



ADAGE

An ABEVA/Duke Energy  
advanced biopower company

June 19, 2009

Via Electronic Mail and U.S. Mail

Florida Department of Environmental Protection  
Bureau of Air Regulation, Division of Air Resource Management  
2600 Blair Stone Road, M.S. 5500  
Tallahassee, FL 32399-2400

Attention: Mr. Alvaro Linero, Director of Special Projects  
(alvaro.linero@dep.state.fl.us)

**RE: Air Construction Permit No. 0470016-001-AC  
Supplement Request No. 01 – 061809 – Submission of Additional  
Information  
Application for ADAGE Hamilton LLC - Air Construction Permit  
Proposed Nominal 50 MW Woody Biomass Electric Power Plant  
Hamilton County, Florida**

Dear Mr. Linero:

ADAGE Hamilton LLC (ADAGE) submitted an application for an air construction permit to the Florida Department of Environmental Protection, Bureau of Air Regulation, Division of Air Resource Management (Bureau) on May 20, 2009 for the construction of a proposed nominal 50 MW Woody Biomass Electric Power Plant to be located in Hamilton County, Florida.

ADAGE, the applicant, hereby submits additional information (referred to as Supplement #01-061809) to support the information provided in the initial air construction permit application dated May 20, 2009. The information being provided specifically pertains to updated regulated air pollutant emissions data and other data needs defined by the Bureau.

The ADAGE original permit application was based on preliminary negotiations with boiler vendors and their preliminary responses to ADAGE's Request for Proposal (RFP). At the same time we were preparing the permit application we were continually pressing our potential vendors to provide us with the lowest possible emission guarantees attainable by our selected technology and our available fuel. We are happy to report to the Bureau that we have now received final proposals from each vendor and we have negotiated lower emissions guarantees. Based on these final documents we are now able to revise our emission estimates downward as follows:

- A reduction in PM/PM<sub>10</sub> emissions by nearly 55%. This is a reduction in PM/PM<sub>10</sub> emissions of approximately 135 tons/year from the proposed woody biomass boiler;
- A reduction in SO<sub>2</sub> emissions by 35%. This is a reduction in SO<sub>2</sub> emissions of approximately 96 tons/year from the proposed woody biomass boiler;
- A reduction in H<sub>2</sub>SO<sub>4</sub> emissions by 35%. This is a reduction in H<sub>2</sub>SO<sub>4</sub> emissions of approximately 15 tons/year from the proposed woody biomass boiler; and
- A reduction in NO<sub>x</sub> and CO emissions, each by 5% or 13 tons/year.

Furthermore the maximum boiler design being evaluated by ADAGE has a maximum instantaneous boiler rating among the potential vendors of 758 MMBTU/hr, a bit lower than our preliminary estimate of 800 MMBTU/hr. This updated boiler rating has been conservatively used to calculate regulated air pollutant emission rates from the proposed biomass boiler while combusting woody biomass.

The data contained in this supplement to the air construction permit application is intended to update the emission estimates presented in the initial application and is based on the latest technical information provided by the boiler vendors being evaluated by ADAGE.

As you consider these emission limits please keep in mind that the project intends to use wood residue materials that in some cases would otherwise be subject to open burning or igniting by lightning strikes and result in forest fires. ADAGE believes that the utilization of these materials as a renewable energy feedstock reduces overall emissions in the region.

ADAGE is also proposing the use of Best Management Practices (BMP) for its Fuel receiving, Handling, Storage and Processing operation. A document summarizing these BMPs is attached to this letter and is referred to as Attachment B. ADAGE also identified in the initial air construction permit application the types of woody biomass to be utilized as fuel in the fluidized bed boiler. ADAGE is not proposing to utilize agricultural type fuels.

ADAGE has also conducted a voluntary air quality impact evaluation that demonstrates the emissions being proposed from the plant would be well below the air quality standards established by the Florida DEP and U.S. EPA. The methodology and the results of that analysis were recently shared with the Bureau during our meeting in Tallahassee on June 10, 2009. That evaluation is now being updated to reflect the reduction in air pollutant emissions addressed in this supplement document. The results of that evaluation, which demonstrated compliance with the state and federal health standards, will be submitted to the Bureau under separate cover.

It is our understanding that by submission of this additional information (i.e., supplement to the air construction permit application), the Bureau will have an additional thirty (30) days from the date of this submittal (June 19, 2009) to review the original application,

Included with this submittal is the following information:

- Attachment A – Revised air pollutant emission limit summary table;
- Attachment B – Best Management Practices for the Fuel Receiving, Handling, Storage and Processing operation;
- Updated tables from the initial application dated May 20, 2009. Tables 2-1, 2-2, 2-3, 2-11 and 2-13; and
- Completed DEP Form No. 62-210.900 (1) – Professional Engineer Certification.

Should you have any questions, please do not hesitate to contact Ms. Vanessa Goff of ADAGE at (585) 749-7302. We look forward to continuing working with the Bureau on issuance of a construction permit for the proposed plant.

