

April 8, 2016

Ms. Lynn Muzzey
Maine Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017

Re: Fiberight | Revised Potential to Emit Calculations

Dear Ms. Muzzey:

At the request of the Maine Department of Environmental Protection (MDEP) Air Bureau, CES, Inc. (CES) has revised the previously submitted Potential to Emit (PTE) calculations associated with the Fiberight, LLC/Municipal Review Committee (MRC) air emission license application. We have attached a summary of the anticipated facility wide emissions as well as a “source by source” estimate of emissions.

The revised PTE calculations are based on the AP-42 Emissions Factors found in Section 1.6 *Wood Residue Combustion in Boilers*. Fiberight believes these emissions factors to be the most applicable published emission factor to predict emissions from the combustion of post hydrolysis solids (PHS). Fiberight is currently having samples of the PHS from their Lawrenceville, Virginia facility analyzed for concentrations of chemical contaminants and ultimate fuel analysis. 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. Upon receipt and review of these laboratory analytical results, Fiberight will submit the results to MDEP to validate the selection of biomass emission factors used to calculate the PTE for the facility.

If you have any questions regarding the attached document, please do not hesitate to contact us.

Sincerely,
CES, Inc.

A handwritten signature in blue ink, appearing to read 'Kyle Sullivan', is written over a white background.

Kyle Sullivan
Senior Project Scientist

KSS/jok
Attachment

Ms. Lynn Muzzey – MDEP | 04.08.2016 | 11293.001 | Page 1

POTENTIAL TO EMIT SUMMARY
FIBERIGHT, LLC
Proposed Hampden, ME Facility

Criteria Pollutants (Ton/Year)							
	Flare	Thermal Oxidizer	Boiler#1	Boiler #2	Scrubber #1	Scrubber #2	Total
Carbon Monoxide (CO)	6.91	2.90	43.59	43.59			97.0
Oxides of Nitrogen (Nox)	1.52	1.45	19.82	19.82			42.6
Sulfur Dioxide (SO2)	2.67	25.21	4.95	4.95			37.8
Particulate Matter (PM)	0.54	1.55	5.94	5.94			14.0
Particulate Matter < 10 µm (PM10)	0.54	1.55	4.36	4.36			10.8
Particulate Matter < 2.5 µm (PM2.5)	0.54	1.55	3.96	3.96			10.0
Volatile Organic Compounds	0.17	0.50	2.58	2.58	2.89	2.89	11.6
ammonia	0.10	0.29	0.00	0.00	0	0	0.4
HAPS	0.06	0.18	8.35	8.35	0.15	0.15	17.2
Hazardous Air Pollutants (Ton/Year)							
	Flare	Tox	Boiler#1	Boiler #2	Scrubber #1	Scrubber #2	Total
acetaldehyde	0	0	0.16	0.16	0.00	0.00	0.33
acrolein	0	0	0.79	0.79	0.00	0.00	1.58
arsenic	0	0	0.00	0.00	0.00	0.00	0.00
benzene	0	0	0.83	0.83	0.01	0.01	1.68
beryllium	0	0	0.00	0.00	0.00	0.00	0.00
cadmium	0	0	0.00	0.00	0.00	0.00	0.00
chromium	0	0	0.00	0.00	0.00	0.00	0.01
cobalt	0	0	0.00	0.00	0.00	0.00	0.00
dichlorobenzene	0	0	0.00	0.00	0.00	0.00	0.01
formaldehyde	0	0	0.87	0.87	0.00	0.00	1.74
hydrochloric acid	0	0	3.76	3.76	0.02	0.02	7.56
lead	0	0	0.01	0.01	0.00	0.00	0.02
manganese	0	0	0.32	0.32	0.00	0.00	0.63
methanol	0	0	0.00	0.00	0.00	0.00	0.00
mercury* (lb/yr)	0	0	1.39	1.39	0.00	0.00	2.77
n-hexane	0	0	0.00	0.00	0.02	0.02	0.05
napthalene	0	0	0.02	0.02	0.00	0.00	0.04
nickel	0	0	0.01	0.01	0.00	0.00	0.01
phenanthrene	0	0	0.00	0.00	0.00	0.00	0.00
toluene	0	0	0.18	0.18	0.10	0.10	0.57

Fiberight, LLC
Flare Potential to Emit

Feed gas rate (SCFM)	1200
Gas Recovery rate	90%
Feed Gas SO2 Concentration (ppm)	500
SO2 MW	64.064
SCF /lbmol	386
Gas Density SCF/lb	379
Operational days per year	328.5
Days venting gas (process upset)	36.5
Gas flared Annual Total (SCF)	63,072,000

