

July 5, 2016

VIA ELECTRONIC MAIL

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Mr. Patrick Bird  
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**Re: Technical Comments and Critical Analysis of Errors, Omissions and Inconsistencies Found in Relation to the Draft Air and Solid Waste Licenses Issued by the Maine DEP and the Fiberight Projects' Air Permit Application/Supplement Information for Same (Main Subtitle: The Planned Use of Post Hydrolysis Solids (PHS) as a Fuel in the Hurst Boilers in Contravention of State and Federal Law and Common Sense).**

Dear Ms. Churchill, Ms. McCarthy, and Mr. Bird,

For the better part of a year, I have had an opportunity to follow the trials and tribulations of Fiberight, LLC, the Municipal Review Committee (MRC) and the consultants CES, Inc. for the aforementioned entities as they shepherd their Air Emission License Application – DEP #A-1111-71-A-N through the Maine Department of Environmental Protection (DEP) regulatory review process. The licensing process has been arduous for the applicants and for any follower of the Fiberight project proposed for Hampden, Maine. I believe the draft licenses that the Maine DEP has issued for the Fiberight/MRC solid waste processing facilities do not comply with state or federal law and that based on the information in the record, that both the Air Emissions License and the Solid Waste License applications should be denied. A public hearing on all of the Fiberight applications is requested to address these and other technical issues.

The first issue I want to address may seem minor but is associated with the fact that the current drafts of the Air and Solid Waste License are not “harmonized” in the Findings of Fact and Order with respect to the basic Fiberight process and the unit operations involved. That disconnect subsequently leads to a problem I see in how projected VOC emissions for a project already approved by the Maine DEP and the Fiberight facility that is pending approval. If left unresolved, the current draft Fiberight air license runs contrary to precedence for the same enzymatic hydrolysis process of converting cellulosic pulp to sugars that has already received an approval by the DEP in the State. (Specifically, Red Shield Acquisition in Old Town, Maine and A-180-77-5-A for NSR#3 – receipt of application November 2, 2012 and approval date March 19, 2013).

The Draft Solid Waste License #S-022458-WK-A-N “Findings of Fact” on Page 20 describes under Section “C Renewable Fuel Production” the enzymatic hydrolysis stage. It notes that how after the sugar solution is separated from the undigested solids (it should read – Post Hydrolyzed Solids or PHS), in paragraph 3, line 6 it states that “The sugar solution is pumped to an evaporator where it is concentrated for storage to be shipped and sold as industrial sugar or will be fed to the anaerobic digester for conversion into biogas”.

In a submittal to the Maine DEP on February 1, 2016, I provided a critical analysis of the (<http://www.maine.gov/dep/ftp/MRC/comments%20received/Analysis%20Comments-February2016.pdf>) contradictory statements on whether industrial sugars are to be sold, whether the equipment even exists to remove impurities that make it undesirable as a marketable industrial sugar, and whether Fiberight even has the equipment to evaporate, i.e. concentrate sugars to a point at which it can be sold. The evaporator referenced in the “Findings of Fact” of the Draft Solid Waste License is not found in any of the Flow Diagrams listed on the DEP website on Dec 21st, 2015. (<http://www.maine.gov/dep/ftp/MRC/applications/supplemental%20application%20submittals/Detailed%20drawing%20plans%2012.pdf>), specifically Process Flow Diagram 6.

The Draft Air License “Findings of Fact and Order” makes no reference to evaporators being part of the Fiberight process, which is surprising in light of the fact that an evaporator can be the source of Volatile Organic Compounds (VOC) and would have to be reported to the DEP by an applicant if it was a significant source. There is precedence for the reporting of VOC emissions and the DEP regulating and licensing such emissions from an operation very similar in some regards to the Fiberight enzymatic hydrolysis part of the operation planned for Hampden.

By way of background information, I was employed at Red Shield Acquisition (dba, Old Town Fuel and Fiber or OTFF) and was very much involved in unit operations and analytical lab analyses when the Biorefinery department I worked in developed the capabilities to take a Novozyme product and enzymatically hydrolyze (for a future 100 dry tons a day plant) the clean hardwood fiber the mill would produce and convert the cellulose and hemi-cellulose fraction to sugars. That very same enzyme is slated to be used by Fiberight to hydrolyze sugars from a Municipal Solid Waste source of old, recovered, foul and washed short paper fibers in a proposed 652 ton per day facility in Hampden, Maine.

At Old Town, this enzymatic hydrolysis (EH) step took 2.5 – 3 days to produce the very dilute solution (8-9% sugars and 91-92% water) containing a low quantity/quality Post Hydrolysis Solids (PHS, which is what Fiberight calls their residual solids). The Old Town Biorefinery operation would be removing the so-called PHS material (which would have amounted to only about 10 (dry) tons per day) from the sugars through a group of 6 centrifuges in parallel to remove this thin, amorphous PHS material, while washing the PHS with small amounts of clean water to recovery as much valuable sugar solution as possible.

The Red Shield/OTFF permit amendment approved by the DEP in March, 2013 was to (quoting from page 2 of the “Findings of Fact and Order”)

“produce sugars in new cellulosic biorefinery using a side stream of washed and screened brown stock (hardwood pulp) from the existing Kraft pulp mill...with expected brown stock use of approximately 100 bone-dried short tons per day, will undergo enzymatic hydrolysis converting cellulose to sugars. The sugars will be further processed to remove impurities

and then will be concentrated. The current expectation is that two-thirds of the finished sugar product will be provided to third parties for conversion to biofuel, and one-third will remain on-site to be further converted to green oil using algal fermentation, oil extraction, solvent recovery, and oil conditioning.”

On “Findings of Fact and Order” page 13 -14 of the OTFF permit amendment, emissions from the evaporator used in the sugar conditioning process were projected to be above the insignificant activity threshold and estimated to be 1.037 tons per year of VOCs. There were a number of other emission sources including but not limited from the hydrolysate storage tanks, separator/filter tanks, conditioned hydrolysate storage tanks, but they all fell below the one ton per year VOC threshold. The DEP still established a VOCs emissions limit of 2.5 tons per year from the potential OTFF Biorefinery operation.