Very truly yours,  
ADAGE Hamilton LLC



Francis Reed Wills  
President



**Attachment A**  
**Revised Air Pollutant Emission Limits**  
**ADAGE Hamilton LLC - Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

Regulated Air Pollutant	Proposed Air Pollutant Emission Limits (Air Permit Application Dated May 20, 2009)	Regulatory Limits	Refined Air Pollutant Emission Limits
NO <sub>x</sub>	0.3 lbs/MMBtu (30-day rolling)  245 TPY (12-month rolling total)	NSPS Db 0.3 lbs/MMBtu	0.3 lbs/MMBtu (30-day rolling)  232.4 TPY (12-month rolling total)
CO	245 TPY (12-month rolling total)	N/A	232.4 TPY (12-month rolling total)
SO <sub>2</sub>	0.18 lbs/MMBtu (hourly) 245 TPY (12-month rolling total)	0.32 lbs/MMBtu SO <sub>2</sub> Applicability Threshold under NSPS Db	0.18 lbs/MMBtu (hourly) 149.4 TPY (12-month rolling total)
H <sub>2</sub> SO <sub>4</sub>	No limits proposed  Application identified H <sub>2</sub> SO <sub>4</sub> emission rate of 40 TPY for woody biomass	N/A	No limits proposed. Refined emission rate is 25.6 TPY for woody biomass
PM/PM <sub>10</sub>	0.066 lbs/MMBtu  (Total PM/PM <sub>10</sub> )  Resulted in 231 TPY (Total PM/PM <sub>10</sub> )	(PM Filterable Only) 0.03 lbs/MMBtu  NSPS Db	0.029 lbs/MMBtu  (Total PM/PM <sub>10</sub> )  Resulted in 96.3 TPY (Total PM/PM <sub>10</sub> )
VOC	No Limits Proposed  Application identified VOC emission rate of 60 TPY for woody biomass	N/A	No limits proposed. Refined emission rate is 56.4 TPY for woody biomass

Notes:

- 1) Proposed woody biomass boiler heat input revised from 800 to 758 MMBtu/hr based on updated boiler vendor specifications.
- 2) Ton per year (TPY) estimates based on boiler heat input of 758 MMBtu/hr, appropriate average emission factor (i.e., lbs/MMBtu) and 8,760 hours per year. The emission factor employed is a long term average, including curtailment and scheduled outages. Shorter term emissions may exceed this average factor.

**ATTACHMENT B**  
**ADAGE Hamilton LLC**  
**Nominal 50 MW Woody Biomass Power Plant, Hamilton County Florida**  
**Best Management Practices for the Fuel Receiving, Handling, Storage and Processing Operations**

Practice	Description
<p>Best Management Practice - Fire Prevention / Spontaneous Combustion Minimization</p>	<ol style="list-style-type: none"> <li>1) Contact local fire marshal to develop fire management plan. Plan will be maintained on site.</li> <li>2) Fire Management plan to include a) requirement to train onsite personnel to handle incipient fires and training on the identification of potential fire hazards and 2) install and maintain equipment for plant personnel to handle incipient fires. The local fire department will be invited to participate in onsite training</li> <li>3) Daily observations of the woody biomass storage areas will be performed by plant personnel to identify potential fire hazards. Plant personnel will be trained on identification of potential fire hazards.</li> <li>4) Signs will be posted at the plant, which identify potential fire hazards.</li> <li>5) Incoming unprocessed materials will be stored in areas with a clearance between each storage area.</li> <li>6) The stacker reclaimer being used will maximize the removal of older material in order to minimize the stacking of newer material on top of older material</li> <li>7) Fine woody biomass material will be minimized in the storage areas.</li> <li>8) Compaction of woody biomass materials in the storage areas will be minimized.</li> </ol>
<p>Best Management Practice - Minimization of Fugitive Dust</p>	<ol style="list-style-type: none"> <li>1) Conveyor systems and associated drop points will be enclosed or partially enclosed.</li> <li>2) Drop points to woody biomass storage areas will be designed to minimize the overall exposed (or exposed to atmosphere) drop height, where technically feasible.</li> <li>3) Periodic equipment maintenance will be performed to maintain conveyor systems and associated drop point integrity. Appropriate plant records will be maintained on equipment maintenance performed.</li> <li>4) Fuel silos will be equipped with vent filters.</li> <li>5) Daily observations of the conveyor systems and associated drop point integrity to identify any equipment abnormalities.</li> <li>6) Plant personnel will be trained on identification of warning signs for potential equipment malfunctions.</li> <li>7) Signs will be posed identifying potential warnings signs of equipment malfunction.</li> <li>8) Procedures will be established for defining excessive fugitive dust from woody biomass truck unloading operations. Plant personnel will visual observe truck unloading operations and if excessive fugitive dust is detected appropriate fugitive dust minimization techniques will be implemented. Plant personnel will be trained on procedures for defining and minimizing excessive dust from the truck unloading operations.</li> <li>9) All major roadways at the plant will be paved.</li> <li>10) Mud, dirt or similar debris will be removed promptly from the paved roads.</li> <li>11) Develop a paved roadway dust minimization plan. If excessive dust is detected by plant personnel implement procedures contained in the dust minimization plan. These procedures could include roadway sweeping, watering or other techniques to minimize dust generation.</li> <li>12) Plant personnel will be trained on what constitutes excessive dust on the paved roadways.</li> </ol>
<p>Storage Pile Management</p>	<ol style="list-style-type: none"> <li>1) Woody biomass storage areas will be managed to avoid excessive wind erosion.</li> <li>2) Fine materials will be minimized to avoid excessive wind erosion.</li> <li>3) A woody biomass fugitive dust management plan will be developed and maintained onsite. Plan will identify warning signs for conditions that could result in excessive fugitive dust formation. Plant personnel will be trained on what warning signs to look for.</li> <li>4) Mechanical moving of woody biomass by front end loaders and other supporting equipment will be minimized on high wind event days.</li> <li>5) Daily visual observations of the woody biomass storage areas will be performed and if conditions are right for fugitive dust formation, procedures from the fugitive dust plan will be implemented.</li> </ol>

**Table 2-1**  
**Summary of Worst Case Potential to Emit Regulated New Source Review (NSR) Air Pollutants and NSR Regulatory Applicability**  
**ADAGE Hamilton LLC Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