Flare Potential to Emit (ton/year)	
Carbon Monoxide (CO)	6.91
Oxides of Nitrogen (Nox)	1.52
Sulfur Dioxide (SO2)	2.67
Particulate Matter (PM)	0.54
Particulate Matter < 10 µm (PM10)	0.54
Particulate Matter < 2.5 µm (PM2.5)	0.54
Volatile Organic Coumpounds	0.17
ammonia	0.10
HAPS	0.06

Emissions Factors			
Pollutant	Emission Factor	Units	Source
Carbon Monoxide (CO)	3.10E-01	lb/MMBtu	manufacturer emissions factor
Oxides of Nitrogen (Nox)	6.80E-02	lb/MMBtu	manufacturer emissions factor
Sulfur Dioxide (SO2)	Calculated based on 500 ppm H2S in raw biogas		
Particulate Matter (PM)	1.70E-05	lb/cu ft Burned	SCC 50300601, landfill flare, WebFire
Particulate Matter < 10 µm (PM10)	1.70E-05	lb/cu ft Burned	SCC 50300601, landfill flare, WebFire
Particulate Matter < 2.5 µm (PM2.5)	1.70E-05	lb/cu ft Burned	SCC 50300601, landfill flare, WebFire
Volatile Organic Coumpounds	5.5	lb/MM cu ft Burned	SCC 10100602, boiler
ammonia	3.2	lb/MM cu ft Burned	SCC 10100602, boiler
HAPS	1.938	lb/MM cu ft Burned	SCC 10100602, boiler

Feed Gas Btu/SCF	707
Sales Gas Btu/SCF	990
Tail Gas Btu/SCF	111

$$\text{SO}_2 \text{ Tail Gas (TG) (ton/yr)} = \frac{\text{lb mol H}_2\text{S} * \text{lb mol SO}_2 * 64.064 \text{ lb SO}_2 * \text{lb mol TG} * \text{scf TG} * \text{ton}}{10^6 \text{ mol(TG)} \text{ lb mol H}_2\text{S} \text{ lb mol SO}_2 \text{ 379 scf TG} \text{ Year} \text{ 2,000 lb}}$$

$$\text{SO}_2 \text{ Digester Gas(ton/yr)} = \frac{\text{lb mol H}_2\text{S} * \text{lb mol SO}_2 * 64.064 \text{ lb SO}_2 * \text{lb mol DG} * \text{scf DG} * \text{ton}}{10^6 \text{ mol(DG)} \text{ lb mol H}_2\text{S} \text{ lb mol SO}_2 \text{ 379 scf DG} \text{ Year} \text{ 2,000 lb}}$$

Fiberight, LLC
John Zink Thermal Oxidizer Hybrid Potential to Emit

Biogas tailings rate (SCFM)	386	Supplemental digester gas Flow rate (scfm)	26
Tailings SO2 Concentration (ppm)	1600	Total supplemental BTU Input (Mmbtu/hr)	3.7
Feed Gas SO2 Concentration (ppm)	500		
SO2 MW	64.064		
Gas Density SCF/lb	379		
Anticipated PSA down time	90%		
Normal Operations days per year	328.5		
Days venting gas (process upset)	36.5		
Tail Gas combusted Annual Total (SCF)	182,593,440		
Feed Gas Combusted Annual Total (SCF)	12,299,040		

Flare Potential to Emit (ton/year)	
Carbon Monoxide (CO)	2.90
Oxides of Nitrogen (Nox)	1.45
Sulfur Dioxide (SO2)	25.21
Particulate Matter (PM)	1.55
Particulate Matter < 10 µm (PM10)	1.55
Particulate Matter < 2.5 µm (PM2.5)	1.55
Volatile Organic Coumpounds	0.50
ammonia	0.29
HAPS	0.18

Emissions Factors			
Pollutant	Emission Factor	Units	Source
Carbon Monoxide (CO)	2.00E-01	lb/MMBtu	manufacturer emissions factor
Oxides of Nitrogen (Nox)	1.00E-01	lb/MMBtu	manufacturer emissions factor
Sulfur Dioxide (SO2)	Calculated based on 1,600 ppm H2S in tailings and 500 ppm H2S in raw biogas		
Particulate Matter (PM)	1.70E-05	lb/cu ft Burned	SCC 50300601, landfill flare, WebFire
Particulate Matter < 10 µm (PM10)	1.70E-05	lb/cu ft Burned	SCC 50300601, landfill flare, WebFire
Particulate Matter < 2.5 µm (PM2.5)	1.70E-05	lb/cu ft Burned	SCC 50300601, landfill flare, WebFire
Volatile Organic Coumpounds	5.5	lb/MM cu ft Burned	SCC 10100602, boiler
ammonia	3.2	lb/MM cu ft Burned	SCC 10100602, boiler
HAPS	1.938	lb/MM cu ft Burned	SCC 10100602, boiler