So a clear technical and regulatory issue/question exists for the “disharmony” between the current Draft Solid Waste and Air Licenses. Is the evaporator part of the Fiberright process as noted in the Solid Waste Permit draft, but has been completely missed in the Draft Air permit and its potential release of higher levels of VOCs from the sugar hydrolysis and evaporation operation? Or is the air emission permitting correct in not accounting for the VOC emissions, but the Solid Waste License “Findings of Fact” incorrect in stating that an evaporator is present to concentrate sugars, produce and sell industrial sugars for sale to third parties? Depending which way the answer comes down from the applicant or the DEP impacts the potential emissions for the Fiberright facility, the potential hours that the air pollution controls equipment runs, what sources of emissions will need now to be collected and treated, (the BACT analysis) and the total quantity of emissions that will be released (Potential-to-Emit calculation tables).

Now that I have addressed the “minor” problem I have between the Draft Air and Solid Waste Licenses, let me focus on the topic that should help the DEP and Region 1 EPA establish that Fiberrights’ Post Hydrolysis Solids is “waste” unless Fiberright can prove otherwise. The “Findings of Fact and Order” on Page 16 of the Draft Air Emission License deals with the Federal Rule Applicability Determination. Part of the analysis deals with the technical issues I see with the DEP fact finding for Hurst Boilers #1 & #2 produced by the vendor Global Energy Solutions (GES) and the unknown vendor of the all important PHS dryers feeding the two boilers, and the air emissions that are produced by these units. Where possible, I will identify specific technical errors and omissions and tie them to certain pages or provide excerpts of Findings of Fact pages in the Draft Air License. In some other cases, the technical points I am making are broad, overarching ones that can’t be tied to specific phrases/excerpts but relate to misapplication/misunderstanding by the Department or by the applicants of the Fiberright technology itself.

I have previous provided some relevant background information on Old Town Fuel and Fibers’ enzymatic hydrolysis process which could potentially take 100 tons per day of clean hardwood pulp fibers, add an enzyme, produce a low concentration sugar containing some impurities, and PHS. I also established that OTFF could concentrate those sugars to an “industrial” grade strength and purity that were considered to be the cleanest in the world. Before the evaporation/concentration step, we had to separate the dilute sugar solution (recall 8-9% sugars and 91-92% water, containing a low quantity/quality PHS residue). The large scale biorefinery operation handling 100 tons per day of hardwood fiber would need to remove about 10 tons per day of the PHS material and need to be running it through as many as 6 centrifuges in parallel to

remove this thin, amorphous material while washing it with small amounts of clean water to recover as much valuable sugar as possible. What I did not state above is what we thought of the PHS and how we would manage that material.

The centrifuges were only expected to be capable of getting the PHS up to 40% solids (60% water with some sugar still remaining in solution). The PHS, with as much sugar removed as practical was slated to be sent to a landfill or sent back to the pulp mill. The low volume and high moisture content of the PHS made it of little value for burning. In spite of successfully making the cleanest industrial sugars in the world for possible conversion to ethanol, algal oils or other products, ultimately, OTFF abandoned the entire Biorefinery project as uneconomical and ultimately closed the entire mill operation.

In contrast, Fiberight is expecting to produce a sugar solution from MSW using the same Novozyme enzyme added to old, recovered, fouled, short paper fibers to produce a weaker sugar solution (5-7% sugar and 93-95% equivalent water) that has much more PHS mixed in (Fiberight says the PHS they make is equivalent to 135 dry tons per day). They propose to use a filter press to separate the sugar solution from the PHS and are unlikely to achieve much better than 30.5% PHS solids (the number is from actual Fiberight data later present in Table 1 of this memo called "Sludge Cake" sampled 11/14/14) and 69.5% watery solution.

Fiberight has convinced themselves and the DEP that before going into a generic dryer box, the PHS solids will be 50% solids and 50% water. That statement and information on a never tested, generic PHS dryer can be found in supplemental application material submitted by CES on behalf of Fiberight at the pdf titled – Fuel and Emissions 3,4,5,6,7,8,9,10 (page 13 at the link - <http://www.maine.gov/dep/ftp/MRC/applications/supplemental%20application%20submittals/Fuel%20and%20Emissions%203%204%205%206%207%208%209%2010.pdf>) The written text of Deliverable 7 in the Fuel and Emissions 3-10 pdf incorrectly describes the PHS coming off a screw press (not a filter press as correctly shown on page 5 of the Findings of Fact and Order of the Draft Air License # A-1111-71-A-N (SM)) at 50% moisture/solids and being dried to 41.5% moisture after going through the auger screw box unit. (See sketch on page 14 of the pdf for a generic drawing of the proposed PHS dryer unit). Based on my technical experience with a OTFF trial centrifuge using a cleaner PHS material, I'm doubtful that either the screw press or crude, unproven dryer unit will work as projected. The supplier of the Andritz Filtration centrifuge confirmed that it was the best solids concentrator available for the amorphous, PHS material created by enzymatic hydrolysis. (In actual pilot plant trials, the best we could do was 70% moisture-30% PHS material). Fiberights' high ash (normally) PHS may allow for somewhat better water removal but I doubt anything could dewater from 97% water down to 50% moisture content, and then feed this into a "generic dryer box". This untested dryer using hot boiler flue gases laden with chemical contaminants (discussed later) is required to get the moisture level down to a maximum 41.5% moisture in order for the gasifier boiler from the vendor Global Energy Solutions (GES) to work properly.

Ultimately, the PHS material is not going to be dried properly for efficient combustion which will result in high emission rates of numerous air pollutants. There are no plans and no equipment in the Fiberight plant design that will be able to convert the PHS material into a dry, uniform pellet or made into a briquette. Fiberight somehow plans to produce enough energy to meet their process steam and electrical needs with untested equipment incapable of meeting their stated objectives.