<b>Estimated Potential to Emit (PTE) Criteria Air Pollutants (tons per year)<sup>(a)</sup></b>										
<b>Source Operation</b>	<b>Reference</b>	<b>PM</b>	<b>PM<sub>10</sub></b>	<b>PM<sub>2.5</sub></b>	<b>NO<sub>x</sub></b>	<b>SO<sub>2</sub></b>	<b>H<sub>2</sub>SO<sub>4</sub></b>	<b>CO</b>	<b>VOC</b>	<b>Fluorides</b>
Woody Biomass Fluidized Bed Boiler	Tables 2-2 & 2-3	96.3	96.3	96.3	232.4	149.4	25.6	232.4	56.4	27.1
Woody Biomass Handling and Processing	Table 2-7	15.70	7.43	1.12	--	--	--	--	--	--
Fly Ash Handling	Table 2-7	0.10	0.05	0.007	--	--	--	--	--	--
Boiler Support Material Handling	Table 2-7	0.03	0.01	0.002	--	--	--	--	--	--
Emergency Generator & Storage Tank	Table 2-8	0.09	0.09	0.09	2.9	0.003	0.0002	1.6	2.9	--
Emergency Boiler Coolant Water Pump & Storage Tank	Table 2-9	0.02	0.02	0.02	0.4	0.12	0.01	0.3	0.6	--
Emergency Fire Pump & Storage Tank	Table 2-10	0.02	0.02	0.02	0.4	0.12	0.01	0.3	0.4	--
<b>Project Total PTE Excluding Fugitive Sources<sup>(a)</sup></b>		<b>112</b>	<b>104</b>	<b>98</b>	<b>236</b>	<b>150</b>	<b>26</b>	<b>235</b>	<b>60</b>	<b>27</b>
<b>Major Source Threshold Rates<sup>(b)</sup> (tons per year)</b>		<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>	<b>250</b>
<b>Project Classified as Major Source Under PSD?</b>		<b>no</b>	<b>no</b>	<b>no</b>	<b>no</b>	<b>no</b>	<b>no</b>	<b>no</b>	<b>no</b>	<b>no</b>
<b>Fugitive Source Operation</b>	<b>Reference</b>	<b>PM</b>	<b>PM<sub>10</sub></b>	<b>PM<sub>2.5</sub></b>	<b>NO<sub>x</sub></b>	<b>SO<sub>2</sub></b>	<b>H<sub>2</sub>SO<sub>4</sub></b>	<b>CO</b>	<b>VOC</b>	<b>Fluorides</b>
In-plant Paved Roads	Table 2-4	24.0	4.7	0.7	--	--	--	--	--	--
Woody Biomass Pile Processing	Table 2-5	1	0.08	0.01	--	--	--	--	--	--
Woody Biomass Pile Wind Erosion	Table 2-6	2.7	1.3	0.2	--	--	--	--	--	--
<b>Total Fugitive Source PTE</b>		<b>28</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>Project Total PTE Including Fugitive Sources</b>		<b>140</b>	<b>110</b>	<b>99</b>	<b>236</b>	<b>150</b>	<b>26</b>	<b>235</b>	<b>60</b>	<b>27</b>

**Notes:**

(a) Fugitive emission sources are excluded from the estimated project total emissions for purpose of determining major source status per F.A.C. 62-210.200(195)(c).

(b) Proposed woody biomass boiler will be capable of natural gas and/or propane (classified as fossil fuels) combustion for startup, shutdown, and bed stabilization purposes and woody biomass (classified as a renewable energy fuel) for normal operations. The heat input of the natural gas and/or propane burners will be less than 250 mmBtu/hour. Because the boiler will not be capable of burning fossil fuels at a heat input rate of greater than 250 mmBtu/hour, the 100-ton/year major source threshold rate does not apply to this project.

(c) Ton per year (TPY) estimates based on boiler heat input of 758 MMBtu/hr, appropriate average emission factor (i.e., lbs/MMBtu) and 8,760 hours per year. The emission factor employed is a long term average, including curtailment and scheduled outages. Short term emissions may exceed this average factor.

**Table 2-2**  
**Estimated Potential to Emit Regulated NSR Air Pollutants from the Proposed Woody Biomass Fluidized Bed Boiler**  
**ADAGE Hamilton LLC Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

