Partnership for Policy Integrity comments on the Barton Renewable Energy Facility

October 15, 2012

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My name is Mary S. Booth. I live in the Town of Pelham, in the State of Massachusetts, USA. I have a PhD in Ecology with specialization in biogeochemistry, and a Masters in Plant Biology. I am the Director of the Partnership for Policy Integrity (PFPI) a group that I co-founded. Much of my work at PFPI consists of reviewing air emissions permits for biomass plants that have been proposed in the United States. I am offering testimony on the Barton plant air permit to assist the Breathe Clean Air Group. I am not being compensated for my work. I am pleased to be of what assistance I can to this group because of the many biomass facility proposals that I have reviewed, the Barton plant strikes me as one of the most dangerous I have seen in terms of potential impacts to human health and general lack of oversight and rigor in permitting.

My testimony will largely focus on emissions of heavy metals emissions from this facility, which I believe will represent a very serious threat to the health of the surrounding community. I believe, and intend to demonstrate, that emissions of heavy metals and other pollutants have been underestimated, and that for some other pollutants, the emissions levels are inexcusably high, given the emissions controls that are available and could be used at the facility. I will also comment on the net greenhouse gas emissions impact by the facility. While I am dismayed by the inadequacy of the controls for NOx and the cavalier attitude of permitting authorities regarding adding to the NOx burden when health standards in the area are already exceeded, this topic is well covered by others, so I will only cover it briefly.

To support my arguments, I will draw on the work I have done in the United States, where I have been involved in regulatory processes around biomass power and where I have reviewed numerous air emissions permits for wood-burning plants, including plants that burn construction and demolition (C&D) wood. I am dismayed at the low quality of the analysis offered by the Barton developer, and accepted by the Environment Agency, and by the overall the lack of rigor in the permitting process..

The general theme that runs throughout my comments is that emissions – of greenhouse gases, of metals, and of other pollutants including NOx and VOCs – have consistently been underestimated or even actively misrepresented. This means that the Barton facility will present a greater threat to human health and the environment than the EA or the developer admits.

Wood and waste burning at the Barton plant: befits overstated, risks downplayed

Biomass and waste burning plant developers are very eager to make their facilities sound "clean" and "green". They are eligible for renewable energy subsidies and power purchase agreements worth millions of pounds, but they'll only reap these rewards if they can sell the public on the idea that all this new "clean" energy won't harm them. A prime example of such "greenwashing" is found on page 8 of Barton's non-technical summary document (emphasis added)
*"The proposals for Barton provide an **excellent opportunity** to deliver a **highly sustainable, clean** and **carbon neutral** energy plant within the heart of the Manchester City Region with minimal impact upon the surrounding environment. The proposed will be an **exemplar** project, leading the way in ensuring Trafford meets and goes **beyond its duty** to contribute to the growth in **renewable and carbon neutral** energy generation. It would also provide additional benefits such as job creation and a **safe**, secure energy supply."*

None of this is true. There there's nothing "clean" about this project compared to real, emissions-free renewable energy and you can be sure at least one wind power engineer at Peel Energy has spit out their coffee on reading this kind of description applied to biopower. The plant will emit as much

particulate matter and NOx as a coal plant, along with heavy metals. Greenhouse gas emissions per unit energy generated are higher than from gas or coal. The project isn't "exemplar" – it is an old technology, a moving grate stoker with the minimal emissions controls.

Emissions of greenhouse gases

CO2 emissions from the Barton plant will exceed those from a coal or gas plant
It is a fundamental physical fact that wood-burning facilities like the Barton plant emit far more CO2 per unit energy generated than coal or gas-fired facilities. This is both because biomass facilities operate at relatively low efficiencies, and also because the energy inherent in biomass fuels per unit carbon is lower than the energy inherent in fossil fuels (the contrast with gas is the greatest).

The units in the table below – pounds of pollutant per million British thermal units of heat input – are how pollutant emissions are typically expressed in the United States. The units are irrelevant to the bottom line, however, which is that per megawatt-hour of electricity produced, a typical biomass-burning facility emits 1.4 to 3.4 times as much carbon dioxide as a fossil fuel burning facility.

	lb CO2 emitted per mmbtu heat input	facility efficiency	mmbtu heat input required per MWh	lb CO2 emitted per MWh
Biomass steam turbine	213	0.24	14.22	3,029
Coal steam turbine	205.6	0.34	10.15	2,086
Gas steam turbine	117.1	0.33	10.40	1,218
Gas combined cycle	117.1	0.45	7.54	883

The applicant's assessment of greenhouse gas emissions is fundamentally flawed
The greenhouse gas (GHG) assessment from Peel Energy is rife with assumptions. It first argues that emissions from power generation displaced by the Barton plant should be taken into consideration and treated as a "reduction" in emissions. However, what if the power that is being displaced is wind power? Since biopower competes for the same subsidies as wind, it seems more likely that meeting renewables goals by building combustion-based technologies will displace truly clean solutions. In fact, claiming that there will be "reductions" in power generation at other carbon emitting facilities is just an unsupported assumption. Unless the applicant is personally promising to take another emitting facility offline once the Barton plant is built, these claims are unenforceable, unverifiable, and therefore worth nothing.

