Human Health Effects of Biomass Incinerators:
Dirty Energy Comes From Smoke Stacks!

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[SLIDE 1] Greetings and thanks you for attending this important briefing

I am Rachel Smolker, I have a Ph.D. in biology from the University of Michigan and I work as co-director of the NGO, Biofuelwatch, (http://www.biofuelwatch.net) an international organization that has been working to expose the problems with biomass electricity for the past 6 years. We work with community groups around the US, in UK and Europe and elsewhere who are opposing biomass incinerators. Mostly they are opposed because of the air pollution health impact concerns. People do not want to be made ill, especially by something that is supposed to be "clean, green and renewable".

Currently the number of biomass facilities is rapidly increasing across the US, with many new facilities proposed and in planning. Some of these are standalone electricity and sometimes electricity and heat facilities. Others are coal facilities that are shifting to co-fire biomass along with coal, often as a strategy to lower certain kinds of emissions –even though it will increase emissions of other pollutants.

The expanding biomass industry is global, supported wherever there are mandates and subsidies for renewable energy – for example via state Renewable Portfolio Standards and numerous state and federal programs such as the ARRA, provisions in the farm bill and others. Biomass incinerators are often favored over other renewables because they can provide baseload electricity.

> Source: "Clean Energy Subsidies For a Dirty Industry" (Biomass Accountability Project, June 2011)
> http://www.nobiomassburning.org/wp-content/uploads/2012/01/BAP-Report-June-2011.pdf

[SLIDE 2] This figure shows EIA projections for the future role of biomass. As you can see, biomass along with wind, are expected to provide the bulk of growth in renewable energy. Because biomass electricity is so polluting, this projected expansion is a huge threat to public health.

> Source: EIA projections for renewable development:
> http://www.eia.gov/todayinenergy/detail.cfm?id=5170

[SLIDE 3] Consider that biomass is the only form of energy labeled renewable that requires continuous input of fuel – biomass- and requires a smoke stack for the continuous output- air pollution!

[SLIDE 4] What is coming out of those smoke stacks?
The precise emissions from each of these biomass incinerators will vary somewhat depending on the nature of the fuel, the temperature of combustion and what sort of controls are or are or are not in place, but here are some of the typical common emissions:

Nitrogen oxides (NOx)
Sulfur dioxide (SO2)

Hazardous Air Pollutants (HAPS, 187 toxins known to cause cancer and disease, identified by EPA). Organic HAPS commonly emitted from biomass incinerators including styrene, acrolein, formaldehyde and acid gases hydrofluoric acid and hydrochloric acid. Also among the HAPS are heavy metals such as mercury and lead

Volatile Organic Compounds
Carbon Monoxide
Particulates: PM10, PM2.5, ultrafine and nanoparticulates
Dioxin

> Source: Permit applications reviewed by Partnership For Policy Integrity: http://www.pfpi.net/air-pollution-2

[SLIDE 5] I live not far from one such facility, and unfortunately have to breathe the consequences of a "renewable" energy policy that failed to consider carefully what "clean, green and renewable" really means. This is a picture of the McNeil biomass generating station in Burlington Vermont not far from my home, one of the oldest biomass incinerators in the country, operating since 1984. The picture shows a very large fuel pile which has caused problems due to leachate from the pile which contained toxins that leaked into adjacent land and entered drinking water wells. Back here are whole trees waiting to be chipped. This facility – at 50 MW, like others in this capacity range, can burn around a ton of wood in one minute!

McNeil is located in a "bowl" – 200 meters from residential area -with the top of stack level with homes on surrounding hillside- a low income neighborhood.

