic minor sources are allowed to emit hundreds of times more particulate matter than the best-controlled facilities

Technology	Tons/year
Allowable emissions @ NSPS limit of 0.03 lb/MMBtu	65.70
Electrostatic precipitator @ 98%	24.53
Baghouse @ 99%	12.26
Baghouse @ 99.5%	6.13
Baghouse @ 99.9%	1.23
High-efficiency baghouse @ 99.99%	0.12

Table 6. Emissions of filterable PM_{10} from a 500 MMBtu wood-burning boiler employing control technologies with differing removal efficiencies. A biomass power plant operating at the NSPS limit of 0.03 lb/MMBtu would emit more than 500 times the PM of a plant employing a high-efficiency baghouse.

In some cases, when regulators do have the option of requiring stricter emissions controls, they don't. For instance, the **new 25 MW biomass boiler at Verso Paper in Bucksport, Maine**, which did go through a BACT analysis, was nonetheless permitted with a 0.03 lb/MMBtu emissions rate for PM,[54] the same rate it would be required to meet if no BACT analysis had been conducted. This large, high-emissions plant is located immediately adjacent to homes and schools.

Sulfur dioxide (SO_2) emissions

Wood is a relatively low-sulfur fuel, and thus generally emits less sulfur dioxide than coal, although relative to natural gas, its emissions of SO_2 are far higher (Figure 2). While sulfur content of "unadulterated" wood samples in EPA's fuel database[55] averages less than 1%, sulfur content can be much higher if wood chips are sourced from construction and demolition debris, which can be contaminated with gypsum wallboard, a material that contains sulfur. If all sulfur in biomass were converted to SO_2 during combustion, the sulfur in even unadulterated fuels would be sufficient to create more than 250 tons of annual emissions at most large biomass power plants. However, SO_2 is neutralized naturally during combustion by alkaline ash products so that up to 90% of it is incorporated in ash, rather than exiting the stack in the flue gas.[56] Facilities that inject alkaline agents like limestone to neutralize hydrochloric acid emissions can also reduce SO_2 emissions.

[54] Maine Department of Environmental Protection. Departmental Findings of fact and order, New Source Review, Amendment #3 for Verso Bucksport, LLC. A-22-77-4-A.

[55] Draft Emissions Database for Boilers and Process Heaters Containing Stack Test, CEM, & Fuel Analysis Data Reported under ICR No. 2286.01 & ICR No. 2286.03 (version 8) May, 2012. Available at http://www.epa.gov/airtoxics/boiler/boilerpg.html (database labeled "Boiler MACT Draft Emissions and Survey Results Databases")

[56] Oglesby, H.S. and Blosser, R.O. 1980. Information on the sulfur content of bark and its contribution to SO2 emissions when burned as a fuel. Journal of the Air Pollution Control Association, 30:7, 769-772.

Synthetic minor facilities tend to have higher allowable SO_2 emission rates than facilities that have gone through PSD permitting. However, in Figure 7, the non-PSD facilities with allowable SO_2 emissions around 250 tons did include sorbent injection in their emissions controls, suggesting that actual emissions would be lower than allowable emissions. Overall, 13 facilities did not appear to plan on using sorbent injection, including a couple of PSD-permitted facilities that plant to rely on "natural" ash sorption of to control SO_2 and HCl emissions.

Figure 7: Projected emissions of sulfur dioxide

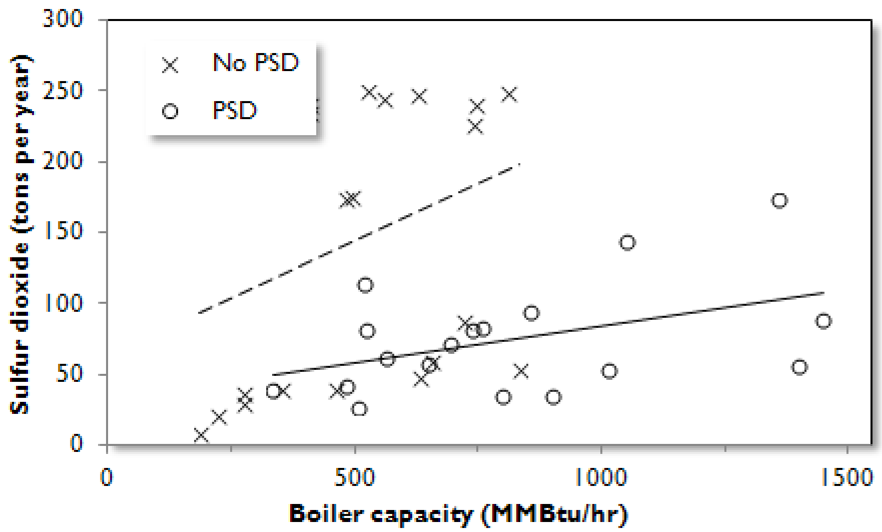

Figure 7. The relationship between permitted SO_2 emissions for some facilities that went through PSD, versus synthetic minor sources that avoid PSD. Dashed line shows trend for no-PSD facilities; solid line shows trend for PSD facilities.

Toxic air pollution from biomass energy

Hazardous air pollutants (HAPs) is the collective name for the group of 187+ compounds that EPA considers especially toxic in air. Although biomass energy is routinely presented as "clean," in fact, biomass burning emits large amounts of HAPs, also known as "air toxics" – including hydrochloric acid, dioxins, "organic" compounds such as benzene and formaldehyde, and heavy metals like arsenic, chromium, cadmium, lead, and mercury. Emissions of metals and other HAPs are likely to be highest when contaminated materials like construction and demolition debris are burned as fuel, but burning just unadulterated forest wood also emits toxic air pollutants. Some of these compounds are contained in the fuel itself while others are created during the combustion process. As we discuss below, the use of contaminated fuels is increasing in the bioenergy industry, thus HAPs emissions from the biomass power industry are likely to increase.

Burning biomass emits a wide variety of air toxics, but the HAP typically thought to be emitted in the greatest quantities is hydrochloric acid (HCl). Other HAPs emitted at relatively high rates include acrolein, acetaldehyde, styrene, benzene, and formaldehyde, which have various respiratory and carcinogenic effects. A co-firing test conducted at the **600 MW Killen coal plant in Wrightsville, Ohio**, where a small amount of biomass was burned at a coal plant, showed the dramatic potential for biomass to increase emissions of air toxics. There, adding just 5% biomass to the coal increased CO emissions by 50%, while increasing the yearly potential to emit for benzene from 1.51 tons to 6.89 tons per year and the PTE for formaldehyde from 0.28 tons to 5.98 tons per year (both these organic HAPs are classified as carcinogens).[57] It is important to note, however, that many HAPs (such as dioxins), while emitted in small quantities as compared to the HAPs discussed above, can pose very significant health risks, due to their high levels of toxicity.

How the Clean Air Act regulates emissions of hazardous air pollutants (HAPs)

The Clean Air Act regulates HAPs by setting National Emissions Standards for Hazardous Air Pollutants (NESHAPS) for different types of emissions sources. The Act requires EPA to set emission standards for each HAP that a source category emits, although the regulations as written do not appear to meet this standard. The allowable emission levels for HAPs, known as the Maximum Achievable Control Technology (MACT) standards, are supposed to be derived by collecting emissions data from existing sources, then setting standards for new facilities based on the best performing (lowest emitting) units of each type.[58]

Bioenergy plants emit acrolein, styrene, benzene, and formaldehyde, as well as heavy metals like arsenic, chromium, cadmium, lead, and mercury.

As EPA currently implements the rules, different types of facilities are held to different MACT standards, with one category being units described as "designed to burn" biomass. Under EPA's current rules, if a boiler burns or co-fires more than 10% biomass, and is greater than 10 MMBtu/hr, it is regulated as a biomass burner under the Industrial/Commercial/Institutional (ICI) rule, known informally as the "boiler rule"[59] or boiler MACT. Amazingly, this rule regulates a facility burning 90% coal and 10% biomass as a biomass burner, which as shown below, has consequences for emissions, as biomass boilers are allowed to emit more pollution than coal boilers.

The "boiler rule" regulates all biomass boilers, no matter how large they are, and sets separate standards for emissions from fossil-fueled boilers up to 25 MW in capacity. However, oil, coal and gas facilities larger than 25 MW are governed not by the boiler rule, but by a separate Electric Generating Unit (EGU) rule, which is more rigorous (discussed below). If a facility burns a

[57] Technical support document, DP&L Killen Electric Generating Station, Boiler #2 coal and renewable fuel co-firing. 2010;
[58] Section 112(d)(2) of the Clean Air Act requires the maximum degree of reduction in emissions that can be achieved, considering cost and other factors, through the full range of potential reduction measures. 42 U.S.C. § 7412(d)(2). In addition, § 112(d)(3) provides that regardless of cost, standards for new and existing facilities must reflect the emission level achieved by the best performing similar sources. 42 U.S.C. § 7412(d)(3).
[59] Whereas coal plants larger than 25 MW are held to a stricter standard for emissions under the Electric Generating Unit MACT standard, all biomass plants, regardless of how large they are, are govern by the more lenient "boiler" MACT

material classified as a commercial or industrial waste[60] it is regulated under the Commercial and Industrial Solid Waste Incinerator rule (CISWI).

Under the boiler rule, a facility is considered a "major" source for HAPs if it has the potential to emit more than 10 tons of any one HAP or more than 25 tons of all HAPs in a year. If potential emissions are anticipated during the permitting process to be less than this, a facility is classified as a minor source, known as an "area" source in MACT parlance. In some cases, the MACT standards set emission limits directly for the HAP in question; in the boiler rule, however, only HCl and mercury are regulated directly, and other HAPs are regulated indirectly by setting limits on emissions of PM and CO, which EPA has claimed can serve as "surrogates" for emissions of various co-emitted HAPs.[61]

While the term "maximum" achievable control technology (MACT) for hazardous air pollutants would imply that HAP emissions are controlled to the greatest degree possible, EPA's approach, and the way data are manipulated to set standards, have not resulted in protective standards. As an area source, the only limit a biomass burner greater than 30 MMBtu[62] must meet under the rule is a filterable PM emissions rate of 0.03 lb/MMBtu, the same rate as required under the NSPS, as described above in the section on PSD avoidance. The biomass area source rule does not set any emissions limits on dioxins, other organic HAPs like benzene and formaldehyde, metals like mercury, arsenic, and lead, or hydrochloric acid (HCl) and other acid gases.

Under the boiler rule, the majority of biomass power plants have almost no restrictions on the amount of toxic pollution they can emit.

Since the area source standard is so weak, it might be expected that emissions standards for major sources of HAPs (those that anticipating exceeding the 10/25 ton limit) would be more rigorous, but in fact, the filterable PM standard for stoker boilers under the major source rule is also 0.03 lb/MMBtu, the <u>same as for area sources</u>, although the filterable PM standard for bubbling fluidized bed boilers is one third the standard for stokers, at 0.0098 lb/MMBtu. In general, the MACT standards are far more lax than what can be routinely achieved using present-day technology. For example, the 0.03 lb/MMBtu filterable PM limit for major source stoker boilers (and area sources) is orders of magnitude higher than filterable PM emissions levels that can be achieved using high-efficiency fabric filters discussed above, as shown in Table 6. The CO standard set by the major source MACT rule is higher than rates commonly set by BACT determinations, as we discuss in more detail below. The major source MACT limit for HCl, which is supposed to serve as a proxy for emissions of other acid gases like hydrogen fluoride, is set at 0.022 lb/MMBtu, about an order of magnitude higher than emissions that can be achieved using sorbent injection. The limit is so high, it allows facilities that have declared themselves major sources for HAPs, like the **31 MW unit being added at the Sierra Pacific Anderson plant in Anderson, California,** to be built *without* HCl controls. That facility projects emitting 45 tons

[60] Municipal waste, medical waste, sewage sludge, and certain other types of waste are regulated separately.
[61] There is considerable debate as to whether these proxies are at all valid, and much evidence that emissions of certain HAPs are decoupled from their proxies.
[62] The rule sets the filterable PM rate at 0.07lb/MMBtu for biomass burners that are 10 – 30 MMBtu in capacity.

of HCl per year. Likewise, the **45 MW (gross) Aspen facility, in Lufkin, Texas**, was permitted as a major source for HAPs with a permit limit of 57 tons of HCl per year, and will not use a sorbent system to control HCl.[63]

Of the permits that we reviewed, the majority were designated as area sources for HAPs, no matter what their boiler size; just 19 (22%) were clearly identified as major sources for HAPs (some simply did not discuss HAPs in their construction permit at all.[64]) As neither the major source rule nor the area source rule is particularly restrictive, the question is what facilities hope to accomplish by being designated as area sources for HAPs. The lack of any emission limits in the area source rule other than the 0.03 lb/MMBtu limit for filterable PM is no doubt attractive for facilities wishing to minimize the requirements they must meet, but as we discuss below, facilities may be challenged to demonstrate that they are truly area sources.

EPA rules let biomass plants emit more toxic air pollutants than coal plants

How do the boiler rule emissions standards for bioenergy compare to standards set for coal plants? We focus here on filterable PM standards, since particulate matter is an important threat to health on its own and is treated by EPA as a proxy for heavy metal emissions under the boiler rule, which does not regulate heavy metal emissions directly. Under the rule, for filterable PM:

- Area source biomass boilers greater than 30 MMBtu/hr are allowed to emit 0.03 lb/MMBtu, the same as an area source coal boiler.
- Major source biomass stoker boilers[65] are allowed to emit more than 27 times the PM of a major source coal boiler (0.03 lb/MMBtu for bioenergy, versus 0.0011 lb/MMBtu for coal).
- Major source fluidized bed biomass boilers are allowed to emit almost 9 times the PM of a major source coal boiler (0.0098 lb/MMBtu for bioenergy, versus 0.0011 lb/MMBtu for coal).

Even under "maximum achievable" standards for air toxics, biomass plants are allowed to be more polluting than coal plants.

Although all biomass energy facilities of any size are regulated under the boiler rule, coal plants larger than 25 MW are regulated under the separate and relatively more rigorous Electric Generating Unit (EGU) MACT rule, which sets the filterable PM emission rate on an output basis,[66] at 0.09 lb/MWh. To do a biomass to coal comparison for two representative 50 MW power plants, where the coal plant is regulated under the EGU rule and the biomass plant

[63] Technical briefing sheet for Aspen Power LLC, Permit No.: 81706 and PDS-TX-1089, and HAP12

[64] In some cases this may be because HAPs are handled by Title V operating permits, which are issued subsequent to construction permits. Most of the permits we reviewed were construction permits, but our database also included a few Title V permits.

[65] For major sources (facilities that exceed the 10/25 ton emissions threshold), the boiler rule sets separate standards for biomass and coal stoker boilers and fluidized bed boilers.

[66] Pollution emissions expressed on an output basis is in units of pounds of pollutant emitted per megawatt-hour of electricity generated; emission expressed on an input basis is in units of pounds of pollutant emitted per million Btu (MMBtu) of boiler capacity, an expression of the heat input to the boiler.

is regulated under the boiler rule, therefore requires converting the bioenergy MACT standard (which is expressed on an input basis, as lb/MMBtu) to an output basis.[67]

Assuming a 24% conversion of energy to electricity for bioenergy, which is a typical value for large-scale bioenergy facilities, for filterable particulate matter:

- The biomass boiler MACT standard of 0.03 lb/MMBtu for a stoker boiler translates to a rate of 0.427 lb/MWh on an output basis, <u>474% the standard for a coal plant regulated under the EGU rule</u>,
- The biomass boiler MACT standard of 0.0098 lb/MMBtu for a fluidized bed boiler translates to a rate of 0.139 lb/MWh on an output basis,[68] <u>154% the standard for a coal plant</u>.