I do however, agree with the applicant's statement on GHG emissions is that avoided emissions from landfilling material are negligible, and therefore have not been considered as a "reduction":
"It is likely that if the fuel were not combusted, it would be disposed of in a landfill where a proportion of the fuel would biodegrade into carbon dioxide and methane. Methane released into the atmosphere contributes to global warming, therefore the methane emissions from landfill that are avoided are relevant to this greenhouse gas assessment. However, wood is not considered to be readily putrescible, so the rate at which it degrades will be relatively low and the amount of carbon that is sequestered in the landfill will be relatively high. The avoided methane emission from landfill is therefore considered to be relatively low, so the contribution to global warming has not been considered further. This makes the overall

assessment conservative because it does not take account of the small avoided emission of methane."

The above conclusion is congruent with the analyses I have seen from the US Environmental Protection Agency and with my own review of the literature on methane and CO2 emissions from landfilled wood.

However, the GHG chapter goes on to argue that emissions of biogenic carbon don't count (while never acknowledging that such emissions are higher per unit energy generated than from fossil fuels):
"The Barton Renewable Energy Plant will release carbon dioxide from the combustion of carbon. However, a proportion of the fuel will be derived from biodegradable materials. Carbon dioxide released from the combustion of biomass is not considered to contribute to global warming, since this carbon has been recently extracted from the atmosphere via photosynthesis. Therefore, it is only necessary to consider carbon dioxide released from the combustion of carbon derived from fossil fuels."

Likewise, the draft permit (at p. 82) states,
"CO2 released from the combustion of biomass is not considered to contribute as much to global warming, since this carbon has been recently extracted from the atmosphere via photosynthesis"

The fact that the carbon was "recently sequestered" has no bearing on the fact that burning this material releases carbon dioxide to the air. Time's arrow points forward. We are interested in the net effect of the facility on atmospheric CO2 loading in the *future* – we are not interested in what role those fuels may have played in sequestering carbon in the past. For example, imagine the following: you are locked in a closed dome with a fixed air supply where the CO2 balance is kept habitable by growing trees. Now, you cut those trees, and burn them. Does it matter to you that the CO2 released by burning those trees was "recently sequestered"? Of course it doesn't. Likewise, the earth is a closed dome – and how we treat the biogenic carbon on it matters. By the applicants reasoning, it would be possible to cut and burn every tree on the planet, and see no effect on atmospheric CO2 loading, because that carbon was "recently" sequestered. Yes, biogenic fuel sources do grow back - but growing new trees to sequester an equivalent amount of carbon as released by burning wood takes decades, time that we don't have in the race to reduce greenhouse gas emissions. This isn't to say wood should never be burned. There may be good reasons to burn wood. But it should never be claimed that burning wood is meaningful to reducing atmospheric CO2 concentrations in the short-to-medium timeframes over which it is most urgent that we reduce emissions.

The applicant has made other unsupported statements in the GHG analysis. For instance, they estimate fuel use by assuming the plant will operate for 8,000 hours. There is no such enforceable limit in the permit.

Burning even "waste" wood emits a great deal of carbon compared to its alternate fate. While admitting that landfilling such wood essentially represents net carbon *sequestration* and there is no carbon "benefit" to burning it, the applicant still goes on to make the specious argument that emissions of biogenic carbon should not be counted. They have performed no analysis to back up their statement. In other words, their statements that the facility's greenhouse gas emissions shouldn't count are completely faith-based.

The Barton facility will add over 215,000 tons of CO2 to the atmosphere each year
I made a rough estimate of the plant's CO2 emissions, as follows. Based on multiple reviews of biomass plant applications in the United States, I assume that the facility's efficiency will be around 26% (this is quite generous. This is a small facility that will not realize the economies of scale. Much larger facilities in the US have stated efficiencies of 24%). I assume that the fuel will on average have a moisture content of 30%, based on the fact that it is a mixture of waste wood, virgin (green) wood, and municipal and other waste (the applicant claims 20%; this is not backed up with any data and seems extremely unlikely given the sources of fuel). I assume that the fuel used at the Barton plant has a higher heating value of 5,950 btu per pound, or 13,117 btu/kg. I assume that the facility will not operate for two weeks each year due to routine maintenance. Multiplying through, wood use under this calculation would be 168,313 tonnes per year, and CO2 emissions would be 216,001 tonnes per year. This is CO2 that is being emitted that would not otherwise be emitted. In contrast, the applicant has claimed (page. 2) of the GHG assessment: *"there is a net **decrease** in carbon dioxide emissions of 77,370 tonnes per annum."*