> Source: see Vermont Law School report on impacts of McNeil: http://www.greenfieldbiomass.info/uploads/Vermont_Law_McNeil_Station_Report_pdf.pdf

[SLIDES 6,7,8] Here is the list of emissions from the McNeil facility…

> Source: EPA date compiled by Planet Hazard www.planethazard.com/phmapenv.aspx?mode=topten&area=state&state=VT

We live a bit further away from McNeil, but my children also have to breathe McNeil's emissions. Meanwhile, other similar facilities are being proposed around the state. Believe it or not, Rutland Vermont has the highest adult asthma rate in the entire country and building more biomass incinerators will make it worse.

[SLIDE 9] This shows the existing and proposed biomass facilities throughout the northeastern US, including Vermont and surrounding states.
Like the McNeil facility, these all will contribute further to air pollution in the region. Imagine how much more air pollution will be added to the atmosphere from all of these new and existing biomass incinerators.

Source:
1) http://wilderness.org/files/Wood-Biomass-Energy-Facilities-in-Northeast-map.pdf

[SLIDE 10] A look at air permit applications shows that biomass incinerators are always more polluting than natural gas, and tend to be similar to coal – in some cases less sulphur and mercury, but more particulates and nitrogen oxides. For example, this slide compares the emissions from an old coal facility, Mt Tom, in Massachusetts, with a proposed biomass incinerator in Fairhaven, Vermont. **In 4 out of 7 major pollutants listed here, the biomass incinerator is more polluting than coal.**

Source:
1) Numbers from permit applications and EPA emissions data, analyzed and presented by Partnership For Policy Integrity: http://www.pfpi.net/air-pollution-2

[SLIDE 11] Even more alarming - This slide compares a 100 MW biomass incinerator – the GREC facility in Gainesville – to a 431 MW natural gas facility. In spite of the huge difference in capacity you can see that the emissions from the biomass incinerator are vastly greater! - far more pollution for ¼ the power.

Source:
1) Numbers from permit applications and EPA emissions data, analyzed and presented by Partnership For Policy Integrity: http://www.pfpi.net/air-pollution-2

[SLIDE 12] There are a lot of different kinds of "biomass" – most of these facilities burn wood, but there are also "biomass" incinerators that burn crop residues, poultry manure, construction and demolition debris, sewage sludge, municipal waste, even plastics and tires in some cases are considered biomass. Burning these different types of materials results in different types of emissions.

1) Source: review of federal legislative definitions of biomass:
https://opencrs.com/document/R40529/

[SLIDE 13] For example, some have argued that burning "wastes" of various sorts, is a "good use" and a way to cope with difficult disposal problems. Poultry manure is one example. The Fibrominn facility in Minnesota burns poultry manure and has been notoriously problematic – with numerous air permit violations. The facility is the state's largest source of arsenic, sulfuric acid and hydrochloric acid pollution. It is also a major source of dioxin.

Source:
1) Energy Justice Network 'Fibrowatch": http://www.energyjustice.net/fibrowatch/

[SLIDE 14] Construction and demolition debris is also worth a closer look, in part because quite a few biomass facilities have started out being permitted to burn wood chips, and then, when supplies of wood chips were hard to come by or are too expensive, they have switched to burning CDD. They can get plenty of CDD and even get paid to take it – because landfilling this material is costly. But for people living downwind, this means an even more toxic brew of pollutants, since CDD tends to be a messy conglomeration of chemically treated building materials and results in increased emissions of arsenic, chromium, copper, lead, mercury, dioxins, furans, and PCPs.

Sources:
1) Review of numerous examples of fuel switching in state of Maine compiled by IndyMedia (Hilary Lister) available on briefing website
2) Maine Legislative Report:
http://www.maine.gov/dep/waste/legislative/documents/legisreportcddfinal.pdf
3) On emissions from burning CDD: http://www.pfpi.net/wp-content/uploads/2011/03/DPH_Comments_PRE_BUD_NOV-18_2009.pdf
4) On Inadequacy of sorting to resolve pollution issues with CDD:
http://www.pfpi.net/wp-content/uploads/2011/03/MEEA-commnents-on-Palmer-BUD-11-18-09.pdf

[SLIDE 15] Current regulations are not sufficient to protect against harms to health.
Many biomass facilities are relatively small, in the range of 30-50 MW and do not qualify as "major sources" of pollution. Therefore they are not required to comply with emissions regulations that would apply to larger facilities. They are not required to use "state of the art" control technologies.