Operating Scenario		Startup, Shutdown, and Bed Stabilization <sup>(a)</sup>		Normal <sup>(b)</sup>		Worst-Case	
Applicable Time Period		Maximum Hourly	Maximum Annual	Maximum Hourly	Maximum Annual	Maximum Hourly (lb/hr)	Maximum Annual (tpy)
Heat Input, H (mmBtu/hr)		240	240	758	758	--	--
Annual Operating Hours, T (hours/year)		--	8760	--	8760	--	--
<b>PM<sub>f</sub></b> <b>(Filterable)</b>	Emission Factor (lb/mmBtu)	0.0056	0.0056	0.01	0.01	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	1.34	5.87	8	33	8	33
<b>PM<sub>c</sub></b> <b>(Condensable)</b>	Emission Factor (lb/mmBtu)	0.0019	0.0019	0.019	0.019	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	0.45	1.96	14	63	14	63
<b>PM</b> <b>(Total)</b>	Emission Factor (lb/mmBtu)	0.0075	0.0075	0.029	0.029	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	1.79	7.83	22	96.3	22	96.3
<b>PM<sub>10</sub></b>	Emission Factor (lb/mmBtu)	0.0075	0.0075	0.029	0.029	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	1.79	7.83	22	96.3	22	96.3
<b>PM<sub>2.5</sub></b>	Emission Factor (lb/mmBtu)	0.0075	0.0075	0.029	0.029	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	1.8	7.8	22	96.3	22	96.3
<b>NO<sub>x</sub></b> <sup>(d)</sup>	Emission Factor (lb/mmBtu)	0.3	0.2	0.3	0.07	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	72	210	227	232	227	232.4
<b>SO<sub>2</sub></b> <sup>(c,d)</sup>	Emission Factor (lb/mmBtu)	0.0006	0.0006	0.180	0.045	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	0.1	0.6	136	149.4	136	149.4
<b>H<sub>2</sub>SO<sub>4</sub></b> <b>(Aerosols and Mist)</b>	Emission Factor (lb/mmBtu)	0.00004	0.00004	0.012	0.0077	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	0.009	0.040	9	25.6	9	25.6
<b>CO</b> <sup>(d)</sup>	Emission Factor (lb/mmBtu)	0.082	0.082	0.6	0.07	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	20	87	455	232	455	232.4
<b>VOC</b>	Emission Factor (lb/mmBtu)	0.0054	0.0054	0.017	0.017	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	1.3	5.7	13	56.4	13	56.4
<b>Fluorides</b> <sup>(e)</sup>	Emission Factor (lb/mmBtu)	0.0000	0.0000	0.008	0.008	--	--
	Emission Rate (lb/hr "hourly" & tpy "annual")	0.0	0.0	6	27	6	27.1

**Calculation Method:**

Maximum Hourly Emission Rate (lb/hr) = Maximum Hourly Heat Input (mmBtu/hr) x Maximum Hourly Emission Factor (lb/mmBtu)

Annual Emission Rate (tons/year) = Average Heat Input (mmBtu/hr) x Average Annual Emission Factor (lb/mmBtu) x Annual Operating Hours (hr/year) / (2000 lb/ton)

**Sample Calculations:**

Maximum Hourly PM Emission Rate for Normal Operating Scenario,

$$8 \text{ lb/hr} = 758 \text{ mmBtu/hr} \times 0.01 \text{ lb/mmBtu}$$

Annual PM Emission Rate for Normal Operating Scenario,

$$33 \text{ ton/year} = 758 \text{ mmBtu/hr} \times 0.01 \text{ lb/mmBtu} \times 8760 \text{ hours/year} / (2000 \text{ lb/ton})$$

**Notes:**

(a) Startup fuel is natural gas. Emission Factors based on AP-42 or NSPS (refer to Table 2-3).

(b) Normal operating fuel is woody biomass. Emission factors based on AP-42, NSPS, or fuel sample testing (refer to Table 2-3).

(c) Reduction of hydrogen fluoride (HF) can reasonably be expected with dry sorbent injection (DSI). Most of the fluoride emissions are expected to occur in the form of HF emissions. However, it was assumed no DSI occurs for calculation of worst-case estimated PTE fluoride rates.

(d) Maximum annual emission factor provided for informational purposes only. Continuous emission monitoring system (CEMS) will be used to demonstrate compliance with the federally enforceable annual emission limit. Short-term emission estimates are provided for informational purposes only. Ton per year (TPY) estimates based on boiler heat input of 758 MMBtu/hr, appropriate average emission factor (i.e., lbs/MMBtu) and 8,760 hours per year. The emission factor employed is a long term average, including curtailment and scheduled outages. Short term emissions may exceed this average factor.



**Table 2-3**  
**Emission Factors and References Used for Estimating Criteria Air Pollutant Emissions from the Proposed Woody Biomass Boiler**  
**ADAGE Hamilton LLC Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

Operating Scenario	Applicable Time Period	Startup, Shutdown and Bed Stabilization: Natural Gas Combustion		Normal: Woody Biomass Combustion	
		Emission Factor (lb/mmBtu)	Reference	Emission Factor (lb/mmBtu) <sup>(f)</sup>	Reference
PM <sub>f</sub> (Filterable)	Annual	0.0056	AP-42 Table 1.4-2	0.01	Engineering Estimate
	Hourly	0.0056	AP-42 Table 1.4-2	0.01	Engineering Estimate
PM <sub>c</sub> (Condensable)	Annual	0.0019	AP-42 Table 1.4-2	0.019	Engineering Estimate <sup>(a)</sup>
	Hourly	0.0019	AP-42 Table 1.4-2	0.019	Engineering Estimate <sup>(a)</sup>
PM (Total)	Annual	0.0075	Sum of PM <sub>f</sub> and PM <sub>c</sub>	0.029	Sum of PM <sub>f</sub> and PM <sub>c</sub>
	Hourly	0.0075	Sum of PM <sub>f</sub> and PM <sub>c</sub>	0.029	Sum of PM <sub>f</sub> and PM <sub>c</sub>
PM <sub>10</sub>	Annual	0.0075	AP-42 Table 1.4-2	0.029	Assume PM <sub>10</sub> = PM
	Hourly	0.0075	AP-42 Table 1.4-2	0.029	Assume PM <sub>10</sub> = PM
PM <sub>2.5</sub>	Annual	0.0075	AP-42 Table 1.4-2	0.029	Assume PM <sub>2.5</sub> = PM
	Hourly	0.0075	AP-42 Table 1.4-2	0.029	Assume PM <sub>2.5</sub> = PM
NO <sub>x</sub>	Annual	0.2	Engineering Estimate <sup>(c)</sup>	0.07	Engineering Estimate <sup>(c)</sup>
	Hourly	0.3	NSPS Subpart Db <sup>(b)</sup>	0.3	NSPS Subpart Db <sup>(b-2)</sup>
SO <sub>2</sub>	Annual	0.0006	AP-42 Table 1.4-2	0.045	Engineering Estimate <sup>(c)</sup>
	Hourly	0.0006	AP-42 Table 1.4-2	0.18	Engineering Estimate <sup>(d)</sup>
H <sub>2</sub> SO <sub>4</sub> (Aerosols and Mist)	Annual	0.00004	Engineering Estimate <sup>(e)</sup>	0.0077	Engineering Estimate <sup>(e,n)</sup>
	Hourly	0.00004	Engineering Estimate <sup>(e,n)</sup>	0.012	Engineering Estimate <sup>(e,n)</sup>
CO	Annual	0.082	AP-42 Table 1.4-1	0.07	Vendor Estimate <sup>(g)</sup>
	Hourly	0.082	AP-42 Table 1.4-1	0.6	AP-42 Table 1.6-2
VOC	Annual	0.0054	AP-42 Table 1.4-2	0.017	Engineering Estimate
	Hourly	0.0054	AP-42 Table 1.4-2	0.017	Engineering Estimate
Fluorides	Annual	0	Engineering Estimate <sup>(h)</sup>	0.008	Engineering Estimate <sup>(i)</sup>
	Hourly	0	Engineering Estimate <sup>(h)</sup>	0.008	Engineering Estimate <sup>(i)</sup>