Thus, even subject to the "maximum achievable" control technology standard for hazardous air pollutants, biomass power plants are allowed to emit dramatically more particulate pollution than coal plants.

EPA rules let biomass plants emit more air toxics than waste incinerators

Under the Clean Air Act, how much pollution an industrial boiler is allowed to emit depends in part on whether it is classified as a biomass burner (an ICI unit) or a waste incinerator (a CISWI unit, which burns commercial and industrial waste).[69] Waste incinerators are generally better regulated than biomass burners, as the CISWI standards apply to *all* units regardless of their size, based on potential to emit, and because the rule regulates a larger number of the pollutants likely to be present in waste, and generally regulates them more tightly (Table 7). This seems reasonable, given that burning wastes is likely to emit more toxins than burning wood and other fuels typically thought of as "biomass," but as we explain below, EPA's new rules blur the line between biomass and waste, allowing a greater amount of contaminated fuels to be burned as biomass in area source boilers, which have no emission limits for HAPs.

As shown in Table 7, while the CISWI rule is not especially rigorous, it does recognize the potential for heavy metals and dioxin emissions from burning waste materials, regulating a couple of metals directly (an important exception is that the CISWI rule does not set an emission limit for arsenic, which is one of the main ingredients in the copper-chromium-arsenate (CCA) cocktail that is used to pressure-treat wood). Unlike the incinerator rule, the boiler rule only regulates non-mercury metals indirectly, by setting emission standards for filterable particulate matter, which EPA considers a proxy for metals emissions.

[67] To do this, one divides boiler capacity by the efficiency of the conversion from heat input to electricity, and converts units of MMBtu to MWh. The conversion from btu to MWh is made assuming 3,413,000 btu per MWh

[68] These conversions assume 24% efficiency for the biomass boilers.

[69] Municipal waste, medical waste, sewage sludge, and certain other types of waste are regulated separately.

Table 7: EPA barely regulates toxic air pollution from biomass plants

CISWI limit for ERU's burning biomass		ICI Major Source limits Stoker boilers		ICI Major Source limits Fluidized bed boilers		ICI Area Source limits	
PM, filterable (mg/dscm)	**5.1**	PM, filterable (lb/MMBtu)	**0.03**	PM, filterable (lb/MMBtu)	**0.0098**	PM, filterable (lb/MMBtu)	**0.03**
Carbon monoxide (ppm at 7% O_2)	**240**	Carbon monoxide (ppm at 3% O_2)	**620**	Carbon monoxide (ppm)	**230**		
Hydrogen chloride (ppmv)	**0.2**	Hydrogen chloride (lb/MMBtu)	**0.022**	Hydrogen chloride (lb/MMBtu)	**0.022**		
Mercury (mg/dscm)	**0.0022**	Mercury (lb/MMBtu)	**0.0000008**	Mercury (lb/MMBtu)	**0.0000008**		
Lead (mg/dscm)	**0.014**						
Cadmium (mg/dscm)	**0.0014**						
Dioxin, furans, total (ng/dscm)	**0.52**						
Dioxin, furans, Toxic Equivalents (TEQ) (ng/dscm)	**0.076**						
Nitrogen oxides (ppmv)	**290**						
Sulfur Dioxide (ppmv)	**7.3**						

Table 7. Allowable emissions under EPA's incinerator rule and major and area source boiler rules.

A biomass plant is allowed to emit ten times more fine particulate matter than a waste incinerator

Because the incinerator and boiler rules express emission rates for the same pollutants using different units, direct comparisons are difficult. However, the comparisons are possible by making reasonable assumptions regarding boiler capacity and stack flow for a facility regulated as either a biomass burner or an incinerator. Considering a representative 50 MW facility with a 740 MMBtu/hr stoker boiler:[70]

- If classified as an incinerator, it would be allowed to emit 9.5 tons per year of filterable PM. If classified as a biomass burner, it would be allowed to emit more than 10 times as much, 97 tons per year, under both the area source rule and the major source rule for stoker boilers. If filterable PM truly is a proxy for emissions of metals, then this means that ten times more heavy metals would be released at a facility regulated as a biomass burner.

[70] These parameters were taken from the permit for the Russell Biomass plant, a 50 MW wood burner that was proposed in Massachusetts.

- As an incinerator, the facility would be allowed to emit 1,518 tons/yr of CO, but double that amount – 3,045 tons/yr – under the major source boiler rule.[71] Importantly, *both* these limits are so high, they are nearly meaningless, as large biomass plants permitted as synthetic minor sources under PSD routinely claim to keep CO emissions at one-tenth this level– see Table 4 and Figure 4, earlier. In fact, the allowable levels of CO emission under the biomass MACT are so high, it is doubtful whether EPA's treatment of CO as a proxy for hazardous air pollutants like dioxin, benzene and formaldehyde is at all meaningful.
- Allowable HCl emissions under the incinerator rule would be 1.28 tons/yr, whereas the rule for major source biomass facilities would allow 5,546% this amount, 71 tons/yr.
- Allowable emissions of mercury would be higher under the incinerator rule than the major source boiler rule, at 8.2 lb/yr versus 5.2 lb/yr, but unlike emissions of CO and PM, which are products of combustion from all fuels, actual mercury emissions depend on the amount of mercury in the fuel.

Bioenergy emissions of Hazardous Air Pollutants: Clean Air Act loopholes

As is the case for criteria pollutants, the bioenergy industry seeks to avoid EPA regulation of hazardous air pollutants. The industry employs a variety of ploys to downplay toxic emissions.

Loophole 4: Most biomass plants have no restrictions on hazardous emissions

As for PSD permitting, the Clean Air Act allows facilities (other than incinerators) to claim "synthetic" minor source status for emissions of HAPs, stating that the facility will stay under the 10/25 ton per year triggering threshold. Claiming area source status is common – of the bioenergy permits that we reviewed, 52 (59%) were synthetic minor sources for HAPs and just 19 (22%) clearly were identified as major sources for HAPs; the rest simply did not discuss HAPs in their permit at all.[72] Facilities claiming area source status by capping HAPs emissions in their permit below the 10/25 ton threshold ranged in size from the **11.5 MW (gross) Green Energy Resources facility proposed in Lithonia, Georgia**, which is limited by its permit to emitting less than 24.5 tons of all HAPs annually,[73] to the **116 MW (gross) Gainesville Renewable Energy (GREC) facility in Florida**, which was in its initial permit limited to emitting 24.7 tons of all HAPs annually.[74] Interestingly, although the GREC application documents initially stated "*GREC will be a major source of HAPs since the potential facility emissions exceed 10 tpy for any individual*

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[71] Converting the CISWI limit for CO to 3% oxygen basis to make it comparable with the limit expressed in the boiler rule, the value is 309 ppm.

[72] Failure to discuss HAPs in a preconstruction permit may indicate that the facility will set HAPs limits in the Title V operating permit; however, if a facility is declaring as a major source for HAPs, it is likely that emissions rates and controls will be referenced in the preconstruction permit.

[73] Georgia Department of Natural Resources, Environmental Protection Division. Permit N. 4911-089-0379-E-01-0, for Green Energy Resource Center. April 26, 2013.

[74] Florida Department of Environmental Protection. Air Permit No. 001031-001-AC for Gainesville Renewable Energy. December 29, 2010.

HAP and 25 tpy for total combined HAPs,"[75] a subsequent evaluation reversed this, stating "*The applicant believes that the proposed GREC project alone (the BFB in particular) will not have a PTE of any single HAP that is equal to or greater than 10 TPY or of all aggregated HAP equal to or greater than 25 TPY*."[76]

Such claims and sudden conversions to area source status for HAPS are not uncommon in the bioenergy world; as we discuss in more detail below, the **58 MW (gross) ecoPower plant being built in Hazard, Kentucky,** also abruptly and inexplicably reduced its projected emissions estimate of HAPs in order to be regulated as a synthetic area source, and a permitting document for the proposed **54.5 MW (net) Piedmont Green Power in Barnesville, Georgia** limits emissions of HAPs to 24.9 tons, stating "*The potential rates exceed this rate. However actual emissions are limited to this rate*."[77] In fact, under federal rules, this constitutes an admission that the facility is a major source, but it was not regulated as such.

How is it that the majority of facilities we reviewed claim to be area sources for HAPs, no matter what their boiler size? There are two main ways that facilities justify this claim. First, because HCl is the HAP that tends to be emitted in the largest quantities by biomass burning, and may easily exceed the annual 10 ton limit, facilities sometimes propose to install an acid-neutralizing sorbent injection system to control emissions. Following a one-time initial emissions test (which may take place sometime in the first 6 months of operation), if a facility is found to be emitting too much HCl to stay below the 10-ton limit per year, it can increase the amount of sorbent until the rate drops to a level where staying below the cap seems feasible. Setting aside the lack of requirements to then maintain this sorbent injection rate at all times, only 51 of the 88 permits we reviewed (58%) clearly required use of sorbents to reduce HCl emissions – in the other cases, facilities claimed area source status for HAPs without promising to control HCl emissions at all.

Loophole 5: The biomass industry lowballs estimates of toxic emissions to avoid regulation

Another way to "reduce" emissions of HAPs, at least on paper, is to simply claim that a biomass plant won't emit much toxic pollution.[78] EPA's published "AP-42" emission factors for HAPs emitted by wood-burning are supposed to be used to calculate total emissions of HAPs during the permitting process. However, the bioenergy industry doesn't like to use EPA's factors, claiming they are too high, and seeks to use lower emissions factors whenever possible. Very often, bioenergy developers use a set of emissions factors from the National Council on Air and Stream Improvement (NCASI), an opaque forestry and bioenergy industry advocacy group (Table 8).

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[75] Environmental Consulting and Technology, Inc. Gainesville Renewable Energy Center Prevention of Significant Deterioration/Air Construction Permit Application. November, 2009. Section 6, p. 6-1.

[76] Florida Department of Environmental Protection. Technical Evaluation and Preliminary Determination, Gainesville Renewable Energy Center, LLC. July 14, 2010. Page 9.

[77] Alaa-Eldin A. Afifi, Georgia Environmental Protection Division, Air Protection Branch. Permit narrative for Piedmont Green Power. February 2, 2010.

[78] Just as for criteria pollutants, the total amount of HAPs emitted by a plant is estimated as the product of boiler capacity (MMBtu/hr) and the emission factor for each pollutant (in lb/MMBtu), producing an hourly rate (pounds per hour; see Equation 1). This rate is then multiplied by 8,760, the number of hours in a year, to estimate annual emissions. The lower the emission rate assumed, the lower the emissions.

Table 8: Industry data helps biomass plants lowball projected emissions of air toxics

Hazardous Air Pollutant	AP-42 factor (lb/MMBtu)	NCASI factor (lb/MMBtu)	NCASI as % of AP-42	Total lb AP-42	Total lb NCASI
ACETALDEHYDE	8.300E-04	1.90E-04	22.9%	1,352.4	309.6
ACETONE	1.900E-04	2.20E-04	115.8%	309.6	358.5
ACROLEIN	4.000E-03	7.80E-05 *	2.0%	6,517.4	127.1
ANTIMONY	7.900E-06	4.20E-07	5.3%	12.9	0.7
ARSENIC	2.200E-05	1.00E-06	4.5%	35.8	1.6
BARIUM	1.700E-04	1.60E-04	94.1%	277.0	260.7
BENZALDEHYDE	8.500E-07	3.00E-06	352.9%	1.4	4.9
BENZENE	4.200E-03	3.30E-03	78.6%	6,843.3	5,376.9
BERYLLIUM	1.100E-06	1.90E-06	172.7%	1.8	3.1
BIS(2-ETHYLHEXYL)PHTHALATE	4.700E-08	4.70E-08	100.0%	0.1	0.1
CADMIUM	4.100E-06	1.90E-06	46.3%	6.7	3.1
CARBON TETRACHLORIDE	4.500E-05	8.90E-07 *	2.0%	73.3	1.5
CHLOROBENZENE	3.300E-05	1.70E-05	51.5%	53.8	27.7
CHLOROFORM	2.800E-05	3.10E-05	110.7%	45.6	50.5
CHROMIUM	2.100E-05	6.24E-07	3.0%	34.2	1.0
COBALT	6.500E-06	1.90E-07	2.9%	10.6	0.3
COPPER	4.900E-05	5.50E-06	11.2%	79.8	9.0
DICHLOROMETHANE	2.900E-04	5.40E-04	186.2%	472.5	879.9
ETHYL BENZENE	3.100E-05	6.80E-06 *	21.9%	50.5	11.1
FORMALDEHYDE	4.400E-03	1.30E-03	29.5%	7,169.2	2,118.2
HYDROCHLORIC ACID	1.900E-02	6.70E-04	3.5%	30,957.8	1,091.7
LEAD	4.800E-05	5.80E-06	12.1%	78.2	9.5
MANGANESE	1.600E-03	1.50E-04	9.4%	2,607.0	244.4
MERCURY	3.500E-06	9.90E-07	28.3%	5.7	1.6
METHYL ETHYL KETONE	5.400E-06	9.10E-06	168.5%	8.8	14.8
NAPHTHALENE	9.700E-05	1.60E-04	164.9%	158.0	260.7
NICKEL	3.300E-05	2.90E-06	8.8%	53.8	4.7
PENTACHLOROPHENOL	5.100E-08	4.60E-08	90.2%	0.1	0.1
PHENOL	5.100E-05	1.40E-05	27.5%	83.1	22.8
SELENIUM	2.800E-06	3.00E-06	107.1%	4.6	4.9
STYRENE	1.900E-03	6.40E-04	33.7%	3,095.8	1,042.8
TOLUENE	9.200E-04	2.90E-05	3.2%	1,499.0	47.3
VINYL CHLORIDE	1.800E-05	1.80E-05	100.0%	29.3	29.3
				Total tons AP-42	**Total tons NCASI**
				31.0	**6.2**

Table 8. HAPs emissions based on potential to emit for a 186 MMBtu boiler. Shaded rows represent air toxics where the emissions factor from NCASI is lower than the EPA factor (data from EPA's AP-42, and NCASI Bulletin 858; NCASI emissions factors marked with asterisks are median values, for instances when mean is not presented).

Whereas EPA's AP-42 emissions factors are based on data that can be publically reviewed, NCASI's emission factors, and the data upon which they are based, are only available to industry partners who pay thousands of dollars per year for membership in NCASI. However, we gained access to NCASI's emissions factors because the publication that contains the information, NCASI Technical Bulletin #858, has been reproduced in air permit applications that we have reviewed. This publication contains the emission factors but none of the underlying data upon which they are based.

Companies use industry-provided emissions factors to avoid regulation as major sources for air toxics

As shown in Table 8, NCASI's industry-supplied emission factors tend to be much lower than EPA's AP-42 factors (shaded rows represent air toxics where the emissions factor from NCASI is lower than the EPA factor). There are only ten instances out of the 33 HAPs shown in the table where NCASI factors are the same or greater than the EPA factors, and for the HAPs with the highest AP-42 factors (acrolein, benzene, formaldehyde, hydrochloric acid, manganese, and styrene, dark shading) the NCASI factors are consistently and significantly lower – for instance, NCASI's emissions factor for acrolein is just 2% of the EPA emission factor.