Even larger facilities and those with emissions above the thresholds for regulations, often find loopholes and ways to avoid regulation. There is a big incentive to do so, since installing equipment and doing what it takes to comply with regulations can be costly. Most often, developers prefer their facilities be considered an "area source" rather than a major source. If there is an issue with some pollutant being above threshold, developers can apply as a "synthetic minor", which means they can agree to limit their hours of operation or capacity in some way to keep just under the threshold. In many cases permit applications report numbers that are suspiciously JUST below the threshold for regulation. For instance, the Gainesville Renewable Energy Center, a 116 MW (gross; 100 MW net) biomass burner with a 1,359 mmbtu boiler, is considered to be an "area" source, because the project claims it will emit less than 25 tons of hazardous air pollutants (the exact value in the permit is 24.7 tons of HAPs). Examination of permit applications also reveals wrongful representations and/or misguided calculations re some emissions. Many air permit applications have been criticized and in some cases legally challenged.

For more details and examples of permit critiques:
1) http://www.bredl.org/pdf3/Wiregrass_Pollution_Report110113.pdf
2) http://www.pfpi.net/wp-content/uploads/2011/03/PFPI-BAP-permit-comment-letter-on-We-Energies-Domtar-biomass-facility.pdf
3) http://www.pfpi.net/wp-content/uploads/2011/03/DB-LTR-TO-ORCAA-013111.pdf
4) http://www.pfpi.net/wp-content/uploads/2012/09/PFPI-comments-on-draft-NSSEP-air-permit-Sept-10-2012.pdf

[SLIDE 16] Even where facilities are required to comply with regulations, those regulations are often flat out inadequate. Dr. Sammons will speak about emissions of particulates from biomass incinerators, which range in size from PM 10 to very very small "ultrafine" and "nanoparticulates".

Current regulations for PM specify controls for the larger particulates, PM10 and 2.5 But it is the much smaller particles – ultrafine and nanoparticulates that are most damaging to health because their small size allows them to bypass the bodies defenses and enter deep into the lungs. These very small particles are precisely the ones that cannot be controlled with current technologies- including cyclonic systems, ESPs and filter baghouses.

Cyclonic systems are not effective at removing the fine particulate matter although according to EPA , some high efficiency systems show removal of 60 to 95% for PM10 and 20 to 70% for PM2.5, Often the sole means of control at smaller facilities i.e. schools etc.

Electrostatic precipitators (ESPs) use an electric field to remove particles from the flue stream. They can remove up to 99% of fine particles (PM2.5) from the flue gas, although their efficacy in removing ultrafine particles is not known. ESPs are expensive and are not typically installed in building-scale biomass burners.

Fabric filters or baghouses are generally considered the most effective means of emissions control for filterable particulates. They can show control efficiencies upwards of 99%. They are installed at some mid-sized facilities and many utility-scale facilities.

The size distribution of the particulate matter that escapes control by a baghouse or ESP is shifted toward the smallest size fractions. Because some of these especially harmful very small particulates result from condensation happening outside of the smokestack, it is not even really possible to accurately assess, filter or otherwise control them with current approaches. Biomass incinerators emit massive amounts of particulates!