**Notes:**

- (a) AP-42 Table 1.6-1 emission factor is 0.017 lb/mmBtu condensable PM. The emission factor of 0.07 lb/mmBtu was used to provide a conservative estimate of the condensable fraction of PM emissions and to account for potential ammonium sulfate formation.
- (b) NSPS Subpart Db limit is 0.3 lb/mmBtu for NO<sub>x</sub> when co-firing natural gas and woody biomass.
- (c) Estimated annual average emission factor required to maintain minor source status. Continuous emission monitoring system (CEMS) will be used to demonstrate compliance.
- (d) Based on upper limit of 95% confidence interval from testing of fuel woods representative of proposed fuel supply as indicated in Tables 2-3A through 2-3F.
- (e) Assumed that 5% of the uncontrolled sulfur dioxide is further oxidized to sulfur trioxide and combined with water to form sulfuric acid
- (f) Factors are based on "Maximum Hourly" SO<sub>2</sub> emission factor as noted above.
- (g) Vendor estimated CO emission rate with good combustion practice control measures.
- (h) It was assumed that natural gas combustion results in no emission of fluorides
- (i) Based on the upper limit of 95% confidence interval for fluorine content of a sample of representative wood fuels as indicated in Tables 2-3A through 2-3F. Assumed 100% of the fluorine in the fuel is emitted as hydrogen fluoride (HF).
- (j) Annual emission factor is a long term average, including curtailment and scheduled outages. Short term emissions may exceed this average factor.

**Table 2-11**  
**Facility Wide Summary of Potential to Emit (PTE) Regulated Hazardous Air Pollutants (HAPs)**  
**ADAGE Hamilton LLC Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