They also claim that this EH solids material is not simply a waste by-product but a valuable fuel. But if we look at the actual data, we see a vastly different story. The DEP “Findings of Fact” are not supported by test results supplied by Fiberight using actual pilot scale equipment that is capable of producing a dry PHS material that will meet the boiler manufacturers’ minimum specifications for proper gasification.

In a technical report to the DEP submitted April 29, 2016 entitled “Fiberight Projects Failure to Demonstrate Its Post Hydrolysis Solids is Eligible for Non-Waste Status at the Federal and State Level” (<http://www.maine.gov/dep/ftp/MRC/comments%20received/KeithBowdenPHStechnicalreview4-29-16.pdf>). I noted how, in my technical opinion:

“CES has, on behalf of the applicant repeatedly adhered to their position that:

1) “technical data” for a mothballed project in Iowa (EPA Region 7) as it pertains to whether “fermentate” fed to boilers, 2) was the same as “wood”, 3) indicated PHS material is not deemed a “solid waste”, but simply a secondary material fuel derived from MSW [Municipal Solid Waste], 4) that boilers combusting the PHS are therefore exempt from designation/consideration/regulation under the more stringent Commercial, Industrial Solid Waste Incinerator (CISWI) facility rules, [or for that matter Municipal Waste Combustor rules] 5) that all the previously cited positions are not only accurate, but now also apply to a different project (no production of ethanol [and no pelletizing/briquetting] and commercial sale of post hydrolysis solids as proposed in Iowa), in a different state (now in Maine) and under a different federal environmental permitting jurisdiction (EPA Region 1) and, finally, 6) that Fiberight is therefore not subject to any other [more stringent] Maine rules or regulations regarding their PHS material. In all my years of involvement in technical projects, I have never witnessed such a convoluted string of “if this, then this, than this”.

My first hand experience told me that PHS from the Fiberight facility would be highly contaminated with various chemical compounds, and far different from the clean hardwood pulp that we at OTFF had successfully processed to industrial sugars.

As the DEP should know, under the RCRA program, it is the Non-Hazardous Secondary Materials Rule (NHSM) at 40 CFR Part 241, that allows for certain “solid wastes” that are RCRA non-hazardous to be managed as “fuels” under certain specific conditions (legitimacy criteria 40 CFR 241.3 et. seq.). The theory, of course, is that solid waste may only be handled as fuels if their handling and if the chemical constituents are substantially analogous to those of actual, traditional fuels.

Until recently, in addition to identifying certain categories of solid waste that may, categorically, be handled as a fuel, the NHSM rule also allowed a facility to submit evidence (self-determination) that their solid waste is sufficiently analogous to a fuel that it meets the legitimacy criteria; in response the EPA would issue a “comfort letter” to affirm the self-determination analysis such that the source would have confidence in the regulatory status of the solid waste as fuel. EPA has now modified this process – it has identified some additional categories of solid wastes that are categorically allowed to be managed as fuel under specific conditions.

In a conversation I had with Mr. Jesse Miller, from the Office of Resource Conservation and Recovery, Materials Recovery and Waste Management Division, MC 5302P, EPA, Washington, DC, on February 10<sup>th</sup>, 2016, I was told of the final Non-Hazardous Secondary Materials rules the EPA issued on February 8, 2016. I had an opportunity to review those new rules. In it, the EPA determined that “Paper recycling residuals (PRR) generated from the recycling of recovered paper, paperboard, and corrugated container and combusted by paper recycling mills whose boilers are designed to burn solid fuels” is not a solid waste under RCRA, and is not required to meet the Clean Air Act (CAA Section 129 emission standards for the incineration units. (Final Rule: Additions to List of Categorical Non-Waste Fuels Docket # EPA-HQ-RCRA-2013-0110).

It just so happens that I was project manager for a successful secondary “recycled” pulp, rehydrating, and cleaning construction project designed to use post-consumer fiber in groundwood containing paper products in Deferiet, New York in the early 1990’s. That experience in dealing with post-consumer recycled pulp in New York State leads me to conclude that Fiberight would not qualify as a PRR and thus does not meet the criteria of a paper recycling mill categories of solid waste that may consider its PHS material as a fuel. In my technical opinion, Fiberight is truly a MSW processing facility and CES has yet to present a valid argument that PHS is NOT a “solid waste”. It should be regulated as a solid waste under RCRA and the boilers are therefore subject to the CAA Section 129 rules.

To classify its PHS as fuel and not waste, Fiberight initiated the NHSM application process in 2012. The self-determination application was made by Fiberight to the EPA Region 7 Office in Kansas and related to the Iowa project (the ethanol facility in Blairstown and subsequently to cover the facility in Marion, Iowa for which permits ultimately were denied). In my submittal of March 23, 2016 to the Maine DEP that focused on projected air emissions and attainment issues, (<http://www.maine.gov/dep/ftp/MRC/comments%20received/Keith%20Bowden%20Technical%20Review%20Comments%20Air%20Application%20March%2023%202016.pdf>), I referenced the statements made in their “Non-waste Determination Application for Non-hazardous Secondary Material - Fermentate from a Cellulosic Ethanol Plant” that Fiberight included in Appendix 1 (<http://www.maine.gov/dep/ftp/MRC/applications/supplemental%20application%20submittals/BACT%20Analysis%20revision%202.pdf>) on two separate permit application submittals (June 15 and December 14, 2015 per the DEP website) for the project in Maine. Fiberight tried to link the solids made via enzymatic hydrolysis of cellulose to sugars and their subsequent fermentation to ethanol of the Iowa project to the non-ethanol involved project in Maine and how Fiberight had switched terminology that used the Post Hydrolysis Solids verbiage.

A major problem ensued for Fiberight when I took the analytical data from that NHSM application and calculated the expected emissions for the project in Maine. The calculations, using approved methodology and clearly laid out in my March 23, 2016 technical memo, showed that emissions were above the threshold for numerous criteria and hazardous air pollutants including carbon monoxide, hydrogen chloride and mercury due solely to the combustion of PHS in the boilers to be used in Hampden Maine. The data presented showed that the Fiberight project did not meet the requirements of Chapter 115 of the State of Maine for a “minor source of air emissions”.