(Sources: See Dr. Sammons supporting materials)

Further, Dr Blackley will talk about the inadequacy of regulation of dioxin emissions where revised regulations have been languishing for over a decade. Spotty inadequate testing and monitoring results in gross underestimates of the actual emissions of this extremely dangerous toxin. Given that dioxins can form any time hydrocarbons are burned in the presence of chlorine, an expanding biomass industry threatens increased exposure to this extremely dangerous toxin which is already pervasive and causing untold damages to human health. EPA estimates that – while most sources of dioxin pollution, including residential wood burning, declined from 1987 through 2000 (the latest national inventory) – dioxin from industrial wood burning increased 56% in that time. [1] This industry-wide total emissions inventory found such an increase because the industry expanded quite a bit in those 13 years, with at least 70 new biomass burning incinerators going online in that time. At least 20 more have gone online since 2000, and dioxins from biomass will continue to rise as long as the industry is growing.[2]

[1] "An Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States for the Years 1987, 1995, and 2000," U.S. EPA, November 2006, Figure 1-5 and Table 1-17.
http://cfpub.epa.gov/ncea/CFM/recordisplay.cfm?deid=159286

[2] eGRID 2012 Database, U.S. Environmental Protection Agency, 2009 data released on 5/10/2012. http://www.epa.gov/cleanenergy/energy-resources/egrid/

[SLIDE 17] Finally, even where facilities are regulated, violations and malfunctions are very common even at new, state-of-the-art incinerators due to mechanical and operational problems. They have difficulty complying with their own permits. **The Wall Street Journal just recently reported 80% of biomass facilities have been cited for exceeding their permitted emissions.** This is a very high rate of problems. It also is clear indication that even with regulations, weak as they are, we are not protected against the health impacts of pollution from these facilities!

Source: Wood Fired Plants Generate Violations
http://online.wsj.com/article/SB10001424052702303740704577524822063133842.html

[SLIDE 18] I want to spend my last minutes telling you about some of the other kinds of pollution resulting from biomass incinerators that may be a surprise. What comes out of the smoke stacks of these incinerators is not the only source of health damaging pollution.

TRUCKING Because biomass – woodchips, chicken manure, etc – are bulky per unit of energy compared to oil or gas, it generally takes large volumes of biomass to supply these facilities. And biomass incinerators, by the way, often operate at very low efficiencies – only around 25%-30% efficiency rates. Recall that a 50 MW facility can burn about a ton of wood chips a minute. The transport of all those wood chips to the facility requires burning on order of 1,365,000 gallons of diesel fuel. Then large volumes of ash have to be hauled away – requiring even more diesel. We have not even considered the diesel fuel burned in the process of harvesting operations. Biomass incinerators result in massive amounts of diesel exhaust, more particulates, more traffic noise and wear and tear on roadways, dust etc. And people – children already suffering from asthma – living and playing in communities near incinerators are breathing in not only the emissions from the smoke stacks, but also the diesel exhaust from delivery trucks. Recent studies indicate that diesel particulates are retained in lungs more than was previously thought to be the case, where they contribute to a variety of diseases.

Sources: a very large body of research on health impacts of diesel exhaust, Examples include:
Why diesel particulates cause Cardiovascular disease:
http://www.sciencedaily.com/releases/2008/06/080604114550.htm
Diesel Fumes Pose Risk to Heart as Well as Lungs
http://www.sciencedaily.com/releases/2011/07/110713211942.htm
Diesel Exhaust Fumes Cause Cancer
http://www.medicalnewstoday.com/articles/246495.php

[SLIDE 19] FIRES AND EXPLOSIONS: Another problem is "accidents". A lot of them. There are a large number of explosions and fires associated with biomass incinerators - the result of a tendency for dust to cause explosions and also large fuel piles, which tend to heat up with decomposition and spontaneously burst into flames. This is a picture of the Tilbury B facility- in UK, which is a massive coal conversion- a 750 MW facility that is switching from coal to wood pellets, many imported from the US. The huge pile – 2100 ton of pellets caught fire and all of that smoldering mess went up in flames with no pollution controls or regulations applied whatsoever. This is not a rare occurrence either. A recent compilation based on web search resulted in 76 examples of explosions and fires at biomass facilities since 2008! ! Just in the past

few days you may have heard about another - at a biomass facility out in Oregon. Again, the fuel pile appears to have heated up and spontaneously burst into flames.