The fact that NCASI emissions factors are so much lower than EPA's makes a real difference when calculating total HAPs emissions from a bioenergy facility. For example, applying the EPA and NCASI emission factors to the 186 MMBtu boiler at the proposed **11.5 MW Green Energy Resource Center in Lithonia, Georgia** produces dramatically different estimates of total tons of annual HAPs emissions. Estimating HAPs emissions using the EPA-sanctioned factors, the plant would emit 31tons of HAPs a year, making it a major source and subject to regulation under the major source boiler rule, whereas under the NCASI factors, the total is 6.2 tons. Because the air permitting branch of the Georgia Environmental Protection Division uncritically accepts and uses NCASI emissions factors with no independent evaluation, the plant in Lithonia was permitted as an area source and is subject to no emission limits for air toxics. This was the case for every biomass power plant permit in Georgia that we have reviewed, with the exception of two facilities.[79]

While EPA has mostly avoided getting drawn into questions about whether facilities should be using non-EPA sanctioned emissions factors for HAPs, the agency has occasionally commented. In their letter to the Hawaii air permitting authority on the **23.8 MW (gross) Hu Honua coal to biomass conversion in Pepe'ekeo, Hawaii**,[80] EPA Region 9 stated that it was *not* acceptable to use non-AP-42 emission factors without justifying why these factors were better than the EPA factors. However, the use of these non-EPA sanctioned factors is widely accepted by state

[79] The Georgia biomass plants we reviewed that have been given area source status for HAPs are: 40 MW Graphic Packaging, Macon; 10 MW Green Energy Partners. Lithonia; 22 MW North Star Jefferson, Wadley ; 25 MW Greenleaf Environmental Solutions, Cumming; 49.8 MW Greenway Renewable Power, LaGrange; 45 MW Wiregrass, Valdosta; 100 MW Warren County Biomass, Warrenton; 15 MW Lancaster Energy Partners, Thomaston; 16 MW Lancaster Energy Partners, Macon; 60 MW Fitzgerald Renewable Energy, Fitzgerald; 54.5 MW Piedmont Green Power, Barnesville. The two plants permitted as major sources were: 110 MW Yellow Pine Energy, Fort Gaines; 25 MW Plant Carl, Carnesville (poultry-waste burner).

[80] Letter from Gerardo C. Rios, Chief, Permits office EPA Region IX, to Wilfred K. Nagamine, Manager, Clean Air Branch, Hawaii Department of Health. June 30, 2011.

permitting authorities, especially in states like Georgia that tend to look favorably on forestry-related industries. Since EPA as a whole does not review many of the permits where these NCASI factors are being used, the Agency appears to be turning a blind eye to the variety of methods being used to lowball HAPs emissions. One of the most egregious examples is the proposed **50 MW (net) ecoPower facility in Hazard, Kentucky**, which invented their own emissions factors using selected emissions data, thus estimating less than ten tons of HAPs *overall* for a 745 MMBtu boiler. Even calculated using the suspect NCASI factors, the total HAPs emissions for the facility would have been more than twice that amount.

The industry-supplied emission factor for HCl likely underestimates actual emissions

Are the NCASI emission factors credible? To evaluate this question, we analyzed actual emissions of hydrochloric acid (HCl) from currently operating plants.[81] We focused on HCl because it is emitted by biomass burning in large quantities, and can thus push a facility over the threshold from being an area source to a major source of HAPs. The AP-42 emission factor for HCl is 0.019 lb/MMBtu (1.9E-02 using scientific notation). Using EPA's emissions factor, a 121 MMBtu boiler (approximately, an 8 MW facility) would have the potential to emit ten tons of HCl per year, and would thus be a major source for HAPs. In contrast, the NCASI emission factor for HCl is 0.00067 lb/MMBtu (6.7E-04), just 3.5% the EPA's AP-42 value. A boiler would have to be 2,840 MMBtu (199 MW) to have a PTE of ten tons per year using the NCASI factor. This is far larger than any facility in our database.

Analysis of actual HCl emissions data suggests the industry-supplied emissions factor under-represents emissions at typical biomass plants

To determine which emissions factor is more representative of HCl emissions from currently operating facilities, we averaged data for the 46 facilties for which EPA has collected recent test data on HCl emissions, grouping data by the year in which the data were collected,[82] and arranged the averages by percentiles (Table 9). Our analysis suggests that the NCASI emissions factor significantly underrepresents typical HCl emissions at most biomass plants. The median and average emission rates of HCl for the EPA dataset are 1.00E-03 and 8.00E-03 lb/MMBtu, respectively <u>200% the value of NCASI's reported median</u> of 5.0E-04 lb/MMBtu, and <u>1,194% of the NCASI average</u> of 6.7E-04 lb/MMBtu. In fact, the NCASI median and average emission factors for HCl are both lower than the 30th percentile of the recent EPA test data, as seen from the actual distribution of HCl emissions from the EPA dataset.[83] This strongly suggests that the NCASI factor under-represents HCl emissions at currently operating plants.

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[81] EPA called for information on actual emissions to assist in formulating the boiler rule. The database is, Draft Emissions Database for Boilers and Process Heaters Containing Stack Test, CEM, & Fuel Analysis Data Reported under ICR No. 2286.01 & ICR No. 2286.03 (version 8) May, 2012. Available at http://www.epa.gov/airtoxics/boiler/boilerpg.html (database labeled "Boiler MACT Draft Emissions and Survey Results Databases")

[82] Three of the facilities were represented by three years of data; eight were represented by two years of data.

[83] It is interesting to note that since EPA published its new dataset, NCASI has updated its set of emissions factors. The group claims that the new data were integrated with existing data using an "elaborate statistical procedure".

Table 9. The NCASI emission factor for HCl under-represents emissions at operating plants

Percentile	HCl EF (lb/MMBtu)
10th Percentile	1.60E-04
20th Percentile	2.89E-04
30th Percentile	**1.00E-03**
40th Percentile	1.00E-03
50th Percentile	1.00E-03
60th Percentile	3.00E-03
70th Percentile	7.00E-03
80th Percentile	1.30E-02
90th Percentile	2.30E-02
95th Percentile	3.70E-02
99th Percentile	8.20E-02
Average	**8.00E-03**

Table 9. Percentile distribution of HCl emission rates for 46 bioenergy facilities in EPA's emissions database. [84] The median and average values reported for the NCASI dataset are both lower than the 30th percentile value.

Is the NCASI emissions factor so low because it is based on emissions data from plants are using a sorbent system to neutralize HCl? We examined the EPA's data to see if using a sorbent system made a difference. While it is likely that a number of facilities in the EPA's HCl emissions dataset use sorbent to neutralize HCl emissions, there is no clear way to determine all that do. However, even facilities that are clearly marked in the EPA dataset as using an acid gas sorbent system can still have emissions that exceed the NCASI emissions factor. For instance, two wood-burning biomass plants, **Covanta's Medota and Delano facilities in California**, both use acid gas sorbent systems. The average HCl emissions rate reported to EPA for the Delano plant was 7.14E-03,which is 1,065% the NCASI average. The average rate for the Mendota plant was 2.65E-02, which is 3,950% the NCASI average.[85] This indicates that even when plants use sorbent systems, their emissions can exceed the NCASI estimate.

Our permits database contains permits for facilities that claim to be area sources for HCl, yet do not propose to use any acid control at all, suggesting their emissions could be elevated and that if they used the NCASI emissions factors to estimate future emissions, they have probably under-estimated. For instance, the proposed **24.9 MW (net) Biogreen Sustainable Energy plant in**

[84] Draft Emissions Database for Boilers and Process Heaters Containing Stack Test, CEM, & Fuel Analysis Data Reported under ICR No. 2286.01 & ICR No. 2286.03 (version 8) May, 2012. Available at http://www.epa.gov/airtoxics/boiler/boilerpg.html (database labeled "Boiler MACT Draft Emissions and Survey Results Databases")

[85] The data for these two plants are notated as "new test data submitted by Biomass Power Association."

La Pine, Oregon, used the NCASI factor to estimate its HCl emissions, claiming to be an area source for HAPs. The plant is not going to use any sorbent system for HCl, even though up to 20% of its fuel will be construction and demolition wood.[86] This suggests this facility should acutally be regulated as a major source for HAPs.

The AP-42 HCl emissions factor of 0.019 lb/MMBtu (1.9E-02), which is based on the average of older data collected by the Agency, falls between the 80^{th} and 90^{th} percentiles of the new set of EPA emissions data that we analyzed, suggesting that it is a relatively protective factor that adequately characterizes emissions of many new facilities. Since so many facilities are being permitted without a sorbent system to reduce HCl emissions, the need to estimate emissions using properly conservative factors is even greater.

Overall, the evidence suggest that the NCASI emission factor for HCl significantly underestimates HCl emissions at most facilities. Of the 88 facilties in our permit database, all but three had boilers that were greater than 121 MMBtu in capacity, meaning that if their emissions had all been calculated using the EPA's AP-42 factor, <u>all these facilities would have been regulated as major sources for hazardous air pollutants on the basis of their potential to emit HCl emissions alone</u>. When states issue permits and allow permit applicants to pick and choose what emissions factors to use for air toxics, including the low-ball NCASI factor for HCl, the result is that facilities are erroneously permitted as "area" sources under the boiler rule.

Loophole 6: Weak testing requirements mean air toxics limits aren't enforceable

Once a facility that has been permitted as an area source for HAPs is operating, lax to non-existent testing requirements for air toxics mean it may be able to exceed allowable emissions thresholds and pollute with impunity. While facilities that avoid PSD by declaring themselves minor sources for criteria pollutants are required to at install continuous emissions monitors (CEMs) for a few criteria pollutants such as NOx and CO, there is almost no monitoring required for emissions of hazardous air pollutants, and thus no way to ensure that permit limits are or can be enforced. Some permits require facilities to perform one-time stack tests for certain air toxics 180 days after startup, then possibly once every few years thereafter, although this is not always enforced. For example, although the **wood- and garbage-burning 33 MW(gross) Evergreen Community Power facility in Reading, Pennsylvania** started operation on August 17, 2009, the plant still had not conducted required stack testing for dioxins, metals, HCl, PM, NOx, SOx, and other pollutants[87] as of September 2011, more than two years later, due to

Facilities are supposed to estimate all emissions of air toxics when claiming minor source status, but few do

[86] Oregon Department of Environmental Quality, Eastern Region. Standard air contaminant discharge permit review report for Biogreen Sustainable Energy Co., LLC. Permit No. 09-9557-ST-01.
[87] Required pollutant tests from letter to Mr. Cliff Heistrand, Evergreen Community Power, from George N. Liddick, Pennsylvania Department of Environmental Protection, June 1, 2009.

malfunctions.[88] The facility had also not been keeping track of emissions of criteria pollutants,[89] as required by federal law. Nonetheless, the plant was allowed to keep operating (see below for more details on malfunctions and violations at the Evergreen facility).

In the biomass power plant permits we reviewed, a lack of accountability for HAPs emissions was the norm. The lax nature of biomass air permitting has been rarely challenged in a formal way before EPA, but petitioners to EPA on the **23.8 MW (gross) Hu Honua coal to biomass conversion in Pepe'ekeo, Hawaii,** did receive some satisfaction from the Agency. In the EPA's response to the citizen petition protesting the lax nature of the Hu Honua air permit, EPA states *"To effectively limit Hu Honua's individual HAP and total HAP PTE to less than 10 and 25 tpy, respectively, as specified, the individual and total HAP emission limits in Section C.7 of the Final Permit must apply at all times to all actual emissions,* ***and all actual individual and total HAP emissions must be considered in determining compliance with the respective limits"***[90] (emphasis added). EPA is saying here that the permit must contain requirements for the facility to examine actual HAPs emissions in a comprehensive way – meaning testing – for the permit to be enforceable.

The EPA Hu Honua decision is significant, because it appears that a number of the permits we reviewed do not include enforceable limits for HAPs. For instance, the permit for the **54.5 MW (net) Piedmont Green Power in Barnesville, Georgia,** requires a one-time stack test for HCl to estimate monthly emissions, but for HAPs other than HCl, emissions are calculated based on emission factors for HAPs "as approved by the Division" (i.e., the Georgia Environmental Protection Division). No stack testing is required. The Piedmont plant was awarded a $49.5 million cash grant from the federal government in "clean energy" funding, but the program apparently does not check whether permits are legal and enforceable before awarding funding.[91]

Many of the biomass plant permits we reviewed do not appear to contain enforceable limits for air toxics, potentially rendering them invalid

The permit for the **42 MW (net) conversion of an oil/gas boiler at the Montville Power plant in Uncasville, Connecticut** allowing the plant to burn biomass provides another example of apparently unenforceable permit limitations on hazardous air pollutants. The plant will be allowed to burn a variety of waste wood, increasing the likelihood it will be a significant source of metals and other HAPs. While the permit states that the Permittee "*shall not cause or allow emission from this equipment to exceed the maximum allowable stack concentration (MASC) for any pollutant listed in RCSA §22a-174-29*," thus referencing a long list of allowable emissions for air toxics regulated in

[88] Pennsylvania Department of Environmental Protection Air Quality Program. Inspection report for United Corrstack, LLC, conducted September 29, 2011.
[89] Ibid.
[90] United States Environmental Protection Agency. In the matter of Hu Honua Bioenergy Facility, Pepeekeo, Hawaii. Permit No. 0724-01-C. Order responding to petitioner's request that the Administrator object to issuance of state operating permit. Petition No. IX-2011-1. Page 17.
[91] The Piedmont facility has received a "Section 1603b" grant, which converts the incentive tax credit, worth 30% of construction costs, to a cash award. Grantees are listed at http://www.treasury.gov/initiatives/recovery/Documents/Section%201603%20Awards.xlsx

Connecticut, the permit only requires stack testing for HCl and ammonia.[92] In contrast, the permit for the **37.5 MW (net) Plainfield Renewable Energy plant in Plainfield, Connecticut**, which will burn "sorted" construction and demolition wood, states "*The Permittee shall demonstrate compliance for each and every hazardous air pollutant emitted from this unit*" that is listed in three tables of the RCSA document, and that emission rates will be calculated using continuous emissions monitoring for certain pollutants and "*initial and annual stack testing (or fuel testing) for all other pollutants*."[93] However, that permit also states that the only stack tests for HAPs that are *really* required are tests for a small handful of HAPs that are listed directly in the permit.[94] In this case, although the permit does at least require testing, its provisions still appear to be contradictory and unenforceable.

Neither of the Title V permits for two biomass energy plants in New York, the **19 MW (net) ReEnergy Lyonsdale Biomass plant in Lyonsdale,** and the **50 MW(net) ReEnergy Black River plant at Fort Drum,** include firm testing and compliance requirements for HAPs. Both simply state, *"For the purpose of ascertaining compliance or non-compliance with any air pollution control code, rule or regulation, the commissioner may require the person who owns such air contamination source to submit an acceptable report of measured emissions within a stated time."*[95] Yet both facilities claim synthetic minor status for HAPs.

Representative of the woefully inadequate state of air permitting for bioenergy is the permit for the **58 MW (gross) ecoPower plant proposed in Hazard, Kentucky**. An early summary of the permit[96] declared that the facility would emit 35 tons of HAPs, putting it over the 25-ton annual threshold and thus making it a major source subject to the major source MACT standard. Evidently, the company objected, because the summary of the final permit[97] states that the *total* emissions of all HAPs from this large 745 MMBtu/hr boiler will now be less than ten tons annually. Further, even the minimal requirement for one-time stack testing for emissions of the main HAPs emitted by biomass burning, including benzene and formaldehyde, [98] was stripped from the final permit. This company cherrypicked their own emissions factors to estimate total HAPs emissions,

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[92] Connecticut Department of Energy and Environmental Protection. Bureau of Air Management. New Source Review Permit for Montville Power, LLC. Modification issue date May 20, 2013; Prior issue date April 6, 2010.

[93] Connecticut Department of Energy and Environmental Protection. Bureau of Air Management. New Source Review Permit for Plainfield Renewable Energy LLC. Permit modification date December 8, 2011.

[94] Connecticut Department of Energy and Environmental Protection. Hazardous Air Pollutants, RCSA §22a-174-29. Available at http://www.ct.gov/deep/cwp/view.asp?a=2684&Q=322184&deepNav_GID=1619

[95] New York State Department of Environmental Conservation. Air Title V Facility Permit for Lyonsdale Biomass, Permit ID 6-2338-00012/00004. Effective date 08/16/2011; and, New York State Department of Environmental Conservation. Air Title V Facility permit for ReEnergy Black River, LLC. Permit ID: 6-2240-00009/00007. Effective date 5/20/2013.