Another unsupported statement in the GHG chapter concerns emissions from trucks:
"It is likely that the total vehicle miles associated with delivering the waste wood fuel to the BREP will be similar to the current vehicle miles associated with its disposal in landfill. The CO2 emissions from waste wood fuel delivery vehicles are therefore likely to be similar to the current emissions from delivery to landfill and so represent a near carbon neutral change. In any case, any small amount of carbon dioxide emissions from fuel delivery vehicles is significantly outweighed by the overall carbon dioxide emissions reduction provided by the development as a whole"

Again, there has been absolutely no analysis of this statement. No modeling. And apparently, no critical evaluation by the Environment Agency. In fact, the dense concentration of diesel-fueled trucks that converge on a facility like this are a concentrated source not only of greenhouse gases, but also NOx and diesel particulate matter, which is acknowledged by the US EPA as extremely deadly. When the EA lets the applicant get away with an unsubstantiated statement like this, it's very convenient for the applicant, because now those other emissions of pollutants can also be ignored, as well.

One last unsupportable statement on GHG emissions, from the non-technical summary, p. 8:
"Under the 'do-nothing' scenario, the application site would likely remain undeveloped with feasible land-uses being limited. If the 'do-nothing' scenario was adopted, the site's potential to contribute towards the promotion of renewable energy and hence reduction in CO2 and greenhouse gas emissions would not be realized."

Given that building the plant will transform this site from open land to a combustion facility that moves thousands of tons of terrestrial carbon into the atmosphere per hour, this statement is positively Orwellian.

Emissions of heavy metals

Background on burning of treated wood in the United States
The Barton plant will burn a variety of wastes, but primarily treated wood. Burning of chemically treated wood produces a great deal of very toxic emissions. Wood that has been "pressure-treated" with the preservative copper chromium arsenate (CCA) is especially toxic, but painted and glued wood also emits a host of dangerous chemicals when burned (including lead, from lead paint;

dioxins; mercury, which is frequently found in construction waste; asbestos fibers, which get mixed in with wood during processing; various other heavy metals, including cadmium; and volatile organic compounds like the carcinogen formaldehyde, which is found in composite and glued wood products). The US EPA treats construction and demolition (C&D) waste wood material as waste, not biomass fuel, and as such, facilities burning treated wood are held to more stringent emissions requirements than those burning "clean" wood. Ash from burning wood including as little as 5% CCA-treated wood can be classified in the US as a hazardous waste and disposed of in special landfills.[1]

I live in the state of Massachusetts. About five years ago, a facility was proposed here that would burn "clean" construction and demolition wood (C&D), which had been sorted to remove contaminated material before it was chipped for fuel. Prior to construction, the air permitting agency required the facility to fund a study to analyze samples of wood chip fuel derived from the sorted material. The study examined the content of heavy metals and other hazardous substances. The results of the study were clear. Even when wood waste had been sorted to remove nearly all treated wood, an analysis of its likely combustion emissions still showed that emissions of arsenic, chromium, and cadmium, as well as dioxins, would be quite high.

The Massachusetts Department of Environmental Health was extremely concerned by these data, pointing out that children in the region already had blood lead levels higher than average, and that asthma rates were higher than average. In response, the state commissioned a health impacts study to examine the effects of burning treated wood. Because the facility developer ultimately decided to change the proposal to a plant that would burn only virgin (forest) wood, the health impacts study was not ultimately carried out. However, the state of Massachusetts did just put out new rules that remove renewable energy subsidies from large-scale, low-efficiency biomass facilities, and these rules explicitly state that **no** construction and demolition-derived waste can be burned even at the smaller, high-efficiency facilities that are still eligible for subsidies.

Emissions of heavy metals depend on their concentration in fuel

Other than mercury, most metals are emitted in particulate form. As stated at p. 29 of the Peel Energy "supporting information" document,

"The injection of activated carbon into the flue gas upstream of the fabric filter is a reliable and well-proven method for reducing mercury concentrations by 90% or more. For other metals, efficient particulate abatement will minimise metal releases"

This means that emissions of heavy metals emissions actually depend on two factors:

- the concentration of the metals in the wood being burned,
- and the efficacy of the emissions controls for controlling particulate matter.

The applicant acknowledges the role of fuel metals content, stating at p. 32 of the air quality assessment,

"While the facility will emit heavy metals, the quantity will be dependant of the mixture of wood, the source of the wood and any treatments that have been made to the wood"

A well-operated fabric filter emissions system is capable of reducing the mass of PM by more than 99.5%, though it is important to note that no system is especially effective in reducing emissions of

[1] Solo-Gabriele, H. 2003. Disposal strategies for CCA-treated wood. Presentation ot the National RCRA Conference, Washington, Dc. August 13.

the ultrafine portion of PM, which is heavily represented in wood combustion emissions. Assuming for the time being that the fabric filter is operated consistently well (and this is often not the case, as many who live near a biomass burner can attest), this means that it is the concentration of metals in the fuel stream that will determine emissions. While the applicant acknowledges elsewhere that the mixture of wood burned at the plant will be extremely variable, they do not acknowledge in the chapter on Abnormal Emissions that such variability will affect emissions of heavy metals. This is a critical omission.