Fiberight, through CES attempted to maintain the fiction that the burning of PHS solid waste was best represented by “wood” emission factors from EPA’s AP-42 Chapter 1.6 even though this was clearly contradicted by using their own data in the 2012 NHSM application, for which the

contaminant comparison of the NHSM data against the emission factor for wood produced the high emission values for hydrogen chloride and mercury. For carbon monoxide, I contend that Fiberight has failed to employ the correct emission factor for wood and biomass, which would result in emissions that exceed the threshold levels. They are using emission factors supplied by a manufacturer of the PHS gasification unit (Global Energy Solutions) that to my knowledge has never tested the actual emissions from the actual gasification of wet PHS material, let alone pelletized or briquetted PHS material in a controlled lab environment. **If such air emission data did in fact exist in a controlled lab at GES and was favorable to Fiberight's case, I am sure they would have presented such data to the EPA or the Maine DEP at this point in the permitting process.**

On April 8<sup>th</sup>, CES issued a memo and also offered up its 6<sup>th</sup> or 7<sup>th</sup> permutation in submittals of the Potential to Emit (PTE) calculations. I noted this in my April 19<sup>th</sup>, 2016 response to the DEP (<http://www.maine.gov/dep/ftp/MRC/comments%20received/Keith%20Bowden%20Air%20comments%20email%20attachment%204-19-16.pdf>). The CES memo in essence states that they will re-characterize the PHS waste material they claimed qualifies as a NHSM and do another recalculation of the various PTE pollutants. Without addressing my March 23, 2016 submittal to the DEP, Fiberight was tacitly acknowledging that their 2012 NHSM application was a problem for them. By seeking to re-characterize the PHS material, they were effectively invalidating their existing NHSM application and any existing basis for the PHS being considered a legitimate "fuel" in their Maine air emission license application, as well as the legitimacy of their "self-determination" that PHS is not a solid waste.

March 3, 2016, Fiberight/CES's submitted to the Town of Hampden Planning Board their Site Plan Review Application, ([http://www.hampdenmaine.gov/vertical/sites/%7B1FCAF0C4-5C5E-476D-A92E-1BED5B1F9E05%7D/uploads/160303\\_MRC\\_Site\\_Plan\\_Review\\_Application\\_3-3-16.pdf](http://www.hampdenmaine.gov/vertical/sites/%7B1FCAF0C4-5C5E-476D-A92E-1BED5B1F9E05%7D/uploads/160303_MRC_Site_Plan_Review_Application_3-3-16.pdf)). At the first public hearing on April 13<sup>th</sup>, Fiberight publically ignored the fact that PHS combustion would produce hazardous air emissions that far exceeded the allowed limits. Finally, on May 25, 2015 after I had pointed out at the 2 earlier planning board meetings of the hazardous discharges that the Hampden residents would face from the air emissions by Fiberight burning the PHS material, Fiberight's consultants CES revealed they would install the necessary air pollution controls and limit boiler operating time to remain a "synthetic minor" air emission source in compliance with Maine law. (EPA April 14, 1998 memo Subject: Potential to Emit (PTE) Guidance for Specific Source Categories) has defined a "synthetic minor" source – those that have the physical and operational capability to emit major amounts, but are not considered major sources because the owner or operator has accepted an enforceable limitation").

I recall Mr. Miller telling me in the early February call that Fiberight's NHSM application was still in the pipeline and that the EPA was still waiting on analytical data that Fiberight had promised the EPA the previous summer and that data would be reviewed individually under the old rules. I did not ask whether if after analytical data was submitted by Fiberight for EPA review, the Fiberight project could still receive a "comfort letter" as had been the past practice. I recall Mr. Miller stating that in general the EPA will no longer issue comfort/approval letters except for those still under review. I now learn from correspondence received on June 29<sup>th</sup>, 2016 and published on the DEP website (<http://www.maine.gov/dep/ftp/MRC/Letter%20from%20EPA%206-29-16.pdf>) that the EPA is still awaiting information from Fiberight supporting their case that PHS is a legitimate fuel and not a solid waste. As indicated above, if the data was available and favorable to the Fiberight cause,

it would have been submitted promptly to the EPA and to Maine DEP and obviated the need for Ms. Jessica Young to write the letter to the Maine DEP regarding EPA's three year wait for Fiberight data submittals (re: July 23, 2013 mentioned by Ms. Young). This fact alone should result in the Maine DEP suspension of the any further action on the Fiberight Air License until the EPA has prepared and submitted a response on whether their PHS material is a "non-waste" fuel product under the NHSM rule.

While Fiberight did not promptly submit analytical data to the EPA, they did ultimately submit to the DEP analytical reports from 4 different labs that were conducted on what CES termed "5 sampling events" of PHS material, and which were published formally on the DEP website in on June 20 (although dated June 6, 2016). (<http://www.maine.gov/dep/projects/mrc/documents/2016-06-06%20PHS%20Briquette%20Analysis%20w%20ultimate%20analysis.pdf>) This term "sampling event" appeared in the final iteration of the BACT analysis (Revision 2 but actually closer to revision 4) in Table 5-2, Fiberight, LLC called PHS Analysis Summary project that supposedly contains the averages (ppm) for these so-called 5 recent events and includes the % metal contaminants and the upper limit (ppm) the lab obtained ([http://www.maine.gov/dep/projects/mrc/documents/2016-06-02%20BACT%20Analysis\\_Rev2.pdf](http://www.maine.gov/dep/projects/mrc/documents/2016-06-02%20BACT%20Analysis_Rev2.pdf))

The upper limit values for 5 of the 14 values listed do not match the high values listed in the analytical results from the 4 labs. Only one upper limit, sulfur is explained by CES as "considered an outlier and was not included in the dataset" (See bottom of page 5). In my technical opinion there is no justification for discarding the sulfur value without some justification/report from the analytical lab or some statistical basis. So there remain 4 errors in the Table and in every case, the CES value is less than the actual analytical lab result. The statistical rationale for this exclusion and skewing of table entries should be explained by CES.