[96] Commonwealth of Kentucky Division of Air Quality Permit Application Summary Form, for ecoPower Generation, LLC. Version marked "Application received 1/7/2010".

[97] Commonwealth of Kentucky Division of Air Quality Permit Application Summary Form, for ecoPower Generation, LLC. Version marked "Application received December 21, 2012".

[98] This provision, found in the draft of the permit dated 6/26/09, stated "During the initial stack testing, the permittee shall determine emission factors for hydrogen chloride, benzene, chlorine, and formaldehyde. The emission factors from stack testing shall be used to demonstrate that emissions of any single HAP do not exceed 9 tons per 12 consecutive months, and that total potential emissions of HAPs do not exceed 22.5 tons per 12 consecutive months. These emission factors shall be valid for the life of the permit unless directed otherwise by the Division [401 KAR 52:020, Section 26]."

not using the NCASI factors, but inventing their own. Nonetheless, typically for bioenergy company rhetoric, the company's website states, "ecoPower is creating a new, clean and renewable source of electricity known as 'bioenergy.'[99]

It is likely that if the requirements imposed by the EPA decision on the Hu Honua facility were applied to other plants – i.e., that once operating, facilities should use *actual* emissions of HAPs, including during startup and shutdown, to determine whether they are complying with the requirement to stay below the 10/25 ton threshold – <u>almost none of the biomass power plants now claiming "synthetic minor" status for HAPs would be able to comply</u>. What saves these facilities from having to comply with air quality laws, however, is that EPA is ignoring the majority of state-level bioenergy permits currently being issued.

Fuel contaminant testing requirements are even more rare

Testing fuels before they are burned to determine whether their combustion will emit toxic air pollution is one way to increase compliance with permitted emissions limits. However, in our review of tens of permits, we rarely found requirements that fuel be tested, and when there was a requirement, it was so lax as to be almost meaningless. For instance, the permit for the proposed **60 MW (gross) Loblolly Green Power plant in Newberry, South Carolina** states that the plant will burn "*clean, untreated wood waste*," and that "*an initial fuel analysis or stack testing will be conducted. No additional analysis will be required, unless the clean, untreated wood becomes inconsistent in composition or is received from another source*."[100] However, the document does not explain how a determination that fuel has become "inconsistent in composition" is to be made if testing is not required.

Fuel testing requirements at the **50 MW(net) ReEnergy Black River plant at Fort Drum, NY**, highlight the difficulty of characterizing fuel contamination in a statistically meaningful way. The facility's permit states that it can burn "*clean wood, unadulterated wood from C+D debris, glued wood creosote treated wood (sic), tire derived fuel and non-recyclable fibrous material (waste paper)*." To determine the amount of contaminated wood burned, the permit states, "*ReEnergy shall employ the "grid test" which consists of a 10 by 10 grid placed over the wood stream and checked to determine the percentage of glued wood, treated/painted wood, and non-wood materials. If it is determined that the percentage of glued wood is between 0 and 1.0% by volume, then the percentage of glued wood for that load is 1%. If it is determined that the percentage of glued wood is between 1% and 20% by volume, the percentage of glued wood for that load is 20%. If it is determined that the percentage of glued wood is greater than 20% by volume,*

Although many biomass facilities are permitted to burn waste-derived fuels, few actually test to determine contamination levels

[99] http://www.ecopg.com/

[100] Loblolly Green Power Statement of Basis, Permit number 1780-0051CA. South Carolina Department of Health and Environmental Control, September 3, 2009.

then the load is considered to 100% glued wood. This method shall be employed once every 5 loads per supplier." [101]

As tractor-trailer loads of wood are typically 20 – 22 tons, this method of checking the "wood stream" (presumably the material being fed to the plant on the conveyor belt) is likely to characterize only a tiny fraction of the material burned. Even done properly, such tests are unlikely to be representative; and it seems unlikely that adequate oversight will occur. As we discuss below, new rules proposed by EPA are likely to increase burning of construction and demolition (C&D) waste while removing any requirement for testing at all.

Contaminated wastes burned as biomass: EPA declines to regulate

The bioenergy industry is growing fast, and looking for new sources of fuel. Construction and demolition debris, as well as municipal and industrial wastes, are especially attractive fuels given their disposal often generates "tipping fees" that can constitute a significant portion of a biomass power plant's income. For instance, the **25 MW (net) Taylor Biomass plant, a wood and garbage-fueled power plant proposed in Montgomery, New York**, estimates that tipping fees for wastes range from $50/ton to over $80/ton, and a 2008 IRS evaluation of the facility's eligibility for tax credits[102] reports that Taylor anticipated receiving $50 for each ton of MSW it received. The Taylor project was permitted under rules governing municipal waste incinerators, though their name suggests they are a biomass plant. [103]

For the purposes of distinguishing "waste" from "biomass," EPA relies on a part of the Resource Conservation and Recovery Act (RCRA) known informally as the "waste rule."[104] As part of determining whether a material is a waste, EPA compares contaminant levels in the material to those in "traditional" fuels. An early draft of EPA's waste rule, from March 2011, explains: "*non-hazardous secondary materials (NHSM) that contain contaminants that are not comparable in concentration to those contained in traditional fuel products or ingredients would suggest that these contaminants are being combusted as a means of discarding them, and thus the non-hazardous secondary material should be classified as a solid waste*."[105]

This definition is problematic for the expanding bioenergy industry. Under the Clean Air Act and court precedent, any facility that burns any solid waste at all is an incinerator and must meet incinerator emission standards, which are, as discussed previously, somewhat more restrictive than those applicable to conventional biomass boilers (Table 7). Further, "waste incineration" doesn't

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[101] New York State Department of Environmental Conservation. Air Title V Facility permit for ReEnergy Black River, LLC. Permit ID: 6-2240-00009/00007. Effective date 5/20/2013.

[102] Internal Revenue Service. Letter ruling on qualification of Montgomery LLC for federal for tax credit. June 11, 2008.

[103] Our report on the Taylor facility, which evaluates claims made by the company in its application for a $100 million "clean energy" loan guarantee from the US Department of Energy, is available at http://www.pfpi.net/wp-content/uploads/2013/05/PFPI-Gasification-and-DOE-loan-guarantees.pdf.

[104] The current version of the rule, and amendments, are available at http://www.epa.gov/epawaste/nonhaz/define/index.htm

[105] 40 CFR Part 241. Identification of non-hazardous secondary materials that are solid waste; proposed rule. Federal Register Vol. 75, NO. 107. Friday, June 4, 2010. p. 31871

sound green and renewable, whereas "biomass power" does. A letter from **Michigan Biomass, an advocacy group working on behalf of six biopower plants[106] in Michigan,** filed in EPA's waste rule docket, explains the bioenergy industry's problem:

"*Waste wood from the pulp and paper and forest products industries is the major source of biomass fuel for these facilities. However, for nearly a decade, these industries have been in decline, drastically reducing the wood available for fuel. Because of this, alternative fuels have played a significant role in offsetting the constrained wood fuel supply. This will only grow tighter as the state's new energy policy promoting biofuels production and incentivizing new biomass-fueled power production puts increasing demand on this limited resource. The ability to fire alternative fuels with our main forest-based wood fuel is imperative to the survival of these projects in this new energy landscape.*

Being regulated as incinerators would represent a regulatory burden to power plants that utilize wood as a fuel and could kill the legitimate reuse of materials that work well as fuel in traditional power plant boilers. Additionally, there is a stigma attached to being classified as an incinerator that plants will want to avoid. It is likely a facility will cease using a material as a fuel if it means they will be classified as an incinerator. Limiting the use of such fuel will jeopardize the viability of these plants and more material will be sent to landfills or open burned." [107]

Biomass industry to EPA: "There is a stigma attached to being classified as an incinerator that plants will want to avoid"

Because biomass burners are usually eligible for renewable energy subsidies and tax breaks, whereas incinerators may not be, it's clear that the stigma of being classified as an incinerator may have actual financial consequences.

Many biomass plants plan to burn contaminated waste materials as fuel

Many of the biomass power plants currently being developed plan to burn waste wood as fuel. An industry database of operating and proposed bioenergy plants lists 54 facilities that burn, or plan to burn, "urban wood," which often includes construction and demolition wood and other potentially contaminated waste wood, such as railroad ties.[108] Of the permits in our database, the majority (61 permits, 69%) allowed burning of some kind of waste wood besides forest and mill residues, with many explicitly stating that construction and demolition debris would be burned. While some of these permits are for plants that have subsequently been cancelled, and some plants won't be built, the high percentage of total permits that allow waste wood burning indicates how widespread this practice has become. Of those 60 permits that allow burning waste wood, 38 (63%) are clearly claiming area source status under the boiler rule, meaning they will only be required to meet the

[106] The six plants represented by Michigan Biomass are Cadillac Renewable Energy, in Cadillac; Genesee Power Station, in Flint; Grayling Generating Station, in Grayling; Hillman Power Company, in Hillman; Lincoln Power Station, in Lincoln; and McBain Power Station, in McBain.

[107] Letter from Tamra S. Van Til, representing Michigan Biomass, to EPA: Comments on advanced notice for rulemaking, docket ID# EPA-HQ-RCRA-2008-0329, Identification of non-hazardous materials that are solid waste. February 2, 2009.

[108] Forisk, Wood Bioenergy US database, December, 2013

relatively high filterable PM standard of 0.03 lb/MMBtu, with no limits on HCl, dioxins, mercury, or other heavy metals, even as they burn potentially contaminated fuels.

Some plants will be fueled almost exclusively by waste wood. The **37.5 MW (net) Plainfield Renewable Energy plant in Plainfield, Connecticut** is permitted to burn up to 495,305 tons per year of wood, including "waste wood from industries" and construction and demolition waste. The wood is supposed to be sorted to remove materials like plastics, gypsum wallboard, and "*wood which contains creosote or to which pesticides have been applied or which contains substances that have been defined as hazardous*,"[109] but it is not clear how effective such sorting can be, given that the sorting facilities rely on visual inspection to remove contaminated materials from a fast-traveling conveyor belt loaded with tons of debris. Any testing program to check for contamination is bound to be statistically invalid, given that on average the Plainfield plant will burn more than 60 tractor-trailer loads of wood chips per day. In Massachusetts, the state commissioned a health risk assessment for burning "sorted" construction waste after a construction and demolition debris burner was proposed for the city of Springfield, citing concerns about emissions of heavy metals and other hazardous air pollutants,[110] but Connecticut has commissioned no equivalent study.

The majority of "area" source permits, which lack any emissions limits for air toxics, allow potentially contaminated waste wood as fuel.

Many other facilities will depend on at least some waste wood, even when forestry wood is apparently available. Two biomass cogeneration expansion projects associated with paper mills on the Olympic Peninsula in Washington, the **20 MW (net) Nippon Paper facility at Port Angeles**,[111] and the **24 MW (net) boiler at the Port Townsend Paper Company plant**,[112] will both burn waste wood as fuel, along with forestry wood (the Nippon facility also burns wastewater-treatment sludge from the paper-making process).

Why would biomass facilities want to burn contaminated fuels? There are a number of reasons. Pass-through of tipping fees for waste disposal to biomass power plants can produce a lucrative revenue stream for a facility. In some cases, facilities may fear that "clean" wood sources are limited, or might become more distant over time , increasing transportation costs. Finally, certain waste fuels burn hotter and produce more energy than green forestry chips. Construction and demolition-derived wood tends to be drier, which increases its heating value per unit mass, and paper-based and especially plastic-based fuels can have significantly higher heating values than wood – for instance, the proposed **25 MW (net) Taylor Biomass plant, a wood and garbage-**

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[109] Connecticut Department of Energy and Environmental Protection. Bureau of Air Management. New Source Review Permit for Plainfield Renewable Energy LLC. Permit modification date December 8, 2011.

[110] This study was not completed because the developer of the Palmer Renewable Energy plant in Springfield elected to reapply as a facility that would only burn "clean" wood derived directly from trees, rather waste wood.

[111] Olympic Region Clean Air Agency. Order of Approval – Notice of Construction 10NOC763, Issued to Nippon Paper Industries USA Co. Ltd. June 21, 2011.

[112] Washington Department of Ecology. Notice of Construction for Port Townsend Paper Corporation, NOC Order No. 7850. October 22, 2010.

fueled power plant proposed in Montgomery, New York depends on plastics in fuel to generate sufficient energy for the gasification process they plan to use.[113]

Shredded tires are another attractive fuel that is seen as integral to the success of the proposed **25 MW North Star Jefferson wood-tire burner proposed in Wadley, Georgia,** where the developer states that "*TDF is important to the financial viability of the project given its high caloric content as evidenced by its use in various industries such as pulp and paper production, cement plants in addition to electricity generation*."[114] The North Star plant avoided PSD and thus did no pre-construction air quality modeling. It will be a significant new source of air pollution in a community that already includes several large polluters, including a lumber mill that is a large source of emissions from burning wood. Developers of the North Star plant include the U.S. Endowment for Forestry and Communities, a non-profit organization that is setting up the for-profit wood and tire-burner to generate revenue and, they say, to revitalize the economy around Wadley.[115]

Loophole 7: EPA rules blur the line between biomass facilities and incinerators

The bioenergy industry needed EPA to redefine wastes as legitimate fuels, because for biomass plants where the "traditional fuel" is unadulterated forest wood, the waste rule's requirement that "non hazardous secondary materials" (NHSM) contain no more contamination than traditional fuels[116] might be assumed to exclude most contaminated materials. EPA's response, which has been to define "traditional fuel" as any fuel a facility *might* burn, even a very dirty coal, has been more than satisfying to the bioenergy industry and other facilities that burn contaminated fuels. The EPA's latest waste rule is explicit – a facility can burn contaminated fuels, including construction and demolition wood, as long as concentration levels of contaminants are "*comparable to or less than the levels in the traditional fuel the unit is designed to burn, whether wood or another traditional fuel*,"[117] and that "*Designed to burn*" means, "*can burn or does burn, and not necessarily permitted to burn*."[118] This includes coal. The rule clarifies further: "*The agency has also determined that restricting comparisons to traditional fuels the unit is permitted to burn is unnecessary. The fact that a facility is not currently permitted to burn a particular traditional fuel does not mean it could not be permitted to burn that traditional fuel in the future. For this reason, we do not believe it is reasonable to limit the comparison to permitted traditional fuels*."[119]

EPA's waste rule classifies contaminated materials as "non-hazardous," allowing them to be burned as biomass

[113] Our report on Taylor Biomass is available at http://www.pfpi.net/wp-content/uploads/2013/05/PFPI-Gasification-and-DOE-loan-guarantees.pdf.
[114] http://northstarrenewable.com/index.php/projects/north-star-jefferson/faqs
[115] http://usendowmentblog.blogspot.com/2011/12/working-not-where-light-is-best-rather.html
[116] Because the rule requires comparing contamination on a material weight basis, not a material energy content basis, a biomass facility can burn a "less contaminated" material and still emit more air toxics than a same-sized coal plant, because the low efficiency of bioenergy requires burning more fuel to produce the same amount of energy.
[117] 40 CFR Parts 60 and 241. Commercial and industrial solid waste incineration units: reconsideration and final amendments; non-hazardous secondary materials that are solid waste. Federal Register Vol. 78, No. 26, Thurs. February 7, 2013. p. 9139.
[118] Ibid, p. 9136
[119] Ibid, p. 9149