Metals emission factors are based on supposition, not data
The applicant could easily test the kinds of waste wood they are planning to burn for fuel, and determine what the content of heavy metals actually is. From there, estimating a conservative emission factor would consist of estimating what the content of metals will be in ash, once the carbon is burned away, then assuming that this concentration is representative of the particulate matter emitted by the plant. If the efficacy of the fabric filter is known, and I assume it is, then the applicant can estimate how much PM, and metals in PM, will be emitted by the plant.

Instead of taking an analytical approach to estimating metals, however, the applicant has simply taken the Waste Incineration Directive mandate that emissions of metals total not more than 0.5 mg/m3, and divided this number by nine metals of concern, estimating the emissions of each therefore as 0.055 mg/m3 (p. 34 of the air quality assessment contains this table). Again, no analysis is done, no modeling or testing is conducted – the applicant simply assumes that if the permit limit exists, it will be met.

In fact, the EA knows this is unrealistic. That is why buried down at the bottom of the permit (Condition IC6 on page 108), the EA has included the provision that after 15 months of operation, *"The Operator shall carry out an assessment of the impact of emissions to air of As, Cd, Cr(VI) and Ni. The assessment shall predict the impact of each metal against the relevant EQS/EAL through the use of emissions monitoring data during the first year of operation and air dispersion modelling. A report on the assessment shall be made to the Environment Agency."*

In fact, neither the applicant nor the EA appear to have any real idea of what heavy metals emissions will actually be.

Periodic monitoring of metals means emissions limits are unenforceable
The Barton plant will have continuous emissions monitors for some pollutants, but <u>not</u> for heavy metals like lead, arsenic, chromium, and cadmium, all of which are frequently found at relatively high concentrations in the construction and demolition waste that will be the plant's primary fuel. To monitor metals emissions, the applicant is subjected to periodic stack testing. Such stack tests can be logistically challenging to set up and require cooperation between the plant operator and the testing agency, thus they are always conducted with a great deal of advance notice. To ensure that the outcome of such tests do not produce any alarming results, the operator can easily switch to using "cleaner", uncontaminated wood around the time the test is conducted. In short, the testing provisions in this permit do almost nothing to assure that real emissions of metals will be known and to protect citizens against metals emissions during routine operation of the facility.

Arsenic emissions are likely underestimated
Arsenic is an example of a heavy metal where the guesswork on emissions by the applicant is especially notable. The modeling assumes an emissions rate of 0.055 mg/m3 for arsenic, or one ninth of the total limit for nine metals that is set at 0.5 mg/m3. However, the EA knows admits this emissions estimate is likely flawed. At p. 111, the draft permit states,
"It is reasonable to expect that arsenic may account for a higher proportion of metals emissions than that assumed in the air quality study because the proposed facility is likely to burn wood treated with arsenic. An emission limit for arsenic should be specified in any permit."

Controlling arsenic emissions may be very difficult, however. Even assuming the fabric filter works perfectly and contains particulate matter to the specified limit, the arsenic content of PM derived from burning contaminated wood can still exceed its permit limit.

As it is, the arsenic emissions postulated in the Barton application result in a modeled concentration in the air near the ground that is 68.66% of the UK health standard. It's surprising that EA would encourage development of a single facility that erodes air quality this much, particularly since they have admitted that actual emissions may be higher than estimated. For the information of the reader, it should be noted that while the health standard for arsenic in the UK is 1.25 ng/m3, the health standard adopted here in Massachusetts for annual exposure to arsenic is 0.2 ng/m3, and the 24-hr standard is 0.5 ng/m3. In other words, the UK standard is 6.25 times higher (less protective) than the standard here in Massachusetts.

Emissions of hexavalent chromium (CrVI) have been underestimated
Hexavalent chromium (CrVI) is the most deadly form of chromium. To estimate emissions, the applicant has guessed that only a small portion – 0.7% - of total chromium will be in the hexavalent form (page 33 of the air quality assessment document). This conclusion is not supportable in light of existing data. The US Environmental Protection Agency's database of chromium speciation provides factors for the percent of total chromium that should be considered to be emitted in the hexavalent form by different processes. The factor for utility boilers burning wood or waste is 56%. Work from a Florida research group that focuses on the fate of CCA-treated wood has also characterized hexavalent chromium. One study[2] concludes,
"*Results show that for both new and weathered CCA-treated wood, Cr(VI) occurred in the range of 0.7–4% of the total Cr*" (see table).

[2] Song, J., et al. 2006. Implication of chromium speciation on disposal of discarded CCA-treated wood. Journal of Hazardous Materials, B128 280-288.