Compound <sup>(a)</sup>	ID/CAS Number	Woody Biomass Boiler Worst Case PTE (tpy)			Emergency Generator PTE (tpy)	Emergency Coolant Pump PTE (tpy)	Emergency Fire Pump PTE (tpy)	Facility Total PTE (tpy)	Major Source of HAP <sup>(b)</sup>
		Wood	Natural Gas or Propane	Worst Case					
Acetaldehyde	75-07-0	1.6E-01		1.6E-01	5.88E-05	3.66E-04	3.66E-04	1.57E-01	no
Acetophenone	98-86-2	1.06E-05		1.06E-05				1.06E-05	no
Acrolein	107-02-8	3.25E-02		3.25E-02	1.84E-05	4.41E-05	4.41E-05	3.26E-02	no
Benzene	71-43-2	3.70E-02	2.16E-03	3.70E-02	1.81E-03	4.45E-04	4.45E-04	3.97E-02	no
bis(2-Ethylhexyl)phthalate	117-81-7	2.32E-01		2.32E-01				2.32E-01	no
Bromomethane	74-83-9	7.90E-03		7.90E-03				7.90E-03	no
Carbon tetrachloride	56-23-5	1.40E-02		1.40E-02				1.40E-02	no
Chlorine	7782-50-5	0.9		0.9				0.9	no
Chlorobenzene	108-90-7	2.50E-02		2.50E-02				2.50E-02	no
Chloroform	67-66-3	1.70E-02		1.70E-02				1.70E-02	no
Chloromethane	74-87-3	7.67E-02		7.67E-02				7.67E-02	no
Dibutylphthalate	84-74-2	2.25E-01		2.25E-01				2.25E-01	no
1,4-Dichlorobenzene	106-46-7	1.69E-01	1.24E-03	1.69E-01				1.69E-01	no
2,4-Dinitrophenol	51-28-5	1.21E-01		1.21E-01				1.21E-01	no
Ethylbenzene	100-41-4	1.90E-03		1.90E-03				1.90E-03	no
Formaldehyde	50-00-0	5.87E-01	7.73E-02	5.87E-01	1.84E-04	5.63E-04	5.63E-04	5.88E-01	no
Hexachlorobenzene	118-74-1	7.17E-04		7.17E-04				7.17E-04	no
Hexane	110-54-3		1.9	1.9				1.9	no
Methyl chloroform	71-55-6	1.90E-02		1.90E-02				1.90E-02	no
Methylene chloride	75-09-2	5.58E-03		5.58E-03				5.58E-03	no
4-Nitrophenol	100-02-7	1.16E-01		1.16E-01				1.16E-01	no
Pentachlorophenol	87-86-5	7.17E-04		7.17E-04				7.17E-04	no
Phenol	108-95-2	1.39E-01		1.39E-01				1.39E-01	no
Propionaldehyde	123-38-6	2.03E-01		2.03E-01				2.03E-01	no
Styrene	100-42-5	1.86E-03		1.86E-03				1.86E-03	no
Tetrachloroethene	127-18-4	1.80E-02		1.80E-02				1.80E-02	no
Toluene	108-88-3	1.53E-02	3.50E-03	1.53E-02	6.55E-04	1.95E-04	1.95E-04	1.63E-02	no
1,1,1-Trichloroethane	71-55-6	1.90E-02		1.90E-02				1.90E-02	no
Trichloroethene	79-01-6	1.88E-02		1.88E-02				1.88E-02	no
2,4,6-Trichlorophenol	25167-82-2	7.18E-04		7.18E-04				7.18E-04	no
Vinyl Chloride	75-01-4	1.04E-02		1.04E-02				1.04E-02	no
Xylenes (mixed)	1330-20-7	1.35E-02		1.35E-02	4.50E-04	1.36E-04	1.36E-04	1.42E-02	no
o-Xylene	95-47-6	1.15E-02		1.15E-02				1.15E-02	no
<b>Hydrogen chloride</b>	<b>7647-01-0</b>	<b>9.7</b>		<b>9.7</b>				<b>9.7</b>	<b>no</b>
Hydrogen fluoride	7664-39-3	5.0		5.0				5.0	no
Polycyclic Organic Matter (POM) <sup>(c)</sup>	POM	2.2E-02	7.2E-04	2.2E-02	4.94E-04	8.01E-05	8.01E-05	2.3E-02	no
1,3-Butadiene	106-99-0					1.87E-05	1.87E-05	3.73E-05	no
Naphthalene	91-20-3	1.36E-02	6.29E-04	1.36E-02	3.03E-04	4.04E-05	4.04E-05	1.40E-02	no
Dioxins and Furans (D/F) <sup>(d)</sup>	DF	9.5E-05		9.5E-05				9.5E-05	no
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	1.65E-08		1.65E-08				1.65E-08	no
Regulated Trace Elements	TRACE	1.2	5.7E-03	1.2				1.2	no
Antimony	7440-36-0	5.73E-03		5.73E-03				5.73E-03	no
Arsenic	7440-38-2	1.60E-02	2.06E-04	1.60E-02				1.60E-02	no
Beryllium	7440-41-7	8.48E-05	1.24E-05	8.48E-05				8.48E-05	no
Cadmium	7440-43-9	3.11E-03	1.13E-03	3.11E-03				3.11E-03	no
Chromium, total	7440-47-3	3.09E-02	1.44E-03	3.09E-02				3.09E-02	no
Cobalt	7740-48-4	2.49E-03	8.66E-05	2.49E-03				2.49E-03	no
Lead	7439-92-1	1.66E-01		1.66E-01				1.66E-01	no
Manganese	7439-96-5	0.8	3.92E-04	0.8				0.8	no
Mercury	7439-97-6	6.19E-04	2.68E-04	6.19E-04				6.19E-04	no
Nickel	7440-02-0	4.82E-02	2.16E-03	4.82E-02				4.82E-02	no
Phosphorus	7723-14-0	6.41E-02		6.41E-02				6.41E-02	no
Selenium	7782-49-2	8.48E-03	2.47E-05	8.48E-03				8.48E-03	no
<b>HAP Total</b>				<b>21.0</b>	<b>3.67E-03</b>	<b>1.85E-03</b>	<b>1.40E-03</b>	<b>21.0</b>	<b>no</b>

**Notes:**

- a) Compounds indicated are regulated Individual HAPs or group of HAPs as defined under the Clean Air Act (Section 112b) and 40 CFR 63 Subpart C (updates to the CAA 112b list)
- b) Project is considered a major source of HAP if potential emissions exceed 10 tpy of any individual regulated HAP or 25 tpy of total regulated HAPs.
- c) POM subtotal includes Dioxins and Furans (D/F)
- d) D/F is not a regulated group of HAP but is shown for reference
- e) Refer to Tables 2-8, 2-9, 2-10, 2-12, and 2-13 for backup calculations.

**Color Code:**

ID Number Represents Group of Compounds  
 Subtotal of Multiple Compounds

**Table 2-13**  
**Potential to Emit Regulated Hazardous Air Pollutants (HAPs) Due to Combustion of Woody Biomass in the Fluidized Bed Boiler**  
**ADAGE Hamilton LLC Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