EPA rules compare contaminant concentrations in biomass to the dirtiest coal
What if the biomass a company wants to burn is so contaminated, they can't find a coal dirty enough to compare to? The waste rule can accommodate that situation, stating: "*Persons who would otherwise burn coal may use any as-burned coal available in coal markets in making a comparison in their NHSM and the contaminants in coal – they are not limited to coal from a specific coal supplier they have used in the past or currently use*." And, while "*national surveys of traditional fuel contaminant levels are one example of another acceptable data source*,"[120] it's also fine to compare to dirty coals internationally: "*a statement that national surveys can be used does not preclude the use of appropriate international data*."[121]

Incredibly, the EPA seems quite sanguine about the implications of these provisions, stating, "*The EPA acknowledges that the revisions adopted as final in today's rule would allow C&D wood contaminant levels to be compared to the highest contaminant levels for coal*."[122]

EPA explicitly acknowledges that rule revisions "allow C&D wood contaminant levels to be compared to the highest contaminant levels for coal"

We found a large number of facilities in our permits database that list potentially contaminated materials as fuel. One permit stands out for having cited the new rule allowing use of fuels that are as contaminated as coal – the **proposed 25 MW wood and tire-burning North Star Biomass project, in Wadley, Georgia.** In its application for an air permit, the company proposed to burn agricultural waste, animal waste, construction and demolition waste, wood, and tire-derived fuel, stating stated that their fuels would be no more contaminated than coal. The Georgia air permitting branch of the Environmental Protection Division (EPD) did ultimately restrict the facility to burning "clean" wood and tire-derived fuel after the community protested, but cited the new EPA rule allowing fuels to be as contaminated as coal as justification for inclusion of tires in the fuel stream: "*Although the permitted fuels for the boiler are wood biomass and TDF, the traditional fuel with which TDF is compared (coal) can be burned in the fluidized bed boiler. This has been confirmed by the boiler vendor - Premier Energy. The 'designed to burn' provision of the legitimacy criteria is based on what the respective boiler is capable of burning, not what it is permitted to burn or intended to burn. Because the boiler is capable of burning coal, the "designed to burn" provision of the legitimacy criteria is met*."[123]

During the permitting process, the company and the Georgia EPD dismissed comments pointing out that burning tires emits a large number of extremely toxic substances, and chose to calculate toxic emissions based on just a subset of the hazardous air pollutants known to be emitted. The company claimed that air toxics emitted by open burning of tires would *not* be emitted when tires were burned in a boiler, but presented no evidence to that effect.[124] Overall, considering the way

[120] Ibid, p. 9144
[121] Ibid, p. 9153
[122] Ibid, p. 9152
[123] Alaa-Eldin A. Afifi, Georgia Environmental Protection Division, Air Protection Branch. Permit narrative for North Star Jefferson Renewable Energy Facility, page 22. May 2, 2012.
[124] Response to public comments on draft permit and permit application no. 20770, North Star Jefferson Renewable Energy. Letter to Eric Cornwell, Manager, Stationary Source Permitting Program, Air Protection Branch, Georgia Environmental Protection Division, from North Star Jefferson. April 17, 2012.

the Georgia EPD invoked the comparison to coal, the North Star permit demonstrates how little protection communities can expect to receive from EPA and state-level permitting agencies when a biomass facility decides it is going to burn contaminated fuels. Communities should consider themselves lucky to even know what materials the facility will burn, since the EPA's rules open the door to so many potentially contaminated materials.

EPA takes industry's word that biomass fuels are "clean" – testing not required

Removal of contaminated materials from the fuel stream relies primarily on visual inspection

Processing waste materials to reduce contamination is one way to meet EPA's "legitimacy criteria" for classifying a material as a non-hazardous fuel, rather than a waste. The first step for processing is generally visual inspection – waste is tipped out onto a sorting room floor and workers manually sort through it to remove household hazardous waste, e-waste, and other contaminated materials such as PVC pipe that can emit high levels of toxics when burned.[125] With construction and demolition debris, visual sorting is the means of removing pressure treated and otherwise contaminated wood.

Although such sorting is prone to a high error rate, EPA nonetheless states that "*In general, contaminated C&D wood that has been processed to remove contaminants, such as lead-painted wood, treated wood containing contaminants, such as arsenic and chromium, metals and other non-wood materials, prior to burning, likely meets the processing and legitimacy criteria for contaminants, and thus can be combusted as a non-waste fuel*."[126]

The line of reasoning that once it is processed, "waste is not waste" was employed by a court in Washington as a reason for denying an effort to require an environmental impact report for the **24 MW Port Townsend Paper biomass expansion project in Washington**. Citizen groups wanted the state to require an environmental impact assessment of the project, which will burn waste materials, emit large amounts of greenhouse gases, and potentially impact forests where logging occurs to provide fuel for the plant. The court responded that a Washington law requiring that "*No solid waste incineration or energy recovery facility shall be operated prior to the completion of an environmental impact statement*" didn't actually apply to the facility, in part because it will not be an "energy recovery facility" for solid waste. Solid waste is defined as "*all putrescible and nonputrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, and recyclable materials*". However, the court determined that hog fuel, urban wood, and burnable rejects from the mill and container recycling facility are *not* solid waste, because they have "become a

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[125] The EPA comfort letters sent to companies manufacturing fuel cubes from garbage and other wastes describe the processing steps as the waste is "transformed" into a non-hazardous secondary material. These letters are available at http://www.epa.gov/epawaste/nonhaz/define/

[126] 40 CFR Parts 60 and 241. Commercial and industrial solid waste incineration units: reconsideration and final amendments; non-hazardous secondary materials that are solid waste. Federal Register Vol. 78, No. 26, Thurs. February 7, 2013. p. 9138

commodity" – therefore, the facility is not actually an energy recovery facility, because it won't actually burn solid waste.[127]

EPA rules allow potentially contaminated biomass fuels to escape testing

The waste rule and its implementation are seen as a disaster by many who are concerned about toxic emissions. In its response to comments on the rule, EPA acknowledges concerns that fuel testing should be required, given the potential for contaminated materials to slip through the sorting process. The rule states that "*there will be instances where testing is conducted and comparisons will have to account for the variability of contaminant levels in NHSMs, including lead concentrations in C&D wood,*"[128] implying one-time testing for initial fuel characterization, rather than ongoing testing. However, "*contaminant testing is not required in all situations. Requiring testing in some situations is unnecessary*."[129] Instead, "expert opinion" is sufficient: "*contaminant legitimacy criterion determinations do not require testing contaminant levels, in either the NHSM or an appropriate traditional fuel. Persons can use expert or process knowledge to justify decisions to either rule out certain constituents or determine that the NHSM meets the contaminant legitimacy criterion.*"[130] EPA adds, "*The agency wishes to emphasize, that determinations that the cellulosic biomass used as a fuel or ingredient is clean, do not presuppose any testing of contaminant levels. Persons can use expert or process knowledge of the material to justify decisions regarding presence of contaminants*."[131]

EPA: construction and demolition-derived wood too clean to monitor?

That construction and demolition wood (CDD) can contain lead-painted wood, copper-chromium-arsenate (CCA)-treated wood, glued woods, asbestos, mercury waste, and other materials that result in toxic emission when burned is well known. Contaminated wood constitutes around 20% of the growing supply of construction and demolition wood generated by housing tear-downs and by storms. [132] This material can contain large amounts of heavy metals – for instance, one study estimated that wood debris generated after Hurricane Katrina contained 1,890 tons of arsenic.[133]

Initially, the draft waste rule included pressure-treated wood as a material where contaminant levels are high enough that combustion may be occurring as a means of disposal, stating "…*non-hazardous secondary materials that may not contain comparable concentrations of contaminants include*

[127] Pollution Control Hearings Board, State of Washington. PCHB No. 10-160 Order on Summary Judgment. PT Air Watchers, No Biomass Burn, World Temperate Rainforest Network, Olympic Environmental Council, and Olympic Forest Coalition, Appellants, v. State of Washington Department of Ecology and Port Townsend Paper Corporation, Respondents. May 10, 2011.
[128] 40 CFR Parts 60 and 241. Commercial and industrial solid waste incineration units: reconsideration and final amendments; non-hazardous secondary materials that are solid waste. Federal Register Vol. 78, No. 26, Thurs. February 7, 2013. p. 9152
[129] Ibid, p. 9152
[130] Ibid, p. 9144
[131] Ibid, p. 9139
[132] Dubey, B., et al. 2007. Quantities of arsenic-treated wood in demolition debris generated by Hurricane Katrina. Environmental Science and Technology, 41:5, 1533 – 1536.
[133] Ibid.

chromium-,copper-, and arsenic (CCA)-treated lumber, polyvinyl chloride (PVC) plastics which can contain up to 60 percent halogens (chlorine), lead-based painted wood, and fluorinated plastics."[134]

However, EPA apparently has such confidence in the data submitted by industry on contamination levels in materials that the Agency has announced it is nearly ready to grant a categorical classification of processed CDD wood as "biomass," and remove testing requirements altogether: "*In the March 2011 final rule, we determined that C&D wood that is sufficiently processed can be a non- waste fuel. The Agency has received additional information since the issuance of that rule on specific best management practices used by suppliers/processors of C&D wood. Such practices include processing to remove contaminants. EPA believes the information received to date would tend to support a listing of these materials as a categorical non-waste fuel and expects to propose that listing in a subsequent rulemaking*."[135] As of mid-March 2014, the EPA's proposed rule granting the reclassification is due to be published in the Federal Register.

An "Inside EPA" article additionally states that that the EPA has also been evaluating industry petitions to list preservative-treated wood as categorical non-waste, including one from the American Forest & Paper Association and the American Wood Council seeking a categorical listing for creosote-treated railroad ties, and one from the Treated Wood Council recommending that "treated wood biomass,"' including wood treated with borate-based preservatives, copper-based preservatives, pentachlorophenol, oilborned copper naphthenate and creosote, be considered a non-hazardous secondary material.[136]

Figure 8. A 50 MW bioenergy plant burns the equivalent of a truckload of chips approximately every 20 minutes. Photo credit: NREL.

EPA did acknowledge in the final waste rule that "*chromated copper arsenate-treated wood (CCA wood) would likely have contaminant levels not comparable to traditional fuels*,"[137] suggesting that this material, by itself, should continue to be treated as a waste and require disposal in incineration units with more protective emissions controls. However, in practice EPA leaves the door wide open to burning this material in area source biomass boilers and thus increasing emissions of metals and other air toxics. Even when visually sorted to

[134] 40 CFR Part 241. Identification of non-hazardous secondary materials that are solid waste; proposed rule. Federal Register Vol. 75, NO. 107. Friday, June 4, 2010. p. 31871

[135] 40 CFR Parts 60 and 241. Commercial and industrial solid waste incineration unites: reconsideration and final amendments; non-hazardous secondary materials that are solid waste. Federal Register Vol. 78, No. 26, Thurs. February 7, 2013. p. 9173

[136] "OMB clears EPA's proposed expansion of 'non-waste' fuel list. Inside EPA.com: The Inside Story. Posted March 13, 2014.

[137] 40 CFR Parts 60 and 241. Commercial and industrial solid waste incineration unites: reconsideration and final amendments; non-hazardous secondary materials that are solid waste. Federal Register Vol. 78, No. 26, Thurs. February 7, 2013, p. 9152

remove obviously contaminated materials, the extraordinarily high volume of C&D that is processed for fuel and the dependence on visual inspection to remove contaminated materials means it is inevitable that pressure-treated, painted, and glued woods get into the fuel stream. Once chipped, and delivered in high volume to a bioenergy facility (Figure 8), as a practical matter, there is little chance of detecting contamination before wood is burned.

Further, since unadulterated wood in the waste stream can be recycled for mulch, wood pellets, animal bedding, and particleboard, the most contaminated materials are what is left over for burning – although, in EPA's view, these are the very materials that are ostensibly sorted out of the bioenergy fuel stream and are *not* used for fuel. It seems inevitable that the EPA's proposal to grant a blanket exemption from testing of C&D wood will mean that more of this contaminated material is burned in biomass power plants that have no restrictions on emissions of air toxics. Importantly, this includes many small "thermal only" wood boilers being installed for heat at municipal buildings, schools, campuses, and hospitals – i.e., in close proximity to sensitive individuals including children, the elderly, and the sick. Many of these boilers are too small to even be covered by the area source rule, which only regulates boilers greater than 10 MMBtu/hr. Once contaminated wood is in circulation as fuel, it is likely to end up being burned at these small facilities, which have almost no emissions controls.

Garbage-derived fuels are EPA's new "non-waste fuel products"

Another category of materials newly classified as fuels under the waste rule is municipal and industrial wastes that have been processed into fuel products. EPA's "legitimacy criteria," the requirements that a waste must meet in order to be reclassified as a non-hazardous secondary material (NHSM), include processing of the material to reduce contaminants or improve energy content. Seizing on the opportunities provided by the waste rule, a number of companies are now processing municipal garbage and industrial wastes into compressed fuel cubes (Figure 9 shows a product from International Paper.[138]) Once EPA issues a "comfort letter" approving these materials as non-hazardous, they can be used as a coal or biomass substitute, and burned in units that are regulated as biomass boilers, rather than the more strictly regulated incinerators. EPA's classification of "biomass" burners as including any boiler that burns just 10% biomass means that even if these fuels contain substantial fossil fuel-derived content, for purposes of regulation, units burning them are subject to the very lax boiler rule standards for biomass boilers.

Figure 9. International Paper fuel cubes, made from compressed waste.

EPA's administrative process to "transform" wastes to non-hazardous fuels is quite hands-off. In accordance with the Agency's legitimacy criteria, a company wishing to get a non-waste

[138] Photo from http://www.globalventurelabels.com/the-environment/

determination for a particular material must describe how the materials are processed, and submit its own supporting data on contaminant levels in its product to the EPA. The EPA then reviews these data, comparing data on contaminant levels in the material to a standard set of contamination levels in wood and coal that ranges from the lowest to the highest levels observed, an extraordinary range. If EPA deems contamination levels in the waste-derived fuel are comparable to those in coal (and sometimes even if they are not), the EPA issues a comfort letter to the company approving the reclassification of the material from "waste" to "fuel."

We reviewed several recently issued comfort letters, and concluded that the EPA review process is sloppy.[139] For example, we found that the EPA trusts companies to test and provide data on contaminants they expect to be present, and does not require similar materials to be tested for similar contaminants. Given the high contaminant concentrations presented by EPA as being present in wood, against which the fuel products are supposed to be compared, it seems likely that the Agency has included contaminated wood as the baseline for measurement. However, this represents circular reasoning, as it assumes that contaminated wood is already acceptable as fuel. We also noted that the ranges of values for contaminant concentrations in fuel vary wildly, and that the EPA's estimate for formaldehyde content in wood, against which prospective fuels are compared, is derived from a single unpublished memo from a single industry source.[140]

EPA signs off on a contaminated fuel product: phthalates and fluorine in SpecFUEL

It seems likely that EPA's process for transforming wastes to fuel, carried out far from public view, can easily lead to approval of contaminated materials as fuel. For instance, the waste disposal company **Waste Management makes a product called "SpecFUEL**," which consists of mostly paper and plastic compressed into cubes. The EPA comfort letter[141] to the company states that according to company-submitted data, "*All contaminants in SpecFUEL are comparable to or lower than those contaminants in both coal and wood/biomass with the exceptions of antimony, fluorine, and bis(2-ethylhexl)phthalate. The latter is a synthetic chemical commonly referred to as DEHP and is used as a plasticizer in plastics, resins, consumer products, and building materials*."