Table 1
Sample details and retention values for CCA-treated wood samples

Sample category	Sample ID	Rated retention (kg/m^3)	Average Cr concentration (mg/kg)	Average Cr(VI) concentration (mg/kg)	Cr(VI) (%)	Remarks
New wood	UN	–	1.2	<0.8	–	Untreated SYP[a]
	A	4	2850 ± 18	90 ± 26	3.2	
	B	6.4	5440 ± 200	36 ± 5	0.7	
	C	6.4	2820 ± 43	43 ± 3	1.5	
	D	6.4	1310 ± 2	22 ± 7	1.7	
	E	6.4	2720 ± 70	45 ± 4	1.7	
	F	6.4	2860 ± 33	55 ± 3	1.9	
	G	6.4	3150 ± 72	45 ± 8	1.4	
	H	4.0	1800 ± 131	71.3 ± 15	4.0	
	I	9.6	6350 ± 920	113 ± 26	1.8	
	J	40.0	15800 ± 230	248 ± 52	1.6	
	pH-N	6.4	1470 ± 46	29.4 ± 14	2.0	Used for pH impact
Weathered wood	Pole	9.6	5340 ± 122	42.4 ± 10	0.8	
	C&D A	–	278 ± 100	6.9 ± 1.2	2.5	
	C&D B	–	421 ± 20	29.7 ± 4.3	7.1	
	pH-W	–	2550 ± 55	16.8 ± 6.7	0.7	Used for pH impact

[a] SYP: Southern yellow pine.

Further, an ash study from that group[3] found extensive conversion of trivalent chromium to the hexavalent form during combustion. From this, it should be concluded that the applicant's estimate that only 0.7% of chromium occurs in the CrVI form is likely not supportable.

Metals contamination levels in ash are significantly underestimated

The underrepresentation of metals content of wood extends also to the underrepresentation of metals content in wood ash. Values presented by the applicant appear to be too low by several orders of magnitude. Page 38 of the "supporting information" document contains the following table, which estimates that heavy metals content of wood ash (mg/kg) is mostly in the single digits:

[3] Solo-Gabriele, et al. 2002. Characteristics of chromated copper arsenate-treated wood ash. Journal of Hazardous Materials, B89 213-232.

The table below shows the typical trace components found in bottom ash.

Table 2.12 - Typical Composition of Bottom Ash

Component	Unit	Average
Total Organic Carbon	%	0.1
Total cadmium	mg/kg	0.4
Total mercury	mg/kg	0.5
Total chromium	mg/kg	9.7
Total copper	mg/kg	32
Total lead	mg/kg	3.4
Total nickel	mg/kg	9.4
Thallium	mg/kg	1.0
Managanese	mg/kg	6824
Arsenic	mg/kg	1.0
Antimony	mg/kg	1.0
Cobalt	mg/kg	4.2
Vanadium	mg/kg	40
Zinc	mg/kg	22
Tin	mg/kg	1.0
Dioxin/Furan (ITEQ)	ng/kg	3.7

However, these numbers don't look like contamination levels of ash, even from untreated wood. Instead, they look like the levels of metals that are found in unburned wood. For instance, a sample of unburned "park waste wood" has contamination levels that are similar to those claimed for ash (this is sample #925 in the European "PHLLLIS" database , which contains data on the composition of hundreds of samples of biomass fuels – available at http://www.ecn.nl/phyllis/).

Elemental analysis (mg/kg sample (dry))

Al	141	Msr	**Fe**	200	Msr	**Pb**	-	ND
As	1.6	Lim	**Hg**	-	ND	**Sb**	-	ND
B	4.7	Msr	**K**	1500	Msr	**Se**	-	ND
Ba	-	ND	**Mg**	260	Msr	**Si**	380	Msr
Ca	1300	Msr	**Mn**	16	Msr	**Sn**	-	ND
Cd	-	ND	**Mo**	-	ND	**Sr**	-	ND
Co	0.6	Lim	**Na**	120	Msr	**Te**	-	ND
Cr	14	Msr	**Ni**	30	Msr	**Ti**	5.1	Msr
Cu	160	Msr	**P**	190	Msr	**V**	0.3	Msr
						Zn	22	Msr

While the wood sample shows arsenic concentrations in unburned wood to be 1.6 mg/kg, incredibly, the value for the ash sample offered by the applicant is only 1 mg/kg/ The applicant is thus claiming that even after nearly all the carbon is burned off, and what is left is the unburnable ash fraction in which metals would ordinarily be concentrated, arsenic concentrations are still lower than in unburned wood. This is simply not credible.