Another problem was discovered in connection with perhaps the seventh of eighth revision to the Potential-to-Emit (PET) Tables and the calculation of emissions listed for the Hurst Boilers #1 & 2. (<http://www.maine.gov/dep/projects/mrc/documents/2016-06-02%20Revised%20Fiberight%20PTE%20kss.pdf>). The PTE table values that CES uses are supposedly the averages for the % metal contaminants that correspond to Table 5-2 averages, but there is no match on Antimony, Arsenic, Cadmium, Chromium, Lead, Manganese, and Nickel. Some are close, but close doesn't count in Permit Applications. The applicant needs to correct these errors and provide their own summary table like the one that I have prepared and included in the following pages for the analytical lab data "events". CES needs to use the correct values to calculate the HAPS discharges. The DEP also needs to recalculate the operating hours accordingly given the Fiberight operation is being considered a "synthetic minor" because of exceedances of various emission levels.

I have summarized that analytical data in the Summary Table 1 that follows to help identify gaps in data, for ease of comparison of the data and to help identify who supplied samples (Fiberight or the vendor for the Hampden, Maine boiler – Global Energy Solutions (GES)).



**Table 1: Summary - "Recent" Fiberight PHS Data – Solids/Pellet/Briquette Form-CES to DEP in June 2016**

Test Parameter	Sample Label/Description - Sampling Date/Received at Vendor/Lab Date - Origin/"Source" of Sample & (Analytical Lab) with Test Results				
	Sludge Cake Sampled (unk) 11/14/14 Rec'd Global Energy Sol. (Technical Lab Inc)	PHS Bunker 12/9/14 Sample 12/10/14 Rec'd Fiberight (grab) (J Reid Assoc. Lab)	Pellets Sampled (unk) 10/30/15 Rec'd Global Energy Sol. (Technical Lab Inc)	PHS Briquettes Sampled (unk) 1/13/16 Rec'd Global Energy Sol. (Hazen Research Inc)	Cell. Briquettes 11/30/15 (unk) 4/15/16 Rec'd Fiberight (maybe) (ALS Environmental)
Moisture %	69.54	Untested	9.57	5.90	5.76
Volatiles % (as is)	26.04		62.90	65.27	62.93
Volatiles % (dry)	85.48		68.56	69.36	66.78
Fixed Carbon % (as is)	3.27		12.39	13.12	14.95
Fixed Carbon % (dry)	10.76		13.69	13.94	15.87
Ash % (as is)	1.15		15.15	15.71	16.36
Ash % (dry)	3.76	Untested	16.75	16.70	17.36
BTU/# (as is)	2,264		8,069	6,995	7,574
BTU/# (dry)	7,434	Untested	8,923	7,498	8,037
Sulfur % (as is)	0.02		0.65	0.223	
Sulfur % (dry)	0.07		0.72	0.237	0.287
Chlorine % (as is)				0.13	
Chlorine % (dry)	0.03		0.10	0.138	.119
<b>Ultimate Analysis (%)</b>					
Ash % (dry)	3.76			15.71	17.36
Carbon (as is) %				44.75	
Carbon (dry) %	47.98			47.56	46.10
Hydrogen (as is) %				5.15	
Hydrogen (dry) %	5.87			5.47	4.99
Nitrogen (as is) %				1.45	
Nitrogen (dry) %	0.57			1.54	1.54
Sulfur (as is) %				0.22	
Sulfur (dry) %	0.07			0.24	0.287
Oxygen (as is) %				26.82	
Oxygen (dry) %	41.75			28.49	29.71
Chlorine (as is) %				0.130	
Chlorine (dry) %				0.138	0.1190
Tot. Potassium (dry) mg/kg		822			
Tot. Strontium mg/kg		12.1			
Tot. Silver (dry) mg/kg		0.270			
Tot. Sodium (dry) mg/kg		656			
Tot. Thallium (dry) mg/kg		<1.34			
Total Tin (dry) mg/kg		40.9			
Tot. Titanium (dry) mg/kg		37.8			
Tot. Vanadium (dry) mg/kg		3.62			
Total Zinc (dry) mg/kg		204			
KEY unk = unknown date/time the PHS sample generated or sent to lab for analysis maybe = not known if from Global Energy Solutions or Fiberight directly					