Regulated HAP <sup>(a)</sup>	ID/CAS Number <sup>(b)</sup>	Emission Factor (lb/MMBtu)	Reference <sup>(c)</sup>	Comments	Regulated Individual HAP <sup>(d)</sup> (X=yes)	POM <sup>(e,g)</sup> (X=yes)	D/F <sup>(f,g)</sup> (X=yes)	PTE (tpy) <sup>(h)</sup>
Acetaldehyde	75-07-0	4.71E-05	MACT FBC		X			1.6E-01
Acetophenone	98-86-2	3.20E-09	AP-42 Wood		X			1.06E-05
Acrolein	107-02-8	9.78E-06	MACT FBC	Removed outlier from database <sup>(h)</sup>	X			3.25E-02
Benzene	71-43-2	1.11E-05	MACT FBC		X			3.70E-02
bis(2-Ethylhexyl)phthalate	117-81-7	6.98E-05	MACT Wood		X			2.32E-01
Bromomethane	74-83-9	2.38E-06	MACT FBC		X			7.90E-03
Carbon tetrachloride	56-23-5	4.23E-06	MACT FBC		X			1.40E-02
Chlorine	7782-50-5	2.80E-04	MACT Wood		X			9.28E-01
Chlorobenzene	108-90-7	7.54E-06	MACT Wood		X			2.50E-02
Chloroform	67-66-3	5.13E-06	MACT FBC		X			1.70E-02
Chloromethane	74-87-3	2.31E-05	MACT FBC		X			7.67E-02
Dibutylphthalate	84-74-2	6.78E-05	MACT Wood		X			2.25E-01
1,4-Dichlorobenzene	106-46-7	5.10E-05	MACT Wood		X			1.69E-01
2,4-Dinitrophenol	51-28-5	3.65E-05	MACT Wood		X			1.21E-01
Ethylbenzene	100-41-4	5.73E-07	MACT FBC		X			1.90E-03
Formaldehyde	50-00-0	1.77E-04	MACT FBC		X			5.87E-01
Hexachlorobenzene	118-74-1	2.16E-07	MACT FBC		X			7.17E-04
Methyl chloroform	71-55-6	5.74E-06	MACT FBC		X			1.90E-02
Methylene chloride	75-09-2	1.68E-06	MACT FBC		X			5.58E-03
4-Nitrophenol	100-02-7	3.50E-05	MACT Wood		X			1.16E-01
Pentachlorophenol	87-86-5	2.16E-07	MACT FBC		X			7.17E-04
Phenol	108-95-2	4.18E-05	MACT FBC		X			1.39E-01
Propionaldehyde	123-38-6	6.11E-05	MACT FBC		X			2.03E-01
Styrene	100-42-5	5.60E-07	MACT FBC		X			1.86E-03
Tetrachloroethene	127-18-4	5.41E-06	MACT FBC		X			1.80E-02
Toluene	108-88-3	4.60E-06	MACT FBC		X			1.53E-02
1,1,1-Trichloroethane	71-55-6	5.74E-06	MACT FBC		X			1.90E-02
Trichloroethene	79-01-6	5.66E-06	MACT FBC		X			1.88E-02
2,4,6-Trichlorophenol	25167-82-2	2.16E-07	MACT FBC	Represents all trichlorophenol isomers	X			7.18E-04
Vinyl Chloride	75-01-4	3.13E-06	MACT FBC		X			1.04E-02
Xylenes (mixed)	1330-20-7	4.06E-06	MACT FBC	Mixed isomer subtotal <sup>(i)</sup>				1.35E-02
o-Xylene	95-47-6	3.47E-06	MACT FBC		X			1.15E-02
Hydrogen chloride	7647-01-0	1.58E-02	Custom	Woody biomass fuel sampling <sup>(k,l,m)</sup>	X			9.7
Hydrogen fluoride	7664-39-3	8.17E-03	Custom	Woody biomass fuel sampling <sup>(k,l,m)</sup>	X			5.0
Polycyclic Organic Matter (POM)	POM	6.8E-06		Group Regulated as Individual HAP <sup>(g,d)</sup>	X			2.2E-02
Acenaphthene	83-32-9	1.09E-07	MACT FBC			X		3.63E-04
Acenaphthylene	208-96-8	2.52E-07	MACT FBC			X		8.38E-04
Anthracene	120-12-7	1.12E-07	MACT FBC			X		3.73E-04
Benzo(a)anthracene	56-55-3	1.01E-07	MACT FBC			X		3.36E-04
Benzo(a)pyrene	50-32-8	4.31E-07	MACT FBC			X		1.43E-03
Benzo(b)fluoranthene	205-99-2	1.01E-07	MACT FBC			X		3.36E-04
Benzo(k)fluoranthene	207-08-9	1.00E-07	MACT FBC			X		3.34E-04
Benzo(i,k)fluoranthene	206-44-0	1.62E-07	MACT FBC			X		5.37E-04
Benzo(e)pyrene	192-97-2	2.10E-09	MACT FBC			X		6.99E-06

**Table 2-13**  
**Potential to Emit Regulated Hazardous Air Pollutants (HAPs) Due to Combustion of Woody Biomass in the Fluidized Bed Boiler**  
**ADAGE Hamilton LLC Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