A recent compilation of fires and explosions at biomass facilities: http://www.pt-raps.co.uk/downloads/wood-dust-fires-since-2008.pdf
Oregon biomass facility fuel pile just a few days ago:
http://www.kobi5.com/component/zoo/item/biomass-one.html
Followed by a second fire a few days later:
http://www.mailtribune.com/apps/pbcs.dll/article?AID=/20120919/NEWS/209190325

[SLIDE 20] ASH is another problem – biomass incinerators produce huge quantities. A typical 50 megawatt biomass plant produces around 1.5 tons of bottom and fly ash per hour. Ash is where toxins are often concentrated including heavy metals and dioxin. Air pollution controls only effectively transfer toxins from the air to the ash. There are rising concerns about high levels of radioactive Cesium 137 – in wood ash –this is because trees act as sponges absorbing things like cesium from nuclear testing, and also mercury, largely legacy from coal burning, that has been spewed into the atmosphere and deposited on soils and waterways. When the trees are burned- the toxins they absorbed are re-distributed back out into the atmosphere. Current practice often is to use ash from these facilities as a soil amendment – spread on agriculture fields.

Attempts have been made to divert ash from landfill by incorporating it in road and cement block construction, with incinerator operators claiming that the ash consequently becomes inert. Research has shown that this is not the case, and heavy metals in particular are leach out and endanger local ecosystems and communities.

I want to mention a recent news item you may have heard about- recently out in Oroville California, a massive pile of ash was found sitting on a lot – and had been for some time – maybe 3 years – blowing around into adjacent lands etc. It was tested and found to be contaminated with heavy metals and dioxin. The pile came from a biomass incinerator operated by Covanta- the facility is one that had been burning wood, and then switched to burning CDD. The impact of this messy problem on surroundings remains to be determined and so far details are not publicly available.

Source:
Covanta Oroville facility ash dump:
http://www.newsreview.com/chico/ash-pile-raises-concerns/content?oid=4660345
Radioactive Cesium 137 in biomass ash:
http://www.sciencedirect.com/science/article/pii/004896979490491X
and see:
http://www.nobiomassburning.org/wp-content/uploads/2012/03/Cs_137-in-woodash-paper-Biofuels-Conference-1992.pdf

[SLIDE 21] WATER USE AND CONTAMINATION – Like all thermoelectric facilities, these require massive amounts of water,
Already, thermoelectric-power withdrawals account for 49 percent of total water use, 41 percent of total freshwater withdrawals for all categories, and 53 percent of fresh surface-water withdrawals. We should not be subsidizing as “renewable” technologies that deplete our already dwindling water resources. The Russell Biomass facility uses nearly a million gallons of water

per day for cooling! 85% will be evaporated and the remaining 15% will be heated, polluted, and dumped back into the river!

Sources: Thermoelectric power plant water use:
http://ga.water.usgs.gov/edu/wupt.html
http://www.nrel.gov/docs/fy04osti/33905.pdf

Specifically regarding biomass facility water impacts:
http://www.nobiomassburning.org/water-pollution/

[SLIDE 22] Consider that no pollution is coming from these solar panels when they produce electricity. Now consider how much pollution is released every day, every hour that a biomass incinerator burns wood, garbage, chicken manure, garbage, or construction debris.

What are the health impacts and costs of treating diseases caused by these solar panels? ZERO.

[SLIDE 23] To summarize, biomass incinerators spew a huge array of pollutants into the air, as well as the land and water. These pollutants are inhaled and ingested by people, and cause serious chronic and fatal diseases you will hear more about from the three doctors.

Yet because biomass has been categorized as "renewable" energy it is receiving federal and state subsidies along with solar and wind, creating the **false** impression that it is clean and green.

For all our sake – and especially for the sake of our children, we must make sure energy policies support truly clean, green and renewable technologies and avoid subsidies for dirty, polluting biomass combustion.

[SLIDE 24] Thank you