EPA has approved waste-derived fuels that contain phthalates, which are known endocrine disruptors

The DEHP that EPA refers to here is commonly known as phthalate, one of a recognized endocrine disrupting class of chemicals that are being phased out in the European Union due to potential health effects, including potential effects on development of reproductive organs in children. EPA's own reference page on DEHP states, "*Animal studies have reported increased lung weights and increased liver weights from chronic inhalation exposure to DEHP. Oral exposure has resulted in*

[139] Available at http://www.epa.gov/epawaste/nonhaz/define/

[140] EPA's memo titled "Contaminant concentrations in traditional fuels: Tables for comparison," dates November 29, 2011 and available at http://www.epa.gov/osw/nonhaz/define/pdfs/nhsm_cont_tf.pdf, cites "Written communication from Tim Hunt of American Forest & Paper Association to Jim Berlow of EPA, July 14, 2011" as the sole source for data on formaldehyde levels in wood.

[141] Letter to Ms. Kerry Kelly, Waste Management, from US EPA Office of Solid Waste and Emergency Response, August 22, 2013. Available at http://www.epa.gov/epawaste/nonhaz/define/

developmental and reproductive effects in rats and mice. A study by the National Toxicology Program (NTP) showed that DEHP administered orally increased the incidence of liver tumors in rats and mice. EPA has classified DEHP as a Group B2, probable human carcinogen."[142]

Although a variety of the waste-derived fuels approved by EPA contain plastics, of the comfort letters we reviewed, the letter about SpecFUEL was the only one that referenced phthalate content. One large source of DEHP is the blue nitrile gloves used for medical exams and other purposes, suggesting that Waste Management may be using medical waste for making its SpecFUEL product. Waste Management reported to EPA that the concentration of DEHP in SpecFUEL cubes is 240 – 1,410 parts per million, but because there are no data on levels of this contaminant in coal or wood to which the SpecFUEL levels could be compared, EPA simply declared that the fuel met the legitimacy criterion for DEHP.

Waste Management also reported the SpecFUEL concentration of fluorine, a toxic substance emitted as hydrogen fluoride gas when burned, as 585 – 1,070 parts per million, significantly exceeding the reported level in coal, which according to EPA's data can reach 178 parts per million (Table 10). However, EPA glossed over the excessive fluorine content when it approved the SpecFUEL product, arguing that because *combined*, concentrations of fluorine and chlorine together were within the ranges found for the most contaminated coals, the high fluorine content in SpecFUEL did not cause it to fail the legitimacy test.

Table 10: Levels of fluorine in SpecFUEL exceed levels in coal

Halogen	Units	Average			Range		
		SpecFUEL[1]	Coal[1]	Wood[1]	SpecFUEL[2]	Coal[2]	Wood[2]
Chlorine	ppm	2033	992	259	1840 - 2250	ND - 9080	ND - 5400
Fluorine	ppm	892	64	32.4	585 - 1070	ND - 178	ND - 300
Total Halogens[3]	ppm	2925	1056	291	2425 - 3320	ND - 9080	ND - 5497

Notes:
1. SpecFUEL data represents five samples taken on different days in January 2012, provided by Waste Management on March 16, 2012..
2. Data for coal and wood (i.e., clean wood and biomass materials) from a combination of EPA data and literature sources, as presented in EPA document *Contaminant Concentrations in Traditional Fuels: Tables for Comparison,* November 29,2011, available at www.epa.gov/epawaste/nonhaz/define/index.htm.
3 The high and low ends of each individual halogen's range do not necessarily add up to total halogens range. This is because maximum and minimum concentrations for individual halogens do not always come from the same sample.

Table 10. Re-creation of Table 3 ("Contaminant Comparison, Total Halogens Group") from EPA comfort letter to Waste Management, approving use of SpecFUEL as a "non-waste fuel product."

142 http://www.epa.gov/ttnatw01/hlthef/eth-phth.html

Another concern about burning plastic-based fuels like SpecFUEL is their dioxin emissions. While the incinerator rule sets limits for dioxins, the boiler rule does not regulate dioxins directly (an initial draft of the boiler rule did include direct limits on dioxins, but EPA removed these in the final rule, presumably due to objections from the bioenergy industry). Instead, the major source boiler rule regulates CO emissions as a proxy indicator of incomplete combustion, which can lead to dioxin formation. The CO limits in the major source boiler rule are extremely lax, and in any case, almost irrelevant to the facilities we reviewed, since so few plants admitted to being major sources for HAPs. The area source rule, which regulates the majority of the facilities we reviewed, contains no limit on dioxins *or* CO. The result of EPA's new waste rule is that if waste-derived fuels like SpecFUEL are burned in biomass units, there are no restrictions or accountability for dioxin emissions, or indeed for any HAPs other than HCl. According to the letter from EPA, Waste Management plants to build SpecFUEL plants all over the United States.[143]

Case study of a biomass power plant burning waste: Evergreen Community Power

The **33 MW (gross) Evergreen Community Power/United Corrstack facility in Reading, Pennsylvania** is an example of the kinds of waste-burning biomass projects that EPA rules encourage and the bioenergy industry wishes to promote. This combined heat and power plant associated with United Corrstack, a paper product manufacturing company, cost $140 million to build. It received a $39 million "clean" energy grant from the federal government at startup.[144] An evaluation by the Department of Energy states that the fuel burned at the plant includes mostly wood, but that there are "*significant amounts of paper, plastic and other foreign debris*"[145] (Figure 10[146]). This fuel mix suggests that the facility is actually an incinerator, although for reasons that are unclear, it was not permitted as one. The DOE reported that the facility receives 41 – 55 tractor trailer loads a day of fuel and burns 300,000 – 350,000 tons per year. It generates ~70,000 tons of toxic ash a year, which costs $2.45 million a year for disposal.

Figure 10. The fuel burned at the Evergreen Community Power facility in Reading, Pennsylvania.

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[143] Letter to Ms. Kerry Kelly, Waste Management, from US EPA Office of Solid Waste and Emergency Response, August 22, 2013. Available at http://www.epa.gov/epawaste/nonhaz/define/

[144] The guidance for the Department of Treasury's 1603(b) program, which converts the Incentive Tax Credit worth 30% of construction costs to a cash grant, states that the program provides a long-term benefit of expanding the use of clean and renewable energy and decreasing our dependency on non-renewable energy sources." http://www.treasury.gov/initiatives/recovery/Documents/GUIDANCE.pdf

[145] U.S. Department of Energy, Mid-Atlantic Clean Energy Application Center. Evergreen Community Power Plant Case Study: 33 MW Facility Using Biomass. November 16, 2011.

[146] U.S. Department of Energy, Mid-Atlantic Clean Energy Application Center. Evergreen Community Power Plant Case Study: 33 MW Facility Using Biomass. November 16, 2011.

The Evergreen plant is located in the Ozone Transport Region, and federal air permitting applicability thresholds were 100 tons when it was permitted, not 250 tons, but the plant projected emitting no more than 98.7 tons of any pollutant, and thus avoided nonattainment New Source Review permitting. [147] Evergreen was also permitted as an area source for HAPs, even though it was permitted to burn municipal waste, demolition debris, railroad ties, and tire-derived fuel. Projected emissions of HAPs included 9.6 tons of HCl per year (just below the 10 tons per year major source threshold) and a variety of heavy metals, including cadmium, cobalt, chromium, nickel, lead (over a ton per year), manganese, mercury (almost seven pounds per year), arsenic, and selenium. Total HAPs emissions were projected to be 23.9 tons per year, perilously close to the 25-ton triggering threshold that facilities so wish to avoid. [148] The facility started operations in 2009, and by 2010 had seen failure of its ash handling system, its sorbent injection system for controlling HCl, which had to be fully replaced, and its SCR system for controlling NOx. [149] An inspection in 2010 found that the facility had failed to record continuous emissions data for some pollutants, and that the 30-day rolling average emissions rate for HCl, which was supposed to be 0.005 lb/MMBtu to ensure the plant didn't emit more than 10 tons, was actually 30 times higher, at 0.149 lb/MMBtu. [150] This rate, maintained over a year, would lead to emissions of over 300 tons of HCl annually. As of 2010 and 2011, the facility was losing $15 million per year, even though the plant does not pay for fuel, but just its transportation. [151]

Needless to say, this was not how the company had represented its future operations. A write-up about the plant from 2009 looks to the future, quoting David Stauffer, a vice-president of United Corrstack. "*Thanks to reduced emissions, the new plant will improve air quality. 'For every megawatt of electricity we make, that electricity will be displacing a fossil fuel unit somewhere,' Stauffer says. 'When we fire up our 25 megawatts, 25 megawatts of coal fire goes down, which helps clean up the air.*'"[152]

Conclusion: Seven recommendations for seven loopholes

The biomass energy industry is growing rapidly in the United States, but regulation has not kept pace – EPA and the states still treat bioenergy as a boutique industry, requiring special treatment, when in fact the industry is an increasingly large and bullying presence. As we found, bioenergy is disproportionately polluting, both due to physical reasons, and due to loopholes and lax enforcement of the Clean Air Act by localities, states, and the EPA.

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[147] Plan approval application for the United Corrstack LLC Evergreen Community Power Project. Submitted to the Pennsylvania Department of Environmental Protection, October, 2006.
[148] Ibid.
[149] Letter from Art McLaughlin, Site Manager for Evergreen Community Power, to Kenneth Hartzler, Pennsylvania Department of Environmental Protection, December 28, 2010.
[150] Annual inspection verification report for minor facilities – United Corrstack, LLC. Date of inspection September 29, 2010. Submitted by William Borst, AQDS, to Pennsylvania Department of Environmental Protection.
[151] The facility anticipated receiving $500,000 in tipping fees in its first year of operation, but only collected $10,000.
[152] Ben Franklin Technology Partners website: "United Corrstack: Developing a co-generation plant to provide steam and electricity to its manufacturing facility." May 10, 2009. Accessed January 2014 at http://nep.benfranklin.org/united-corrstack-developing-a-co-generation-plant-to-provide-steam-and-electricity-to-its-manufacturing-facility/

What can be done to reduce the threat of pollution from biomass power? Our analysis identified seven loopholes in clean air laws and their enforcement; here, we suggest how these loopholes can be closed.

Loophole 1: Biomass plants can emit more pollution before triggering federal permitting

The Clean Air Act requires a coal plant to go through federal Prevention of Significant Deterioration permitting, including a best available control technology analysis and air quality modeling, if a facility emits 100 tons of a criteria pollutant per year. Biomass plants get to emit two and a half times as much of each pollutant – 250 tons per year – before PSD permitting applies.

The fix: Burning biomass for electricity produces as much or more of key pollutants as coal – so biomass should be regulated like coal. EPA has the authority to require that biomass plants be added to the list of pollution sources where PSD permitting is triggered at 100 tons. Biomass power plants are big, polluting facilities that emit hundreds to thousands of tons of pollution each year. They should be regulated accordingly.

Loophole 2: EPA's free pass for bioenergy CO_2 lets large power plants avoid regulation

The EPA's decision to not regulate bioenergy CO_2 under the Clean Air Act was deemed unlawful by the U.S. Court of Appeals in 2013. The exemption has allowed a large number of plants to escape PSD permitting, thus doubling allowable pollution from this industry.

The fix: EPA should regulate bioenergy CO_2 now. Once in the PSD program, facilities can discuss how to reduce their net emissions of CO_2 during the consideration of best available control technology.

Loophole 3: State regulators help biomass power plants avoid more protective permitting

Regulators routinely accept even far-fetched permit limits for biomass facilities that claim they can meet "synthetic minor" permit limits of 250 tons of each criteria pollutant per year. Avoiding PSD doubles the pollution a plant is allowed to emit, and avoids air quality modeling that could determine whether a facility will cause EPA health standards to be exceeded.

The fix: If Loophole 1 were fixed, and PSD permitting was triggered at 100 tons of emissions, most biomass plants would have to go through PSD. Likewise, if EPA implemented the Court's decision and regulated bioenergy CO_2, most plants emit more than 100,000 tons of CO_2, also triggering PSD. Beyond those fixes, EPA should subject every power plant permit to federal oversight – especially those from states like Georgia, where regulators routinely issue synthetic minor source permits with the most minimal of conditions. It is going to take meaningful federal oversight to ensure these facilities set emissions limits that are federally enforceable, as the Clean Air Act requires.

Loophole 4: Most biomass plants have no restrictions on hazardous air emissions
The boiler rule, the part of the Clean Air Act that regulates emissions of hazardous air pollutants, is extremely weak. Area source plants, which constitute the majority of biomass facilities, have no limits on emissions of hazardous air pollutants, and the MACT standard for PM (0.03 lb/MMBtu) is double the rate issuing from most BACT determinations. Major source facilities face only lax emissions standards on PM, CO, HCl, and mercury, standards that usually don't require facilities to reduce their emissions at all.

The fix: EPA should make the so-called Maximum Available Control Technology standard meaningful, by setting standards as the Clean Air Act requires – standards that require the maximum degree of reduction of each HAP that is "achievable," considering cost and other statutory factors. At a minimum, without regard to cost, they must reflect the emission level that the cleanest sources have achieved – sources that are using emission control technologies that are effective and available, such as high-efficiency fabric filters that dramatically reduce particulate matter emissions. The biomass MACT should be made at least as protective as the standards for waste incinerators and coal boilers – especially given that facility can be classified as biomass boilers even when burning up to 90% coal, and when burning highly contaminated wastes.

Loophole 5: The biomass industry lowballs estimates of toxic emissions to avoid regulation
There is an epidemic of biomass facilities claiming to be synthetic minor sources for hazardous air pollutants. Almost no matter what their boiler size, facilities claim they should be regulated as area sources of HAPs that emit less than 25 tons of HAPs per year, and less than 10 tons of any individual HAP. Our analysis determined that the commonly used emission factor provided by the secretive industry group NCASI significantly under-represents typical emissions of hydrochloric acid, an important HAP. Using these industry emissions factors appears to lowball HAPs at the permitting stage, under-representing actual emissions.

The fix: EPA and the states should require that HAPs emissions are estimated at the permitting stage based on emissions factors that are transparently derived, with a generous margin for error that assumes emissions are likely to spike at the very times (such as startup and shutdown) when they are least likely to be measured. Most facilities are probably major sources for HAPs, and should be regulated as such.

Loophole 6: Weak testing requirements mean air toxics limits aren't enforceable
Facilities have been able to claim minor source status for HAPs with impunity because their permits contain so few requirements for actual testing and ongoing monitoring of emissions, once the plant is operating.

The fix: EPA's recent decision on the Hu Honua permit states that if a facility wants to be regulated as a synthetic minor source (for criteria pollutants or HAPs) it must conduct testing that represents its true emissions, including during startup and shutdown. The permit must be written to require such testing, otherwise it is not federally enforceable, and is thus invalid. For limits to be truly enforceable, there should be ongoing monitoring with results revealed in real time, so that states and citizens can know when and if a facility is violating its permit.

Loophole 7: EPA rules blur the line between biomass facilities and incinerators

EPA's rules allow materials that are just as contaminated as coal – and in some cases, more contaminated, as in the case of phthalate-containing "fuel cubes" – to be burned in biomass plants as "non-hazardous secondary materials," instead of waste incinerators, where emissions are more tightly regulated. EPA is proposing to grant a blanket designation as non-hazardous for construction and demolition waste wood, which contains heavy metals like arsenic, lead, and mercury, and emits carcinogens like benzene, formaldehyde, and dioxins when burned.

The fix: EPA needs to put people first – not the bioenergy industry, which has an inexhaustible appetite for contaminated fuels, particularly materials they are paid to dispose of by burning. The EPA should ensure that it does not create a loophole for unregulated waste incineration and that it protects public health by ensuring that all waste burners – including those that label themselves biomass units – meet the protective standards that Congress enacted for waste burning.