Data from the Florida research group that focuses on characterizing contamination levels in treated wood and figuring out safe remediation and disposal shows how far off the Barton plant's ash numbers are. An analysis of ash [4] from wood treated with different concentrations of the copper-chromium-arsenate wood preservative concludes (emphasis added)
"Results from neutron activation analysis (Table 2) indicate that metal concentrations of the untreated wood ash samples were on the order of a 100 mg/kg for each metal. Metal ***concentrations for the ash prepared from C&D wood were on the order of 1000–4000 mg/kg for each metal****. For the 4, 9.6 kg/m3, and weathered wood samples,* ***Cr, Cu, and As concentrations were on the order of tens of thousands of mg/kg,*** *whereas for the 40 kg/m3 wood ash sample,* ***concentrations were on the order of hundreds of thousands of mg/kg****. For the 40 kg/m3 sample, data show that the metals, Cr, Cu, and As, account for 36% of the ash by weight. The measured values of the unburned wood samples were between 30 and 50% higher than their rated value. The measured values of the untreated, 4, 9.6, 40 kg/m3, and weathered wood samples were < 0.3, 4.8, 13.1, 48.7, and 12.7 kg/m3, respectively, with a standard deviation less than 6% of the measured values"*

Table 2
Total metals concentrations of ash samples

Sample description	Average metals concentration from neutron activation analysis (mg/kg)		
	Cr	Cu	As
Untreated wood ash	106 (22)[a]	330 (192)	31 (7)
Ash from wood treated at 4 kg/m^3	21300 (7700)	10520 (3800)	11080 (3100)
Ash from wood treated at 9.6 kg/m^3	49150 (19100)	32950 (11900)	37950 (20500)
Ash from wood treated at 40 kg/m^3	165000 (3000)	98450 (4500)	99300 (5700)
Ash from weathered wood	52250 (13000)	39250 (15600)	30550 (12100)
Ash from recycled wood waste, C&D 1	1100	1400	730
Ash from recycled wood waste, C&D 2	1860	2090	1310
Ash from recycled wood waste, C&D 3	3530	1900	2250
Ash from laboratory mixture of untreated wood (95%) and CCA-treated wood at 4 kg/m^3 (5%)	–	–	–

[a] Standard deviation of the analysis between the University of Florida and Massachusetts Institute of Technology reactor given in parenthesis.

In sum, this lab, which specializes in analyzing preserved wood and wood ash, concludes that concentrations of heavy metals are thousands to hundreds of thousands of times higher than the levels claimed by Peel Energy for the Barton plant.

Disposal of ash as a source of environmental contamination
Fugitive dust from ash handling operations at a biomass plant can be a significant nuisance. If the ash is actually a hazardous waste, the problem goes from an annoyance to a health hazard. The applicant

[4] Solo-Gabriele, et al. 2002. Characteristics of chromated copper arsenate-treated wood ash. Journal of Hazardous Materials, B89 213-232.

does admit that some wastes from the plant will be considered hazardous. For instance, p. 37 of the supporting technical information document states,
"As can be seen in the process flow diagram in Annex 1, boiler ash will be mixed with bottom ash. It is acknowledged that this is a common practice in waste incineration plants in the UK. The mixture of boiler ash and bottom ash is a non-hazardous waste which can be recycled. If the boiler ash were to be mixed with the APC residues, the mixture would be defined as hazardous waste and this would restrict the ability of the operator to recycle the boiler ash.Peel are investigating options for the recovery of the bottom ash at any facilities in the local area. At the time of submitting this application, there have not been any facilities identified for recovery of the bottom ash, so bottom ash will be transferred for disposal."

However, table 2.13 on page 39 states that bottom ash and boiler ash are "*relatively inert, classified as non-hazardous*". Thus, while the applicant admits that in some cases, materials from the facility will need to be landfilled as a hazardous waste due to contamination. Yet strangely, the applicant claims that some kinds of ash can be used as "aggregate" or in other ways. It strains credulity that the ash and residues from different parts of the combustion process would have dramatically different composition, given that the plant will be burning contaminated materials.

Is the Davyhulme area being treated as a sacrifice zone?
With regard to the area where the plant is to be built, the EA notes in the draft permit that it already experiences significant environmental contamination:
"There have been a number of potentially contaminative activities in the immediate vicinity of the site which have included a sewage works comprising storm water filter beds, bacteria beds and grit drying beds. It is regarded that areas of the site may have been subject to the tipping of waste products or residues from the adjacent sewage works. In addition, a variety of processes have operated on the sewage works site which are likely to have involved excavation, burial of past processes and deposition of surplus materials. A previous ground investigation undertaken to the south of the site by United Utilities indicated that there were elevated levels of lead, total cyanide, benzene, polyaromatic hydrocarbons (PAH) and total petroleum hydrocarbons (TPH) compounds in the made ground."