**Summary Table 1- "Recent" Fiberight PHS Data – Solids/Pellet/Briquette Form - CES to DEP in June 2016**

Test Parameter	Sample Label/Description - Sampling Date/Received at Vendor/Lab Date - Origin/"Source" of Sample & (Analytical Lab) with Test Results				
	Sludge Cake Sampled (unk) 11/14/14 Rec'd Global Solutions (Technical Lab Inc)	PHS Bunker 12/9/14 Sample 12/10/14 Rec'd Fiberight (grab) (J Reid Assoc. Lab)	Pellets Sampled (unk) 10/30/15 Rec'd Global Solutions (Technical Lab Inc)	PHS Briquettes Sampled (unk) 1/13/16 Rec'd Global Solutions (Hazen Research Inc)	Cell. Briquettes 11/30/15 Sample (unk) 4/15/16 Rec'd Fiberight (maybe) (ALS Environmental)
*Moisture %	69.54	Untested	9.57	5.90	5.76
*Volatiles % (as is)	26.04	"	62.90		62.93
*Volatiles % (dry)	85.48	"	69.56	69.36	66.78
*Ash % (as is)	1.15	"	15.15	15.71	16.36
*Ash % (dry)	3.76	Untested	16.75	16.70	17.36
Arsenic (as is) ppm	0.7?		<0.1	1.11	
T. Arsenic (dry) mg/kg	0.7?	<1.34	<0.027	1.18	3.5
Fluor(ine/ide) (as is) ppm	75?		36		
Fluor(ine/ide) (dry) ppm	75?		6.0#		
Mercury (as is) ppm	0.03?		1.9	0.35	
Mercury (dry) mg/kg	0.03?	0.272	0.31#	0.37	0.767 ppm
Selenium (as is) ppm	<0.1?		<0.1	3.72	
T. Selenium (dry) mg/kg	<0.1?	1.84	<0.02#	3.95	Non-detect (<1.1)
Antimony(as is) ppm	0.2?		0.1		
T. Antimony (dry) mg/kg	0.2?	1.56	0.017#	261/43.6#	14.2
Beryllium (as is) ppm	<0.1?		0.1		
Beryllium(dry) mg/kg	<0.1?	<0.134	0.02#	<10/<2#	Non-detect (<0.43)
Cadmium (as is) ppm	<0.1?		<0.1		
T. Cadmium (dry) mg/kg	<0.1?	0.387	<0.02#	27/4.5#	5.83
Chromium(as is) ppm	2.5?		0.5		
T. Chromium (dry) mg/kg	2.5?	23.6	0.08#	94.7	75.8
Cobalt (as is) ppm	0.1?		<0.1		
T. Cobalt (dry) mg/kg	0.1?	<1.34	<0.02#	13	8.7
Lead (as is) ppm	5.0?		10.0		
T. Lead (dry) mg/kg	5.0?	39.5	1.6#	4440/741#	1090
Manganese (as is) ppm	9.8?		1.0		
T. Manganese (dry) mg/kg	9.8?	55.1	0.16#	1210/202#	214
T. Magnesium (dry)mg/kg		465			
T. Molybdenum(dry) mg/kg		4.77			
Nickel (as is) mg/kg	2.1?		1.4		
T. Nickel (dry) mg/kg	2.1?	11.0	0.23#	424/70.8#	73.8
T. Aluminum(dry) mg/kg		2696			
Total Barium (dry) mg/kg		47.4			
Total Boron (dry) mg/kg		<13.4			
Total Calcium (dry)mg/kg		5049			
Total Copper (dry) mg/kg		42.3			
Total Iron (dry) mg/kg		1684			

KEY: unk = unknown date/time the PHS sample generated/sent out maybe = not known if from Global Energy Solutions or Fiberight directly  
 \* = Repeat of Lab Result from Prior Page For Reader Convenience ? = Question on Lab Labeling of whether Ashed for Metals  
 # = Calculated Result by Lab Based on % Ash of Metals Result

The columns of data are in chronological order as best that I can determine based on the paucity of information contained on the 4 different analytical labs involved and/or the lack of basic chain of custody (COC) information provided by the various parties and lab Quality Assurance/Quality Control (QA/QC) reports. (If such COC and QA/QC information is made available by the applicant that refutes the conclusions I have drawn from the information, I would request an opportunity to review it. The ALS Environmental analytical report dated 4/15/16 indicates a 16 page report so I acknowledge that some of the requested information may exist.)

I was appalled with the lack of data, the lack of consistency in lab selection, and the fact that an outside observer like me could not determine whether any basic requirements of good sampling protocols were followed under SW 846 Chapter 9 requirements. Briefly the highlights of the data in left to right order are as follows:

1. A “Sludge Cake” sample (presumably of wet PHS) that has no date for which it was produced (presumably in Lawrenceville, Virginia) and sampled, and notation of whether it is a representative composite, how the sample was chemically preserved (if needed) and whether it was stored in air tight containers/refrigerated. We do know that the sample was sent by the boiler vendor (GES) to the Technical Laboratories, Inc and received 11/14/14. (Technical Labs does not indicate whether they conduct the metals analysis on ash “dry” or “as is” like their clearly label the 10/30/15 received sample data in column 3 of the Table). The ash content is unusually low compared to the NHSM application data and the samples that are in pellet or briquette form, which points to a sample that was not adequate mixed when sampled. The Aluminum content is very high. The basic test of pH was not conducted/reported for this sludge cake sample. It is common knowledge that metals contaminants are more soluble in acid environments versus caustic ones, such that this basic test parameter should be provided for all PHS samples that are in a wet state where “free liquid” exists. This will have an impact on the metal contamination concentrations present in the PHS material and the resultant air emissions in the stack gases. There is no COC or QA/QC information provided.
2. A “PHS Bunker” sample taken 12/9/14 (an unknown terminology based on Fiberight’s flow diagram for their process) was clearly labeled as a grab sample (not good) sent by Fiberight and analyzed within the required holding times (good). Still there is no COC or QA/QC information provided. Surprisingly, the basic tests of % moisture, % ash, pH, BTU heat content, etc were not conducted. If that data is available from Fiberight or GES would be invaluable and the fact that it was not done is questionable, unless the local Virginia lab selected was not capable of running the tests. This omission in basic analytical testing/results points to the importance of a sampling plan (see the discussion that follows on the
3. The next column labeled “Pellets” was tested by Technical Labs, with unknown production process details, date of sampling, type (grab-composite), ship date from Fiberight (assumed), receipt date at the boiler vendor GES, date of pelletization, whether binder/additives employed, and lack of COC and QA/QC data for Technical Labs who received the same on 10/30/15 is not provided to the DEP or interested

parties to the Fiberight licensing process. In this sampling event case, the lab labels the metals testing as being “Mineral Testing on Ash”. What is then done with this data (see June DEP website analytical data memo of February 23, 2016 from Alan Iantosca of Fiberight) to Kyle Sullivan (CES) that describes how to calculate a result for metals content in fuel, by reducing it by the % ash of the dry pellet. What is the basis for reducing the metals values to generate a new, calculated metals value? Is there an approved EPA guidance document for this data manipulation?