Feed Gas Btu/SCF	707
Sales Gas Btu/SCF	990
Tail Gas Btu/SCF	111

$$\text{SO}_2 \text{ Tail Gas (TG) (ton/yr)} = \frac{\text{lb mol H}_2\text{S} * \text{lb mol SO}_2 * 64.064 \text{ lb SO}_2 * \text{lb mol TG} * \text{scf TG} * \text{ton}}{10^6 \text{ mol(TG)} \text{ lb mol H}_2\text{S} \text{ lb mol SO}_2 \text{ 379 scf TG} \text{ Year} \text{ 2,000 lb}}$$

$$\text{SO}_2 \text{ Digester Gas(ton/yr)} = \frac{\text{lb mol H}_2\text{S} * \text{lb mol SO}_2 * 64.064 \text{ lb SO}_2 * \text{lb mol DG} * \text{scf DG} * \text{ton}}{10^6 \text{ mol(DG)} \text{ lb mol H}_2\text{S} \text{ lb mol SO}_2 \text{ 379 scf DG} \text{ Year} \text{ 2,000 lb}}$$

Fiberight, LLC
Boiler #1 Potential to Emit

Heat Input (mmBtu/hr)	47.57
Total Gas fired (MMBtu)	1016
Btu/Scf Natural Gas	1020
Natural Gas (scf)	996078
Annual Hours of operation	8322
PHS (btu/lb) (dry)	8923

Pollutant	Ton/Year
Carbon Monoxide (CO)	43.59
Oxides of Nitrogen (Nox)	19.82
Sulfur Dioxide (SO ₂)	4.95
Particulate Matter (PM)	5.94
Particulate Matter < 10 µm (PM ₁₀)	4.36
Particulate Matter < 2.5 µm (PM _{2.5})	3.96
Volatile Organic Coumpounds	2.58
ammonia	0.00
HAPS	8.3

Emissions Factors Biomass (PHS)			
Pollutant	Emission Factor (lb/mmBtu)	Emission Factor (lb/hr)	Source
Carbon Monoxide (CO)	0.22	10.47	Emission factors provided by manufaturer (AP-42 1.6)
Oxides of Nitrogen (Nox)	0.1	4.76	Emission factors provided by manufaturer (AP-42 1.6)
Sulfur Dioxide (SO ₂)	0.025	1.19	Emission factors provided by manufaturer (AP-42 1.6)
Particulate Matter (PM)	0.03	1.43	Emission factors provided by manufaturer (AP-42 1.6)
Particulate Matter < 10 µm (PM ₁₀)	0.022	1.05	Emission factors provided by manufaturer (AP-42 1.6)
Particulate Matter < 2.5 µm (PM _{2.5})	0.02	0.95	Emission factors provided by manufaturer (AP-42 1.6)
Volatile Organic Coumpounds	0.013	0.62	Emission factors provided by manufaturer (AP-42 1.6)

Emissions Factors Natural Gas / Bio-methane			
Pollutant	Emission Factor (lb/10 ⁶ scf)	Total lb/yr	Source
Carbon Monoxide (CO)	84	83.67	Emission factors provided by manufaturer (AP-42 1.4)
Oxides of Nitrogen (Nox)	50	49.80	Emission factors provided by manufaturer (AP-42 1.4)
Sulfur Dioxide (SO ₂)	0.6	0.60	Emission factors provided by manufaturer (AP-42 1.4)
Particulate Matter (PM)	7.6	7.57	Emission factors provided by manufaturer (AP-42 1.4)
Particulate Matter < 10 µm (PM ₁₀)	7.6	7.57	Emission factors provided by manufaturer (AP-42 1.4)
Particulate Matter < 2.5 µm (PM _{2.5})	7.6	7.57	Emission factors provided by manufaturer (AP-42 1.4)
Volatile Organic Coumpounds	5.5	5.48	Emission factors provided by manufaturer (AP-42 1.4)

Controls

Baghouse for PM

SNCR for Nox, Manufacturer performance guarantee reduced EF from 0.22 lb/mmBtu to 0.10 lb/mmBtu