Burning C&D wood that contains lead paint could significantly add to lead exposure in the area. Given that heavy metals, including lead, are already elevated in the area, has anyone bothered to check what the levels of lead in childrens' blood are, before permitting another facility that will be a significant source of heavy metals? One can do a simple internet search and find a wealth of articles on childhood lead poisoning, such as this one[5], which points out that "*recent research has indicated that significant neurologic damage to children occurs even at very low levels of exposure*" The abstract's numbers speak for themselves:
"Objectives: This research updates estimates of elevated blood lead levels among a cohort of children ≤ 6 years of age and compiles recent research to determine a range of the costs of lead paint hazard control ($1–$11 billion) and the benefits of reduction attributed to each cohort for health care ($11–$53 billion), lifetime earnings ($165–$233 billion), tax revenue ($25–$35 billion), special education ($30–$146 million), attention deficit–hyperactivity disorder ($267 million), and the direct costs of crime ($1.7 billion).

[5] Gould, Elise. 2009. Childhood Lead Poisoning: Conservative Estimates of the Social and Economic Benefits of Lead Hazard Control. Environ Health Perspect. 2009 July;117(7): 1162–1167. Available at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2717145/

Results: Each dollar invested in lead paint hazard control results in a return of $17–$221 or a net savings of $181–269 billion.
Conclusions: There are substantial returns to investing in lead hazard control, particularly targeted at early intervention in communities most likely at risk. Given the high societal costs of inaction, lead hazard control appears to be well worth the price."

Promoting incineration that mobilizes lead and other metals, diffusing them into the atmosphere and depositing them in an already burdened environment, is bad public policy. People and the environment should be protected from new sources of pollution.

Emissions of other pollutants

Emissions of PAHs will be higher than represented
Polycyclic aromatic hydrocarbons (PAHs) are a class of chemicals emitted by combustion of wood and other materials. They are considered to be carcinogenic, mutagenic, and teratogenic (causing birth defects). Wood combustion is noted as an especially potent source of PAHs. Referring to emissions of the PAH benzo(a)pyrene, the draft permit (p. 31) states that modeling for emissions impacts assumed a concentration of 0.002 mg/m3. The applicant must not have liked how the results came out, because the EA states that they "*subsequently used actual data*" - a value of 0.00011 mg/m3, only 5.5% of the modeled concentration. However, "*The Applicant confirmed that the WID data used was from municipal waste plants as there was no data available for wood burning plants*"

I was curious what emissions of this very toxic chemical were from wood-burning, so I checked the US EPA's database of emissions from wood-burning boilers and found a range of reported emissions of benzo(a)pyrene up to 22 ug/m3, which is 200 times higher than the level assumed by the applicant and 11 times greater than used in the air quality assessment. Again, by choosing arbitrary emissions factors for air pollutants, the applicant is dramatically under-representing potential emissions.

Emissions of volatile organic compounds will be higher than represented
Volatile organic compounds are a class of organic pollutants that contains many air toxics identified by the US Environmental Protection Agency as threats to health. Several of those emitted by biomass facilities, such as benzene and formaldehyde, are carcinogens. Apparently, even though a number of VOCs are considered extremely harmful to health, only two have been considered in the permitting of the Barton plant. The air quality assessment admits (at p. 31) that "*In reality, only a small fraction of the VOCs released from the plant will be benzene and 1,3-butadiene*." Rather than acknowledging the air quality and health threat that the full suite of VOCs represents, however, the applicant goes on to state, "*Therefore, the contribution of the plant to the benzene and 1,3-butadiene levels in the atmosphere can be considered insignificant*." This statement is emblematic of the kind of reasoning employed by the applicant that consistently downplays threats to health.

"Best available technology" is not really the best

NOx emissions could be reduced considerably
While others have offered strong testimony on the NOx issue, there are a couple things to add. The applicant has rejected two opportunities to reduce NOx emissions. First, by rejecting fluidized bed

technology in favor of a moving grate stoker boiler, the applicant has rejected the opportunity to reduce the NOx inherently emitted by the combustion process. Table 5.1 in the BAT document states that NOx emissions from the moving grate are 320 – 380 mg/m3, while those from a fluidized bed are 250 – 300. This is a large inherent difference of over 20%. Further, the applicant admits that ammonia consumption for the fluidized bed is only about one-half that for the moving grate boiler. Ammonia leakage from this injection process is one of the major sources of air pollution from this plant, which adds to particulate loading in the air, therefore, every opportunity should be taken to reduce its use. The applicant rejects yet another opportunity to reduce both NOx emissions and ammonia emissions by choosing SNCR instead of the far more effective SCR for NOx reduction.

Carbon monoxide and volatile organic compounds could be reduced
The application shows that the only "control" for CO and VOCs considered was "good combustion control". There was no consideration of an oxidation catalyst, which is being required on many plants in the in the United States as BAT. Such a system oxidizes not only CO but also toxic VOCs like benzene and formaldehyde. To not even mention it in the BAT discussion shows how unserious the consideration of BAT was.

Metals could be reduced by burning cleaner fuels
The chief way to reduce emissions of metals from the facility is to ensure that fuels don't contain them. Yet the permit's discussion of BAT for metals in contains no discussion of fuel contamination and how it can be controlled. This is another demonstration of just how unsubstantive this BAT discussion really is.