Another noteworthy aspect for this sample is the high ash percentage itself for this pellet material, being 16.75% on a bone dry basis. High ash values is typical of the content of PHS/NSHM application material reported in the past, but this ash level is significantly above those reported in the literature for wood and biomass. The only woody material that would come close to having ash levels this high would be raw bark itself from a debarking operation for a biomass boiler operation. Bark with a high ash (typically silica-sand) is not going to be prevalent in MSW waste stream and is not a component found in a post enzymatic hydrolysis solids being pelletized by GES or anyone else. On top of that, this same pellet material derived from PHS material of unknown origins, has the highest BTU per pound high heat value ever reported for the PHS material. How does one achieve such a high (dry) BTU/pound value at the same time you have a high inorganic ash residue produced in the PHS material. Has GES added some artificial binder to the material it supposedly received from Fiberight?

As for the previous samples in the table, COC and QA/QC information provided by Fiberight and GES would be appropriate but is clearly lacking. This analytical result demonstrates that the PHS material analyzed here is not consistent with typical wood or biomass materials.

4. The “Fiberight PHS Briquette” label is the first one provided to an analytical testing lab (a new one called Hazen Research, Inc. by the boiler vendor but many questions still arise. When and in what sampling and preparatory state did Fiberight supply the material to GES, how did they store the PHS material, what did GES do with/to the sample, when, and Briquette represent a composite of the original PHS material? The samples were received by Hazen on January 13, 2016, but not reported out until January 22 or February 3, 2016. Without knowing the COC and QA/QC information being provided by any of the parties involved, doubts exist as to the veracity of the samples all along the torturous path for the PHS material. Again, is it appropriate to convert the ashed metals content results to “Metal, Dry Whole Fuel Basis”? The lead result before and after result manipulation is high for this Briquette. (The chlorine value is also high and clearly supports the installation of acid gas controls that I alerted the DEP to in my March 23, 2016 memo, before I had access to this data). What test methods were utilized by Hazen Research, Inc. To me, it appears to be like the “wild, wild west” where anything goes with respect to the sampling, preparation, analyticals and final reporting on the PHS data provided by the DEP by the applicants.

5. The final column “Cellulosic Briquettes” is a new moniker that was provided by Fiberight or by the vendor GES for a sample dated 11/30/15 but which was analyzed by the 4th different analytical lab ALS Environmental on April 15, 2016. (They were previously cited as providing a 16 page analytical report of which CES provided only 3 page excerpt). The issues of whether the PHS material from Fiberight was a composite or grab exists, as do the obvious long sample holding times, the lack of COC and QA/QC information provided remain for this “sampling event”. It is more like a “sampling marathon” over many months and raises a serious technical question as to the reliability one can place in these numbers. Mercury is clearly being analyzed outside the allowable holding time for any analyte (November 30, 2015 to April 15, 2016). Even so, the analytical test results for mercury, lead and chlorine are noteworthy/high, and support my recommendation for air emission controls on the PHS boiler stacks.

If one looks objectively at the summary table, possibly 4 of 5 recent “sampling event” samples are coming from Hurst Boiler mfg - Global Energy Solutions that have been held who knows how long by them and from what vintage PHS. In addition, there is a cluster of sampling (10/30/15 & 11/30/15 & 1/13/16) in the last 3 columns of the table that points to the possibility that analytical tests are on samples from the GES storage room that were sent to 3 different labs on the very same PHS material (that is either in a GES pellet or briquette form) from PHS generated in 2015. That is the year that the Lawrenceville Virginia plant processed only 90 tons of MSW in the entire year, so PHS material (wet or dried and made into pellets or briquettes) would have been at a premium. (See Appendix Table 1 at the end of this technical analysis containing the data for Fiberight’s Lawrenceville, Virginia pilot plant consumption of MSW for the years 2012-2015 based on data from the Virginia Department of Environmental Quality). The applicant can refute this supposition on my part by providing dates of manufacture of the wet PHS material, sample shipping data, COC reports for all samples, QA/QC information from Fiberight, GES and the other involved analytical labs.

The most recent “sample event data” of April 15, 2016 was done after CES’s memo of April 8<sup>th</sup>, 2016 and referenced earlier in my April 19<sup>th</sup> report to the DEP. In that memo to the Maine DEP it was stated that they would do the additional testing of the PHS from their Lawrenceville, Virginia facility “for concentrations of chemical contaminants and ultimate fuel analysis.”

I pointed out that Fiberight should not be able to ignore the actual analyses of PHS solids they have done in the past, as not representative of PHS without providing some credible explanation. CES inexplicably says: accept new actual analyses run on PHS from their Lawrenceville, Virginia facility. What is the basis for Fiberight to be able to reject old data from the Lawrenceville facility on samples produced by enzymatic hydrolysis in 2011 or 2012, and other years and accept the “cherry picked” new set of numbers analyzed for concentrations of chemical contaminants and ultimate fuel analysis generated in more recent years?. Based on the data that I summarized in my table above, it appears that Fiberight, through CES threw out just the NHSM application data collected in the early period of its operation (2010-2012), and then is now trying to pass off the “5 sampling events” as somehow more relevant/useful.

In the April 8<sup>th</sup>, 2016 memo to the DEP, the applicant goes on to say, quote:

“The results of these analyses will be used to demonstrate that the unfired PHS material is similar to contaminant concentration and BTU content of biomass.”

So “unfired PHS material” is similar to the contaminant concentration of wood or biomass. But, I have already mentioned some of the high values that are summarized in the table (such as ash, lead, aluminum), and exceed the high range typical of that found for wood & biomass. The Environmental Protection Agency’s Contaminant Concentrations in Traditional Fuels: Table for Comparison ([https://www.epa.gov/sites/production/files/2016-01/documents/nhsm\\_cont\\_tf.pdf](https://www.epa.gov/sites/production/files/2016-01/documents/nhsm_cont_tf.pdf)) shows a high range of 340 mg/kg for lead (Pb), yet ALS got 1090 mg/kg. CES incorrectly shows the upper limit value for lead as 1040 in Table 5-2 of the latest BACT revision in June, 2016.