All around the country, communities are being faced with large biomass plants that are promoted as "clean and green" renewable energy. When people find out how much pollution these facilities emit, however, and the special treatment the bioenergy industry receives, they wonder why their scarce renewable energy dollars are supporting an industry that can, literally, kill people with its emissions. The data from the 88 permits we reviewed tells the story – again and again, biomass plants are allowed to emit more criteria pollutants and hazardous air pollutants, as well as greenhouse gases, than fossil fueled plants or even waste burners. The majority of the biomass plants currently being built will burn some kind of waste materials, and it is increasingly difficult for communities to protect themselves from toxic air pollution in light of the rollback on regulation at EPA now underway. It is time to take a clear-eyed look at what this bioenergy industry actually represents – the liquidation of pollution-emitting and often toxic materials into the atmosphere, where they are dispersed into the environment and the air we breathe. Across the board, it is time for states and the federal government to stop promoting and supporting biomass power as "clean" energy, and recognize its real impacts.

Summary case studies: the emerging bioenergy industry

The following are some representative examples of biomass power plants being proposed and built around the country. Information on facilities and the loopholes from which they benefit is taken from permits and permit application documents. Unlike the set of permits for new, "greenfield" facilities that we used for graphically demonstrating the differences between PSD facilities and synthetic minor facilities (Figures 4 through 7), this list includes some biomass facilities that previously burned fossil fuels.

Sierra Pacific, Anderson, CA

What: An existing facility that is increasing biomass-burning capacity. 468 MMBtu/hr stoker boiler; 31 MW (gross)

Estimated CO_2 emissions (tons per year): 401,890

Permitted emissions (tons per year): NOx: 267 CO: 472 $PM_{10\ total}$: 41 SO_2: no limit set

Status for NOx, PM, and CO: Major source (PSD)

Status for HAPs: Major source

Fuel: 25 bone dry tons/hour of: "a. Untreated wood pallets, crates, dunnage, untreated manufacturing and construction wood debris from urban areas; b. All agricultural crops or residues; c. Wood and wood wastes identified to follow all of the following practices; i. Harvested pursuant-to an approved timber management plan prepared in accordance with the Z'berg-Nejedly Forest practice Act of 1973 or other locally or nationally approved plan; ii. Harvested for the purpose of forest fire fuel reduction or forest stand improvement."

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Unknown

Notes: This air permit does not set a limit for SO_2 at all, and does not specify any means of controlling emissions of HCl, as apparently, the major source limit of 0.022 lb/MMBtu for HCl under the boiler rule is so easily met, no controls are needed. The plant can emit up to 45 tons of HCl under the major source limit. This permit is also notable in that it actually specifies an emission rate for CO_2, unusual for a bioenergy plant permit.

DTE Stockton, Stockton, CA

What: Refire of old coal plant to biomass. 699 MMBtu/hr stoker boiler; 54 MW (gross).

Estimated CO_2 emissions (tons per year): 600,259

Permitted emissions (tons per year): NOx: 108 CO: 248 $PM_{10\ total}$: 58 SO_2: 70

Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)

Status for HAPs: Synthetic minor source

Fuel: "Biomass is defined as any organic material originating from plants, not chemically treated and not derived from fossil fuels, including but not limited to products, by-products, and residues from agriculture, forestry, aquatic and related industries, such as agricultural, energy or feed crops and residues, orchard and vineyard prunings and removal, stone fruit pits, nut shells, cotton gin trash, corn stalks and stover, straw, seedhulls, sugarcane leavings and bagasse, aquatic plants and algae, cull logs, eucalyptus logs, poplars, willows, switchgrass, alfalfa, bark, lawn, yard and garden clippings, paper (unprinted), leaves, silvicultural residue, tree and brush pruning, sawdust, timber slash, mill scrap, wood and wood chips, and wood residue. Biomass does not include tires, material containing sewage sludge, or industrial, hazardous, radioactive, or municipal solid waste."

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: As a coal plant, this facility stopped operation in 2009. It is located in a highly polluted area, with "extreme" non-attainment status for ozone. Emissions from the new biomass boiler triggered offset requirements for emissions of NOx, SOx, PM_{10}, and VOCs, but rather than being compelled to obtain new offsets, the facility was allowed to treat the cessation of previous allowable emissions from the coal plant as mostly offsetting biopower emissions. Although the DTE Stockton boiler is about 50% larger than the boiler at the PSD-permitted Sierra Pacific Anderson plant described in this report, the DTE plant claimed synthetic minor status to avoid PSD permitting.

Plainfield Renewable Energy, Plainfield, CT

What: 523 MMBtu/hr fluidized bed boiler; 37.5 MW (net)

Estimated CO_2 emissions (tons per year): 449,207

Permitted emissions (tons per year): NOx: 175 CO: 239 $PM_{10\ fil}$: 84.8 SO_2: 81.3

Status for NOx, PM, and CO: Major source (PSD)

Status for HAPs: Synthetic minor source

Fuel: 56.54 tons per hour of chipped trees, stumps, branches or brush as defined in RCSA 22a-208a-1; Recycled wood or clean wood, meaning any wood or wood fuel which is derived from such products or processes as pallets skids, spools, packaging materials, bulky wood waste or scraps from newly built wood products, provided such wood is not treated wood. [CGS 22a-209a][RCSA 22a-208a-1]; Processed Construction and Demolition wood, meaning processed wood from construction and demolition activities which has been sorted to remove plastics, plaster, gypsum wallboard, asbestos, asphalt shingles and wood which contains creosote or to which pesticides have been applied or which contains substances defined as hazardous under section CGS 22a-115. [CGS 22a-209a]; Other types if properly sized, clean, uncontaminated wood materials, such as sawdust, chips, bark, tree trimmings or other similar materials. The plant is also allowed to burn up to 781 gal of biodiesel per hour, with no restrictions on number of hours that biodiesel can be burned.

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Unknown

Notes: This permit requires the plant to burn "sorted" waste wood that has had contaminated materials removed, but does not specify what level of contamination is acceptable, a problem given that no sorting program can remove 100% of contaminated materials. The permit contains a requirement for *initial* testing for emissions of sulfuric acid, ammonia, arsenic, beryllium, cadmium, chromium, nickel, copper, benzene, titanium, formaldehyde, lead, manganese, mercury, dioxins (2,3,7,8-TCDD equivalents), selenium, hydrogen chloride, styrene, silver, and zinc. The permit also calls for the facility to meet certain emission limits for HAPs, but does not specify how those emission limits should be met, or whether testing for all HAPs is required. The HAPs provisions in this permit therefore appear to be unenforceable, although subsequent issuance of a Title V operating permit may rectify this.

Montville Power, Uncasville, CT

What: 600 MMBtu/hr stoker boiler when firing biomass; 42 MW (net). Can convert to distillate oil or gas for up to 995 MMBtu/hr and 82 MW (net).

Estimated CO_2 emissions (tons per year): 515,244 (when firing biomass)

Permitted emissions (tons per year): NOx: 158 CO: 263 $PM_{10\ fil}$: 31.5 SO_2: 65.7

Status for NOx, PM, and CO: Major source (PSD)

Status for HAPs: Presumably major

Fuel: Chipped trees, stumps, branches or brush. Recycled wood or clean wood, meaning any wood or wood fuel which is derived from such products or processes as pallets skids, spools, packaging materials, bulky wood waste or scraps from newly built wood products, provided such wood is not treated wood. Other Clean Wood, if properly sized, clean, uncontaminated wood materials, such as sawdust, chips, bark, tree trimmings or other organic based materials.

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Unknown

Notes: This permit requires the facility to meet emissions standards for a long list of air toxics outlined in Connecticut regulations, but only specifies testing for HCl and ammonia, which while toxic, is not considered to be a hazardous air pollutant. The permit therefore appears to be unenforceable, although subsequent issuance of a Title V operating permit may rectify this.

Gainesville Renewable Energy, Gainesville, FL

What: 1,359 MMBtu/hr fluidized bed boiler; 116 MW (gross), 100 MW (net)

Estimated CO_2 emissions (tons per year): 1,167,000

Permitted emissions (tons per year): NOx: 416 CO: 714 $PM_{10\ fil}$: 58 SO_2: 172.6

Status for NOx, PM, and CO: Major source (PSD)

Status for HAPs: Initially permitted as area source; may be re-permitted as major source

Fuel: "Tops, limbs, whole tree material and other residues from soft and hardwoods that result from traditional silvicultural harvests; Saw dust, bark, shavings and kerf waste from cutting/milling whole green trees; fines from planning kiln-dried lumber; wood waste material generated by primary wood products industries such as round-offs, end cuts, sticks, pole ends; and reject lumber as well as residue material from the construction of wood trusses and pallets. Tops, limbs, whole tree material and other residues that result from the cutting or removal of certain, smaller trees from a stand to regulate the number, quality and distribution of the remaining commercial trees; and forest understory which includes smaller trees, bushes and saplings. Tops, limbs, whole tree material and other residues that are damaged due to storms, fires or infectious diseases. Tree parts and/or branches generated by landscaping contractors and power line/roadway clearance contractors that have been cut down for land development or right-ofway clearing purposes. Wood derived from used pallets packing crates; and dunnage disposed by commercial or industrial users. Herbaceous plant matter; clean agricultural residues (i.e., rice hulls, straw, etc.; no animal wastes or manure); and whole tree chips and pulpwood chips."

Construction and demolition wood or other waste allowed as fuel? No

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: Early in the permit application process, this massive plant applied as a major source for HAPs, but subsequent revisions claimed it would emit less than 25 tons of HAPs, and the facility was ultimately permitted as an area source. Now, a pending and potential permit revision filed in February 2014 seeks to regulate the facility under the major source boiler rule,[153] after all, although this re-permitting process is currently suspended. If the plant is re-permitted as a major source for HAPs, its allowable filterable PM emissions will decrease under the major source MACT for bubbling fluidized bed boilers, from 0.015 lb/MMBtu to 0.0098 lb/MMBtu. This change would reduce permitted emissions of filterable PM from 89 tons to 58 tons per year.

Green Energy Partners, Lithonia, GA

What: Two stoker boilers of 93.22 MMBtu/hr; 11.5 MW (net).

Estimated CO_2 emissions (tons per year): 160,103

Permitted emissions (tons per year): NOx: 25 CO: 249 $PM_{10\ fil}$: 24 SO_2:8.1

Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)

Status for HAPs: Synthetic minor source

Fuel: "Biomass shall consist of wood wastes in chip or in shredded form from timber harvesting, pre-commercial thinning of forest plantation stands, harvesting non-commercial, dead or deformed species for fuel purposes and land clearing activities (limbs, tops, stumps and non-commercial trees), and may also include peanut hulls, pecan shells, cotton stalks, lumber and pallet wood wastes (unpainted/untreated only) and similar woody biomass. "

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: This plant is being built in the Atlanta metro area, which is out of attainment with EPA's air quality standard for PM and ozone. It is proposing to use a ceramic filter system for control of NOx and PM, a technology unique to this facility. Permitted as a synthetic minor source, the company has avoided measures that could be taken to reduce emissions. Like almost all the biomass plants that have received air permits in Georgia in recent years, the

[153] Gainesville Renewable Energy Center. Initial Title V air operation permit application filed with Florida Department of Environmental Protection. February 10, 2014.

company was permitted to use non-EPA emissions factors for HAPs, which dramatically underestimate emissions compared to the EPA-sanctioned emissions factors.

North Star Jefferson, Wadley, GA

What: 312 MMBtu/hr fluidized bed boiler; 25 MW (gross).

Estimated CO_2 emissions (tons per year): 275,000

Permitted emissions (tons per year): NOx: 249 CO: 249 $PM_{10\ fil}$: 21 SO_2: 249

Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)

Status for HAPs: Synthetic minor source

Fuel: wood, shredded tires

Construction and demolition wood or other waste allowed as fuel? Initially yes; as permitted, no.

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: The facility is located in an area with large existing pollution sources, including wood-burners. No pre-construction air quality modeling has been conducted. It is being developed by a pro-forestry non-profit organization, the U.S. Endowment for Forestry and Communities, but the developer has stated that burning tires is important to the success of the facility. As for other biomass facilities permitted in Georgia, this facility used non-EPA sanctioned emissions factors to come to the conclusion that it is a minor source for HAPs. Initial stack tests are required to establish emissions rates for certain HAPs.

Piedmont Green Power, Barnesville, GA

What: 657 MMBtu/hr stoker boiler; 54.5 MW (net).

Estimated CO_2 emissions (tons per year): 564,192

Permitted emissions (tons per year): NOx: 228 CO: 227 $PM_{10\ fil}$: 86 SO_2: not spec

Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)

Status for HAPs: Synthetic minor source

Fuel: "Biomass shall consist of wood wastes in chip or in shredded form from timber harvesting, pre-commercial thinning of forest plantation stands, harvesting non-commercial, dead or deformed species for fuel purposes and land clearing activities (limbs, tops, stumps and non-commercial trees), and may also include peanut hulls, pecan shells, cotton stalks, lumber and pallet wood wastes (unpainted/untreated only) and similar woody biomass."

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: While this facility claims to be a synthetic minor source for HAPs, and the permit states that potential emissions of HAPs are greater than 25 tons, the permit contains no testing requirements other than a one-time test for HCl. The permit would thus likely be deemed unenforceable under Clean Air Act requirements, although the omission might be rectified when the Title V operating permit is issued. This facility was awarded $49.5 million in "clean" energy funding from the federal government, as a 1603b award that converts the federal renewable energy incentive tax credit to a cash grant.

Hu Honua, Pepe'ekeo, HI

What: Refire of old coal plant. 407 MMBtu/hr stoker boiler; 23.8 MW gross, 21.5 MW net

Estimated CO_2 emissions (tons per year): 349,507

Permitted emissions (tons per year): NOx: 210 CO: 246 $PM_{10\ fil}$: 21.4 SO_2: 39.2

Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)

Status for HAPs: Synthetic minor source

Fuel: wood, biodiesel

Construction and demolition wood or other waste allowed as fuel? No

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: This facility took synthetic minor status for criteria pollutants and HAPs. EPA commented on this permit, observing that it was unlikely that a facility this size could stay below its CO cap, and observing that the use of non-EPA sanctioned emission factors for calculating HAPs emissions needed to be justified. As allowed by the Clean Air Act, a citizen group petitioned the EPA to formally object to the permit, and EPA has responded, agreeing that as written, the pollution limits are not enforceable. This decision is significant because EPA has made it clear that actual emissions testing for both criteria air pollutants and HAPs must be conducted under a variety of operating conditions for a facility to be able to claim and maintain synthetic minor source status. Many permits for bioenergy facilities being issued around the country do not contain these requirements, particularly for HAPs, and are therefore likely unenforceable under the terms of the Clean Air Act.

ecoPower, Hazard, KY

What: 745 MMBtu/hr fluidized bed boiler; 58 MW

Estimated CO_2 emissions (tons per year): 577,073

Permitted emissions (tons per year): NOx: 240 CO: 240 $PM_{10\ fil}$: 240 SO_2: 240

Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)

Status for HAPs: Synthetic minor source

Fuel: Hardwood tree stems removed during pre-commercial thinning operations. Storm and fire damaged hardwood trees and tree parts. Low quality hardwood logs and hardwood blocks that are trimmed in the production of sawlogs. Hardwood wood industry byproducts such as shavings, saw dust, bark, and similar materials that do not contain preservatives, resins, or other additives. Low quality hardwood logs and hardwood wood chips produced during right-of-way operations and urban forestry operations. Unrecyclable untreated hardwood pallets, untreated lumber, and dunnage.

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: An early draft of the air permit classified the facility as a major source for HAPs that would emit over 35 tons per year. The final version of the permit reduced the amount of HAPs to 7.71 tons. The applicant achieved the reduction in estimated HAPs by making up their own HAPs emissions factors, and only counting certain HAPs toward total emissions. Provisions requiring stack testing were removed in the final version of the permit, so the HAPs limits are unenforceable at this point.