Fuels are not adequately characterized
Chapter 3 of the application, which describes the site, surroundings, and proposed development, also contains a description of the fuels to be burned:
"Virgin wood material – up to 30% - this will consist of chipped virgin timber, wood pellets, short rotation coppice and energy crops such as myscanthus;
- *Reclaimed waste wood – between 65% and-75% – this will consist of waste wood sourced from various sources including water transfer stations, wood processing facilities/plants and other sources that would otherwise be predominantly sent to landfill;*
- *Up to 5% Solid Recovered Fuel which has been produced to a recognised standard"*

Such descriptions are also found scattered throughout the application and seemed designed to convince the public that the Barton plant will be nothing more than a simple wood-burner. However, the list of fuels actually permitted at the facility is much broader. The list of wastes permitted to be burned at the Barton facility, from schedule 2 of the draft permit, includes

- Plants, wood
- Particle board and veneer "not containing dangerous substances"
- (so "dangerous substances" do exist… but the facility has no fuel testing, no enforceable standards. Therefore this prohibition is meaningless).
- Construction and demolition wood, a subcategory of the C&D category that includes "excavated soil from contaminated sites"
- As part of the category "Wastes from waste management facilities, off-stite waste water treatment plants and the preparation of water intended for human consumption and water for industrial use" containing the subcategory "wastes from physico/chemical treatments of

waste (includingdechromatation, decyanidation, neutralisation), is the permitted fuel category of "combustible wastes not containing dangerous substances (solid recovered fuel
- produced to standard BSEN 15359:2011)"
- again, "wood not containing dangerous substances"
- "combustible waste" – SRF

This is contains some very nasty materials indeed, combustion of which will produce emissions that are unlikely to be fully controlled by the very average emissions controls at the facility.

There are no real controls on what the Barton facility will burn
The "supporting information" document, p. 15, states that "unacceptable" fuels will not be burned at the facility:
"Any unacceptable waste will be rejected and stored in a designated area in the tipping hall. The Environmental Management System (EMS) will include procedures to control the inspection, storage and onward disposal of unacceptable waste. Certain wastes will require specific action for safe storage and handling."

These provisions have little meaning in reality. The permit says little about controlling what wastes are burned, and "unacceptable" wastes are not defined. Given that the facility is permitted to burn a large range of wastes, and will burn solid refuse, who will be sorting through the refuse to ensure that "unacceptable" fuels will not be burned? This provision is not enforceable.

Assurances that wastes will be "safe" are meaningless
Despite the long list of contaminated materials approved as fuel for the Barton plant, the language of the draft permit is sanguine. At p. 21, EA assures that
"We are satisfied that the Applicant can accept the wastes contained in Table S2.2 of the Permit because:
(i) the wastes are all categorised as non-hazardous in the European Waste Catalogue and are capable of being safely burnt at the Installation.
(i) these wastes are likely to be in the design calorific value (CV) range for the plant;
(ii) these wastes are unlikely to contain harmful components that cannot be safely processed at the Installation"

Here, EA appears to be stating that that because someone else has stated that wastes are not harmful, that's sufficient. The EA doesn't appear to feel any need to actually test fuels to assure that air quality standards are not violated and peoples' health is protected – the word of European bureaucrats is enough.

Routine facility operation as planned will not safeguard air quality and human health

Permitted rates for short term emissions will cause air pollution to spike
There is a dramatic difference between the daily permitted average emissions rates in the permit, and the short-term rates. For instance, while daily average rates of PM are 10 mg/m3, the half-hour average is 300% greater, at 30 mg/m3 (since heavy metals are associated with PM emissions, allowing such increases adds to the uncertainty of what actual heavy metals emissions rates at this plant will be). Hydrochloric acid rates jump 600% , from 10 to 60 mg/m3. Sulfur dioxide rates

quadruple, from 50 to 200 mg/m3, and NOx rates increase by 320%, from 125 to 400 mg/m3. Short-term localized pollution events are well known in the medical community to be associated with dramatic increases in mortality and morbidity, including asthma attacks and heart attacks. Permitting a plant that controls its pollution this poorly in a densely populated area is bad public policy.

Start-up and shutdown emissions will cause air pollution to spike
The supporting technical information document states, page 22:
"The emission limit values under the Waste Incineration Directive do not apply during start-up and shutdown when the plant is incinerating waste materials. Therefore, a signal would be sent from the main plant control system to the CEMS package to indicate when the plant is operational and burning waste. The averages would only be calculated when this signal was sent, but raw monitoring data would be retained for inspection."

Start-up and shutdown events at biomass plants are notorious for causing pollution events that can blanket an area with noxious emissions. Exempting the facility from emissions limits during these periods will cause harm to air quality and human health.

Thank you for the opportunity to comment.

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