Fiberight, LLC
Boiler #1 Potential to Emit

HAPS EMISSIONS (PHS)		
HAP	lb/mmBtu	Ton/yr
acetaldehyde	8.300E-04	0.16
acrolein	4.00E-03	0.79
arsenic	7.90E-06	0.00
benzene	4.20E-03	0.83
beryllium	1.10E-06	0.00
cadmium	4.10E-06	0.00
chromium	2.10E-05	0.00
cobalt	6.50E-06	0.00
dichlorobenzene	0.00E+00	0.00
formaldehyde	4.40E-03	0.87
hydrochloric acid	1.90E-02	3.76
lead	4.80E-05	0.01
manganese	1.60E-03	0.32
methanol	0.00E+00	0.00
mercury* (lb/yr)	3.50E-06	1.39
n-hexane	0.00E+00	0.00
naphthalene	9.70E-05	0.02
nickel	3.30E-05	0.01
phenanthrene	7.00E-06	0.00
toluene	9.20E-04	0.18

Source of EF AP-42 2.4

HAPS EMISSIONS (Natural Gas)		
HAP	lb/10 ⁶ scf	Ton/yr
arsenic	2.00E-04	0.00
benzene	2.10E-03	0.00
beryllium	1.20E-05	0.00
cadmium	1.10E-03	0.00
chromium	1.30E-03	0.00
cobalt	8.40E-05	0.00
dichlorobenzene	1.20E-03	0.00
formaldehyde	7.50E-02	0.00
lead	5.00E-04	0.00
manganese	3.80E-04	0.00
mercury* (lb/yr)	2.60E-04	0.00
n-hexane	1.80E+00	0.00
naphthalene	6.10E-04	0.00
nickel	2.10E-03	0.00
phenanthrene	1.70E-05	0.00
toluene	3.40E-03	0.00

Fiberight, LLC
Boiler #2 Potential to Emit

Heat Input (mmBtu/hr)	47.57
Total Gas fired (MMBtu)	1016
Btu/Scf Natural Gas	1020
Natural Gas (scf)	996078
Annual Hours of operation	8322
PHS (btu/lb) (dry)	8923

Pollutant	Ton/Year
Carbon Monoxide (CO)	43.59
Oxides of Nitrogen (Nox)	19.82
Sulfur Dioxide (SO ₂)	4.95
Particulate Matter (PM)	5.94
Particulate Matter < 10 µm (PM ₁₀)	4.36
Particulate Matter < 2.5 µm (PM _{2.5})	3.96
Volatile Organic Coumpounds	2.58
ammonia	0.00
HAPS	8.3

Emissions Factors Biomass (PHS)			
Pollutant	Emission Factor (lb/mmBtu)	Emission Factor (lb/hr)	Source
Carbon Monoxide (CO)	0.22	10.47	Emission factors provided by manufacturer (AP-42 1.6)
Oxides of Nitrogen (Nox)	0.1	4.76	Emission factors provided by manufacturer (AP-42 1.6)
Sulfur Dioxide (SO ₂)	0.025	1.19	Emission factors provided by manufacturer (AP-42 1.6)
Particulate Matter (PM)	0.03	1.43	Emission factors provided by manufacturer (AP-42 1.6)
Particulate Matter < 10 µm (PM ₁₀)	0.022	1.05	Emission factors provided by manufacturer (AP-42 1.6)
Particulate Matter < 2.5 µm (PM _{2.5})	0.02	0.95	Emission factors provided by manufacturer (AP-42 1.6)
Volatile Organic Coumpounds	0.013	0.62	Emission factors provided by manufacturer (AP-42 1.6)

Emissions Factors Natural Gas / Bio-methane			
Pollutant	Emission Factor (lb/10 ⁶ scf)	Total lb/yr	Source
Carbon Monoxide (CO)	84	83.67	Emission factors provided by manufacturer (AP-42 1.4)
Oxides of Nitrogen (Nox)	50	49.80	Emission factors provided by manufacturer (AP-42 1.4)
Sulfur Dioxide (SO ₂)	0.6	0.60	Emission factors provided by manufacturer (AP-42 1.4)
Particulate Matter (PM)	7.6	7.57	Emission factors provided by manufacturer (AP-42 1.4)
Particulate Matter < 10 µm (PM ₁₀)	7.6	7.57	Emission factors provided by manufacturer (AP-42 1.4)
Particulate Matter < 2.5 µm (PM _{2.5})	7.6	7.57	Emission factors provided by manufacturer (AP-42 1.4)
Volatile Organic Coumpounds	5.5	5.48	Emission factors provided by manufacturer (AP-42 1.4)

Controls

Baghouse for PM

SNCR for Nox, Manufacturer performance guarantee reduced EF from 0.22 lb/mmBtu to 0.10 lb/mmBtu