Another thing that jumps out is the apparent lack of complete testing of the correct parameters in the PHS material. I see no results listed in the most recent Potential To Emit tables (June 2016) for fluorine, a listed non-metal element contaminant or for formaldehyde in Table 2, titled “Contaminant Concentrations in Wood & Biomass Materials”, cited above in the EPA’s NHSM regulations. Furthermore, given that the PHS is derived from MSW, it would not be unexpected to see additional chemicals not typically found in wood or biomass, as was the case with Waste Management’s SpecFUEL NHSM determination, which found Bis(2-ethylhexyl) phthalate (DEHP), an SVOC, and required analysis for chemicals that could be found in coal. This NHSM determination placed additional restrictions on Waste Management regarding ash content. ([https://yosemite.epa.gov/osw/rcra.nsf/ea6e50dc6214725285256bf00063269d/FBC1CD73BEB2979385257F72006F4346/\\$file/14869.pdf](https://yosemite.epa.gov/osw/rcra.nsf/ea6e50dc6214725285256bf00063269d/FBC1CD73BEB2979385257F72006F4346/$file/14869.pdf))

What assurances does the Maine DEP or the EPA have that a sampling plan was prepared by Fiberright or GES by a qualified engineer to ensure that the results of the sampling effort for PHS are precise, representative and accurate enough to properly characterize the waste under EPA SW-846 and laid out in Chapter 9 regulations? The sampling plan should address the following considerations:

- Data quality objectives
- Determination of a representative sample
- Statistical methods to be employed in the analyses
- the PHS waste generation and handling processes
- the constituents /parameters to be sampled
- the physical and chemical properties of the waste material
- sampling equipment, methods and sampling containers
- quality assurance and quality control, preservation times and handling methods, and
- chain of custody

Should the Maine DEP accept at face value that all these basic requirements were met by Fiberright and others during the “5 event sampling” program. From where I stand and looking at the issues raised in the above 5 bullet points, the answer is clearly NO. Unfortunately, the Maine DEP has accepted this information at face value without applying its own technical expertise to ask key questions regarding the regulatory requirements, and in the draft license shifted the regulatory risk of the Fiberright project (and by extension the co-applicant, MRC) which is neither

to the benefit of the applicants or the citizens of the state of Maine. The Findings of Fact on page 16 of the Draft Air License A-111-71-A-N(SM) states:

*Fiberight has requested that their license be processed based on their self-certification that the PHS is a non-waste. Fiberight acknowledges and understands that relying on their self-certification puts them at significant risk of not being able to operate in compliance with Federal rules should EPA make a determination that PHS does not meet the requirements to be considered a non-waste.*

*By considering PHS to be a non-waste, it is treated like a “traditional” fuel similar to biomass. As such, Boiler#1 and #2 are being licensed assuming they are biomass-fired boilers.*

EPA clearly notes in its policy statement (*USEPA Office of Solid Waste and Emergency Response/Office of Resource Conservation and Recovery Policy on the Use of “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods” (SW-846)*) that:

*The United States Environmental Protection Agency’s (EPA) Office of Resource Conservation and Recovery (ORCR) provides analytical and sampling methods to assist the regulated and regulatory community and others in implementing the Resource Conservation and Recovery Act (RCRA). These methods are published in the Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846) on the ORCR Web site ([www.epa.gov/epawaste/hazard/testmethods/index.htm](http://www.epa.gov/epawaste/hazard/testmethods/index.htm)). With the exception of those particular methods which are promulgated in the regulations to implement RCRA (see 40 CFR 260.11), the remaining methods are considered guidance, and users may select any scientifically appropriate method when conducting analyses to comply with the RCRA regulatory program. (<https://www.epa.gov/sites/production/files/2015-10/documents/policy-statement-federal-register.pdf>)*

Clearly, it is the intention of EPA that either SW-846 or “any scientifically appropriate method” should be applied to comply with programs under RCRA, including NHSM. CES/Fiberight should be required to demonstrate that the data is representative of the PHS that Fiberight plans to combust at the proposed Hampden, Maine facility, perform the requisite statistical analyses around the mean result for each chemical constituent of interest and concern and to establish the upper and lower confidence interval for the parameter, and to determine applicable regulations for licensing purposes. The high limit/range of emissions can then be determined and the project can then be appropriately classified as a minor or major air pollution source, and whether the applicant is in permit compliance with Maine statutes.

If the current dataset is inadequate for this purpose, then the NHSM should be rejected until such time as the data is developed, analyzed and resubmitted.

Sincerely,

*Keith A. Bowden*

Keith A. Bowden

**Table 2: Tons of Municipal Solid Waste Processed by Fiberight at Lawrenceville, VA**

(Data Source Virginia Dept. of Environmental Quality Tel: (804) 527-5173 – Josh Byerly-josh.byerly@deq.virginia.gov)

Year	Tons MSW Sent to Pilot Plant	Tons managed on-site (AD)	Tons Sent Off-Site		Comments***
			Recycled	Treated, Stored, Disposed of ...	
2012*	316.8	18.4**	66.2	232.2	26.7% recycle rate
2013	416.0	153.0**	25.0	238.0	42.8% recycle rate
2014	322.0	None Reported	16.06	305.94	4.99% recycle rate
2015	90.0	None Reported	14.0	76.0	15.6% recycle rate
2016	Ask Fiberight		Ask Fiberight	Ask Fiberight	

\* Pilot Plant Begins under Fiberight - Permit changed from Atlantic Recycling Technologies to Fiberight and assigned Permit # PBR 592

\*\* Tons Used on-site for the production of methane via Anaerobic Digestion

\*\*\* Recycle rate is the sum of on-site managed and recycle off-site divided by total sent

**SUMMARY CONCLUSION/Issues:** Given that Fiberight reports 6000 hours of pilot plant operation in 4 years and having **ONLY** processed 1144.8 tons: (Their own reports to DEQ)

1. Fiberight in Virginia has averaged 286.2 tons per YEAR of MSW Processing (0.19 tons per hour) and they have proposed to build/operate a 181,500 ton per year plant in Hampden!
2. The scale up factor from the Virginia Plant to the Hampden Plant is 634.2 to 1 (181,500 tons per year/286.2 per year).
- 3, Average recycle rate is only 25.6% over the 4 years.