Verso Bucksport, Bucksport, ME

What: 814 MMBtu/hr stoker boiler; 25 MW (gross)

Estimated CO_2 emissions (tons per year): 699,014

Permitted emissions (tons per year): NOx: 476.3 CO: 952.7 $PM_{10\ fil}$: 95.3 SO_2: 243.9

Status for NOx, PM, and CO: Major source

Status for HAPs: Presumably a major source; permit makes no mention of HAPs.

Fuel: "Fuel oil (including fuel oil, off-specification waste oil, and specification waste oil), natural gas, and biomass (including wood waste, wood chips, bark, mill waste treatment sludge, paper roll core ends, and waste papers)."

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Unknown

Notes: Located immediately adjacent to homes and schools, the Verso Bucksport paper mill expanded its biomass-burning capabilities to 25 MW to take advantage of renewable energy credits available in the Northeast. Although the facility went through a BACT analysis, its emission rate for PM (at 0.03 lb/MMBtu) is highly permissive, double what other BACT-permitted plants and coal plants achieve. At 0.3 lb/MMBtu, the 24-hr allowable NOx emissions rate is also more than triple the limit at other PSD- permitted plants. The facility does not use any sorbent system to reduce hydrochloric acid emissions.

Burgess Biopower, Berlin, NH

What: 1,013 MMBtu/hr bubbling fluidized bed boiler; 70 MW (gross)

Estimated CO_2 emissions (tons per year): 869,903

Permitted emissions (tons per year): NOx: 244.5 CO: 307.3 $PM_{10\ fil}$: 40.9 SO_2: 48.7

Status for NOx, PM, and CO: Major source

Status for HAPs: Major source

Fuel: "Whole tree wood chips and other low-grade clean wood"

Construction and demolition wood or other waste allowed as fuel? No

Use of NCASI or other non-EPA factors to estimate HAPs? Unknown

Notes: Located at the site of an old pulp mill, this facility is immediately adjacent to homes and schools. It is the largest wood-burning plant in the Northeast. The permit specifies that the plant will burn about 113 tons of wood chips per hour, which will be sourced primarily from whole trees. This facility admitted to being a major source for HAPs, in contrast to another all "clean" wood plant, the 100 MW (net) Gainesville Renewable Energy Center, which claimed to be an area source.

ReEnergy Lyonsdale Biomass, Lyons Falls, NY

What: 290 MMBtu/hr stoker boiler; 19 MW (net)

Estimated CO_2 emissions (tons per year): 243,882

Permitted emissions (tons per year): NOx: 249 CO: 249 $PM_{10\ fil}$: ~124 SO_2: "Less than 10 tons"

Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)

Status for HAPs: Synthetic minor source

Fuel: Unadulterated wood, up to 30% pallets; also non-recyclable fibrous material such as wax cardboard in combination with other fuels in quantities up to and equal to 30% by weight of the boiler's fuel feed. Non-recyclable fibrous material may be in the form of pellets, extrusions, chips, shreds, or other shapes that provide suitable fuel management capability.

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Unknown

Notes: While the permit clearly authorizes the facility to burn waste materials, the company's website states that the plant "*provides sustainable electricity from responsibly harvested green forest residue biomass, and unadulterated wood.* This permit exploits an obscure loophole in the law that allows it to specify a filterable particulate matter emission rate of 0.1 lb/MMBtu. The facility is required to do one stack test for PM every five years to demonstrate compliance. The permitted NOx emission rate of 0.2 lb/MMBtu is about three times higher than the rate at plants that go through a BACT analysis. The permit contains no limits on HCl emissions and no sorbent system is specified in the permit. This is a Title V permit with no firm testing requirements to establish and maintain its synthetic minor source status for HAPs, suggesting that it is unenforceable.

ReEnergy Black River, Fort Drum, NY

What: Refire of existing old coal plant. Three circulating fluidized bed boilers, 284 MMBtu/hr each; 60 MW (gross)

Estimated CO_2 emissions (tons per year): 658,274

Permitted emissions (tons per year): NOx: 538.5 CO:234.1 $PM_{10\ fil}$: 52 SO_2: 696.3

Status for NOx, PM, and CO: Major source

Status for HAPs: Synthetic minor source

Fuel: "The proposed fuels to be combusted are clean wood, unadulterated wood from C+D debris, glued wood creosote treated wood, tire derived fuel and non-recyclable fibrous material (waste paper)."

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Unknown

Notes: This facility is allowed to burn a number of waste-derived fuels. Its testing requirements for fuel state "*ReEnergy shall employ the "grid test" which consists of a 10 by 10 grid placed over the wood stream and checked to determine the percentage of glued wood, treated/painted wood, and non-wood materials. If it is determined that the percentage of glued wood is between 0 and 1.0% by volume, then the percentage of glued wood for that load is 1%. If it is determined that the percentage of glued wood is between 1% and 20% by volume, the percentage of glued wood for that load is 20%. If it is determined that the percentage of glued wood is greater than 20% by volume, then the load is considered to 100% glued wood. This method shall be employed once every 5 loads per supplier."* This is a Title V permit with no firm testing requirements to establish and maintain its synthetic minor source status for HAPs, suggesting that it is unenforceable.

Biogreen Sustainable Energy, La Pine, OR

What: 353 MMBtu stoker boiler, 24.9 MW (net)
Estimated CO_2 emissions (tons per year): 303,135
Permitted emissions (tons per year): NOx: 232 CO:247 $PM_{10\ fil}$: 46 SO_2: 39
Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)
Status for HAPs: Synthetic minor source
Fuel: "Wood in the form of hog fuel, bark, and chips, forest management residue (slash), wood from yard debris , and construction and demolition wood materials will be used as fuel for the boiler. The facility will not bum wood by-products that contain plywood or resin materials. Less than 20% of the heat input to the boiler on an annual basis will come from yard debris and construction and demolition materials"
Construction and demolition wood or other waste allowed as fuel? Yes
Use of NCASI or other non-EPA factors to estimate HAPs? Yes
Notes: The facility's website[154] states, "Creating clean energy from local forests," but a significant portion of the plant's fuel will come from construction and demolition waste. This permit contains a requirement to test HCl emissions to ensure its emission factor is valid, but does not contain any requirement to test for other HAPs, suggesting it is unenforceable.

Evergreen Community Power/United Corrstack, Reading, PA

What: 482 MMBtu/hr stoker boiler; 33 MW (gross)
Estimated CO_2 emissions (tons per year): 414,000
Permitted emissions (tons per year): NOx: 96 CO: 99 $PM_{10\ fil}$: 96 SO_2: 92
Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)
Status for HAPs: Synthetic minor source
Fuel: Wood, construction waste, municipal waste
Construction and demolition wood or other waste allowed as fuel? Yes
Use of NCASI or other non-EPA factors to estimate HAPs? Yes
Notes: See section above for details on this plant.

Nacogdoches Power, Sacul, TX

What: 1,374 MMBtu bubbling fluidized bed boiler, 116 MW (gross).
Estimated CO_2 emissions (tons per year): 1,179,908
Permitted emissions[155] (tons per year): NOx: 602 CO: 903 $PM_{10\ total}$: 192.6 SO_2: 274
Status for NOx, PM, and CO: Major source (PSD)
Status for HAPs: Major source
Fuel: 1.4 million tons a year of "biomass materials in the form of forest residue (primarily residual tops and limbs of trees, unutilized cull trees, and slash), and mill residue (including sawdust). Whole tree wood chips may also be used as fuel."

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[154] http://biogreenenergyco.com/
[155] Calculated from permitted rates, as no limits for total tons are specified in permit.

Construction and demolition wood or other waste allowed as fuel? Yes – "clean municipal wood waste"
Use of NCASI or other non-EPA factors to estimate HAPs? Unknown
Notes: This is the sister plant to the Gainesville Renewable Energy Center in Florida, which claims to be a minor source for HAPs although it was permitted as a major source. The Nacogdoches plant was permitted as a major source, with permitted emissions of 126 tons of HCl per year.

EDF Allendale, Allendale, SC

What: New facility; 275 MMBtu/hr stoker; 21 MW gross, 17.5 MW net
Estimated CO_2 emissions (tons per year): 236,153
Permitted emissions (tons per year): NOx: 241 CO: 250 $PM_{10\ fil}$: 36 SO_2: 30.1
Status for NOx, PM, and CO: Synthetic minor source (avoided PSD)
Status for HAPs: Synthetic minor source
Fuel: The boiler is permitted to burn only clean, untreated wood waste as fuel. Clean wood is defined in SC Regulation 61-62.1 as untreated wood or untreated wood products including clean untreated lumber, tree stumps (whole or chipped), and tree limbs (whole or chipped). Clean wood does not include yard waste, or construction, renovation, and demolition waste (including but not limited to railroad ties and telephone poles). The use of any other substances, including yard waste and construction, renovation and demolition waste, as fuel is prohibited without prior issuance of a construction permit revision from the Bureau of Air Quality.
Construction and demolition wood or other waste allowed as fuel? No
Use of NCASI or other non-EPA factors to estimate HAPs? Yes
Notes: This permit would be a major source for HAPs if AP-42 emission factors had been used to calculate emissions instead of a combination of NCASI and other factors. This facility has a twin which has also recently come online, the EDF Dorchester plant in Harleyville, SC.

Dominion Energy, Southampton, Altavista, and Hopewell, VA

What: Three 63-MW coal plants being converted to 51 MW biomass plants: Altavista (Altavista, VA), Hopewell (Hopewell, VA) and Southampton (Franklin, VA)
Estimated CO_2 emissions (tons per year): 2,030,060 (three facilities)
Permitted emissions (tons per year): NOx: 412 (x 3) = 1,236 CO: 916 (x 3) = 2,748
$PM_{10\ fil}$: 59.6(x 3) = 178.7 SO_2: 38.2 (x 3) = 114.6
Status for NOx, PM, and CO: Major sources (PSD)
Status for HAPs: Unknown.
Fuel: Three permits; two specify use of 785,480 tons of wood a year and no contaminated wood; one permit (Southampton) allows use of 5,879,518 gal/yr distillate fuel oil. "Biomass means those residuals that are akin to traditional cellulosic biomass including forest-derived biomass (e.g., green wood, forest thinnings, clean and unadulterated bark, sawdust, trim, and tree harvesting residuals from logging and sawmill materials) wood collected from forest fire clearance activities, trees and clean wood found in disaster debris, and clean

biomass from land clearing operations, each as specified in the definition of Clean Cellulosic Biomass in 40 CFR 241.2, excluding any wood which contains chemical treatments or has affixed thereto paint and/or finishing materials or paper or plastic laminates. Approved biomass is biomass that does not contain contaminants at concentrations not normally associated with virgin biomass materials."

Construction and demolition wood or other waste allowed as fuel? No

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: While initial stack testing is required to determine emissions of SO_2, NOx, CO, VOCs, sulfuric acid mist, and hydrogen fluoride, there is no stack testing required for HCl or other HAPs. Requirements for HAPs testing may be included when Title V operating permits for the plants are issued.

Nippon Paper, Port Angeles, WA

What: Facility expansion; 420 MMBtu/hr stoker; ~20 MW net (cogen, uses some thermal energy)

Estimated CO_2 emissions (tons per year): 360,670

Permitted emissions (tons per year): NOx: 184 CO: 644 $PM_{10\ fil}$: 2 SO_2: 152

Status for NOx, PM, and CO: Major source

Status for HAPs: Major source (PSD)

Fuel: "Approved Cogeneration Plant Fuels: The Permittee shall burn only clean woody biomass, recycled wood-derived fuel, dewatered wastewater treatment sludge, natural gas, and ultra low sulfur diesel fuel in the cogeneration plant. For the purpose of this order: a. Clean woody biomass, also known as hog fuel or hogged fuel, is defined is any woody material that meets the definition of clean cellulosic biomass in §241.2. b. Recycled wood-derived fuel is defined as any woody, non-hazardous secondary material that has been declared non-waste by the standards and procedures outlined in §241.3. c. Dewatered wastewater treatment sludge is defined as clarifier sludge consisting largely of pulp and paper fibers and produced on site that has been declared non-waste by the standards and procedures outlined in §241.3. d. Natural gas means any fuel defined as natural gas in §63.7575, including propane and LPG. e. Ultra low sulfur diesel fuel means fuel oils containing less than 0.05 weight percent nitrogen and less than 0.0015 weight percent sulfur that comply with the specifications for fuel oils numbers 1 and 2 as defined by ASTM D396 or diesel fuel numbers 1 and 2 as defined by ASTM D975. Ultra low sulfur fuel oil may contain any percentage of biodiesel that complies with the specifications in ASTM 6751, provided the nitrogen and sulfur limits are met by the liquid fuel mixture."

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: Located on the Olympic Peninsula, about 31 miles from the Port Townsend Paper Company, this facility was required to reduce emissions of air toxics more than most other facilities we reviewed, but as it burns a variety of contaminated fuels, including paper-making sludge, its emissions of air toxics are likely to be high. The company is required by its permit to develop a fuel monitoring plan and test fuel analyze for chlorine and mercury content. It is supposed to ensure that "recycled wood derived fuel" meets a quality assurance plan. The plant was permitted as a major source of HAPs before the significantly weakened version of the boiler rule that exists today, and was required to meet a filterable PM emission limit of 0.0011 lb/MMBtu (the current MACT standard for major source boilers is 0.03 lb/MMBtu, which is 27 times higher). The filterable PM limit explains the relatively low estimated emissions of 2 tons per year from the plant. The permit also sets limits for emissions of acrolein, ammonia, benzene, formaldehyde, hydrogen chloride (HCl) mercury, and dioxins/furans. Initial and "intermittent" stack tests are required to ensure compliance (once per permit term, or every five years). The plant is also required to install a continuous emissions monitoring system for PM, which is unusual for the permits we reviewed.

Port Townsend Paper Company, Port Townsend, WA

What: Facility expansion; 414 MMBtu/hr stoker; ~24 MW net (cogen, uses some thermal energy)

Estimated CO_2 emissions (tons per year): 355,518

Permitted emissions (tons per year): NOx: 262 CO: 635 $PM_{10\ fil}$: 36.4 SO_2: 96

Status for NOx, PM, and CO: Major source (PSD)

Status for HAPs: Synthetic minor source

Fuel: "Wood fuels including hog fuel, forest biomass, and urban wood. Ecology does not currently classify these wood fuels as solid waste. Wood fuels do not include wood treated with creosote, pentachlorophenol, or copper-chrome-arsenic; or municipal waste. Forest biomass means the by-products of current forest management activities, current forest protection treatments authorized by the agency, or the by-products of forest health treatment prescribed or permitted under Washington's forest health law. Forest biomass does not include municipal solid waste. Urban wood is purchased wood fuel meeting an acceptance program which prohibits wood treated with creosote, pentachlorophenol, or copper-chrome-arsenic; municipal waste, hazardous material contaminants (asbestos, lead, mercury), lead painted items, and plastic coatings." (Urban wood is demolition waste. Port Townsend Paper's fuel also includes reprocessed fuel oil (about 15% of total fuel) and corrugated cardboard recycling rejects ("OCC rejects"), meaning corrugated boxes that are too contaminated with labels, fasteners, etc., to recycle. PTPC uses approximately one-third of Washington's recycled cardboard.

Construction and demolition wood or other waste allowed as fuel? Yes

Use of NCASI or other non-EPA factors to estimate HAPs? Yes

Notes: Unlike the Nippon Paper plant at Port Angeles, which was issued by the Olympic Region Clean Air Agency in Washington, the permit for this facility was issued by the Washington Department of Ecology and contains relatively few protective measures, even though it is a larger facility than the Nippon plant. Emissions calculations that were used to justify the expansion of biomass burning at the facility include reductions from installing future emissions control equipment that will be required by law regardless of whether the biomass project is built or not. The proposed expansion will increase fuel throughput to 2.9 times the present amounts.