Fiberight, LLC
Boiler #2 Potential to Emit

HAPS EMISSIONS (PHS)		
HAP	lb/mmBtu	Ton/yr
acetaldehyde	8.300E-04	0.16
acrolein	4.00E-03	0.79
arsenic	7.90E-06	0.00
benzene	4.20E-03	0.83
beryllium	1.10E-06	0.00
cadmium	4.10E-06	0.00
chromium	2.10E-05	0.00
cobalt	6.50E-06	0.00
dichlorobenzene		0.00
formaldehyde	4.40E-03	0.87
hydrochloric acid	1.90E-02	3.76
lead	4.80E-05	0.01
manganese	1.60E-03	0.32
methanol		0.00
mercury* (lb/yr)	3.50E-06	1.39
n-hexane		0.00
naphthalene	9.70E-05	0.02
nickel	3.30E-05	0.01
phenanthrene	7.00E-06	0.00
toluene	9.20E-04	0.18

Source of EF AP-42 2.4

HAPS EMISSIONS (Natural Gas)		
HAP	lb/10 ⁶ scf	Ton/yr
arsenic	2.00E-04	0.00
benzene	2.10E-03	0.00
beryllium	1.20E-05	0.00
cadmium	1.10E-03	0.00
chromium	1.30E-03	0.00
cobalt	8.40E-05	0.00
dichlorobenzene	1.20E-03	0.00
formaldehyde	7.50E-02	0.00
lead	5.00E-04	0.00
manganese	3.80E-04	0.00
mercury* (lb/yr)	2.60E-04	0.00
n-hexane	1.80E+00	0.00
naphthalene	6.10E-04	0.00
nickel	2.10E-03	0.00
phenanthrene	1.70E-05	0.00
toluene	3.40E-03	0.00

Fiberight, LLC
Scrubber #1 Potential to Emit

Operating Rate (Tons MSW/year)	214000
Operating Hours	8760
Capture Efficiency	90%
Control Efficiency	95%
VOC Emission (lb/hour)	14.64
VOC Emission (Ton/Year)	2.89

Pollutant	ppmv	Ton/year
acetaldehyde	0.08	0.00
acrolein	0.00	0.00
arsenic	0.00	0.00
benzene	2.40	0.01
beryllium	0.00	0.00
cadmium	0.00	0.00
chromium	0.00	0.00
cobalt	0.00	0.00
dichlorobenzene	1.15	0.00
formaldehyde	0.01	0.00
hydrochloric acid	5.00	0.02
lead	0.00	0.00
manganese	0.00	0.00
methanol	0.00	0.00
mercury	0.00	0.00
n-hexane	6.57	0.02
napthalene	0.00	0.00
nickel	0.00	0.00
phenanthrene	0.00	0.00
toluene	29.50	0.10

VOC Emission Factor			
Organic Compounds Rumpke Landfill	157.38	lb/hr	Ohio EPA Permit #P0112360
MSW Received at Rumpke 2011	2300000	ton/yr	Ohio EPA Permit #P0112360; PTE
Annual MSW Fiberight ME	214000	ton/yr	Maximum planned annual receipts
Organics to Scrubber	14.6432	lb/hr	Ratio (185000/2300000)*157.38 = 12.66
Reference VOC Concentration	835	ppm	

Fiberight, LLC
Scrubber #1 Potential to Emit

Operating Rate (Tons MSW/year)	214000
Operating Hours	8760
Capture Efficiency	90%
Control Efficiency	95%
VOC Emission (lb/hour)	14.64
VOC Emission (Ton/Year)	2.89

Pollutant	ppmv	Ton/year
acetaldehyde	0.08	0.00
acrolein	0.00	0.00
arsenic	0.00	0.00
benzene	2.40	0.01
beryllium	0.00	0.00
cadmium	0.00	0.00
chromium	0.00	0.00
cobalt	0.00	0.00
dichlorobenzene	1.15	0.00
formaldehyde	0.01	0.00
hydrochloric acid	5.00	0.02
lead	0.00	0.00
manganese	0.00	0.00
methanol	0.00	0.00
mercury	0.00	0.00
n-hexane	6.57	0.02
napthalene	0.00	0.00
nickel	0.00	0.00
phenanthrene	0.00	0.00
toluene	29.50	0.10

VOC Emission Factor			
Organic Compounds Rumpke Landfill	157.38	lb/hr	Ohio EPA Permit #P0112360
MSW Received at Rumpke 2011	2300000	ton/yr	Ohio EPA Permit #P0112360; PTE
Annual MSW Fiberight ME	214000	ton/yr	Maximum planned annual receipts
Organics to Scrubber	14.6432	lb/hr	Ratio (185000/2300000)*157.38 = 12.66
Reference VOC Concentration	835	ppm	