Regulated HAP <sup>(a)</sup>	ID/CAS Number <sup>(b)</sup>	Emission Factor (lb/MMBtu)	Reference <sup>(c)</sup>	Comments	Regulated Individual HAP <sup>(d)</sup> (X=yes)	POM <sup>(e,g)</sup> (X=yes)	D/F <sup>(f,g)</sup> (X=yes)	PTE (tpy) <sup>(n)</sup>
Benzo(g,h,i)perylene	191-24-2	1.01E-07	MACT FBC			X		3.34E-04
Chrysene	218-01-9	1.02E-07	MACT FBC			X		3.38E-04
Decachlorobiphenyl	2051-24-3	4.04E-09	MACT FBC			X		1.34E-05
Dibenzo(a,h)anthracene	53-70-3	1.00E-07	MACT FBC			X		3.33E-04
Dichlorobiphenyl	DiCBP	1.53E-08	MACT FBC			X		5.07E-05
Fluoranthene	206-44-0	1.62E-07	MACT FBC			X		5.37E-04
Fluorene	86-73-7	1.21E-07	MACT FBC			X		4.02E-04
Heptachlorobiphenyl	HepCBP	2.44E-09	MACT FBC			X		8.09E-06
Hexachlorobiphenyl	HexCBP	2.75E-09	MACT FBC			X		9.15E-06
Indeno(1,2,3-cd)pyrene	193-39-5	1.00E-07	MACT FBC			X		3.33E-04
2-Methylnaphthalene	91-57-6	4.05E-08	MACT FBC			X		1.34E-04
Monochlorobiphenyl	MonCBP	5.83E-09	MACT FBC			X		1.94E-05
Naphthalene	91-20-3	4.10E-06	MACT FBC		X	X		1.36E-02
Nonachlorobiphenyl	NonCBP	2.88E-09	MACT FBC			X		9.56E-06
Octachlorobiphenyl	OctCBP	2.04E-09	MACT FBC			X		6.78E-06
Perylene	198-55-0	2.27E-10	MACT FBC			X		7.52E-07
Phenanthrene	85-01-8	3.31E-07	MACT FBC			X		1.10E-03
Pentachlorobiphenyl	PenCBP	3.17E-09	MACT FBC			X		1.05E-05
Pyrene	129-00-0	1.38E-07	MACT FBC			X		4.57E-04
Tetrachlorobiphenyl	26914-33-0	5.69E-09	MACT FBC			X		1.89E-05
Trichlorobiphenyl	25323-68-6	3.41E-08	MACT FBC			X		1.13E-04
Dioxins and Furans (D/F)	DF	2.8E-08		Subset of POM Group <sup>(i)</sup>		X	X	9.5E-05
Heptachlorodibenzo-p-dioxins	37871-00-4	1.19E-08	MACT FBC			X	X	3.95E-05
Heptachlorodibenzo-p-furans	38998-75-3	1.48E-09	MACT FBC			X	X	4.90E-06
Hexachlorodibenzo-p-dioxins	34465-46-8	3.21E-09	MACT FBC			X	X	1.06E-05
Hexachlorodibenzo-p-furans	55684-94-1	2.93E-09	MACT FBC			X	X	9.72E-06
Octachlorodibenzo-p-dioxins	3268-87-9	5.03E-09	MACT FBC			X	X	1.67E-05
Octachlorodibenzo-p-furans	OCDF	3.53E-10	MACT FBC			X	X	1.17E-06
Pentachlorodibenzo-p-dioxins	36088-22-9	6.53E-10	MACT FBC			X	X	2.17E-06
Pentachlorodibenzo-p-furans	30402-15-4	2.14E-09	MACT FBC			X	X	7.12E-06
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	4.98E-12	MACT FBC		X	X	X	1.65E-08
Tetrachlorodibenzo-p-dioxins	41903-57-5	1.07E-10	MACT FBC			X	X	3.55E-07
2,3,7,8-Tetrachlorodibenzo-p-furans	51207-31-9	6.33E-11	MACT FBC			X	X	2.10E-07
Tetrachlorodibenzo-p-furans	30402-14-3	6.25E-10	MACT FBC			X	X	2.07E-06
Regulated Trace Elements	TRACE	3.52E-04		Group not regulated as an individual HAP				1.2
Antimony	7440-36-0	1.73E-06	MACT FBC		X			5.73E-03
Arsenic	7440-38-2	4.81E-06	MACT FBC		X			1.60E-02
Beryllium	7440-41-7	2.55E-08	MACT FBC		X			8.48E-05
Cadmium	7440-43-9	9.38E-07	MACT FBC		X			3.11E-03
Chromium, total	7440-47-3	9.32E-06	MACT FBC		X			3.09E-02
Cobalt	7740-48-4	7.50E-07	MACT FBC		X			2.49E-03
Lead	7439-92-1	4.99E-05	MACT FBC		X			1.66E-01
Manganese	7439-96-5	2.48E-04	MACT FBC		X			8.24E-01
Mercury	7439-97-6	1.86E-07	MACT FBC		X			6.19E-04

**Table 2-13**  
**Potential to Emit Regulated Hazardous Air Pollutants (HAPs) Due to Combustion of Woody Biomass in the Fluidized Bed Boiler**  
**ADAGE Hamilton LLC Hamilton County, Florida**  
**Proposed Nominal 50-MW Woody Biomass Power Plant**

Regulated HAP <sup>(a)</sup>	ID/CAS Number <sup>(b)</sup>	Emission Factor (lb/MMBtu)	Reference <sup>(c)</sup>	Comments	Regulated Individual HAP <sup>(d)</sup> (X=yes)	POM <sup>(e,g)</sup> (X=yes)	D/F <sup>(f,g)</sup> (X=yes)	PTE (tpy) <sup>(n)</sup>
Nickel	7440-02-0	1.45E-05	MACT FBC		X			4.82E-02
Phosphorus	7723-14-0	1.93E-05	MACT FBC		X			6.41E-02
Selenium	7782-49-2	2.55E-06	MACT FBC		X			8.48E-03
<b>HAP Total</b>								<b>19.2</b>

**Color Code:**

ID Number Represents Group of Compounds
Subtotal of Multiple Compounds

**Notes:**

- a) Pollutant regulated either individually or by membership in a group of HAPs which is regulated as an Individual HAP (i.e. polycyclic organic matter).
- b) CAS number was used where available. ID was created for compounds which represent a group of related compounds (i.e. "PenCBP" represents all pentachlorobiphenyl isomers).
- c) **References** used in development of emission factors in order from most to least preferred reference:
  - (1) **Custom** - Developed specifically for this project. See notes for additional details.
  - (2) **MACT FBC** - Obtained from vacated boiler MACT backup database tests performed on wood-burning fluidized bed boilers
  - (3) **AP-42 FBC** - Obtained from AP-42 (Section 1.6) backup database tests performed on wood-burning fluidized bed boilers
  - (4) **MACT Wood** - Obtained from vacated boiler MACT backup database tests performed on wood-burning boilers of any configuration
  - (5) **AP-42** - Obtained from AP-42 Table 1.6-3 or Table 1.6-5
- d) Indicates regulated individual HAP or group of HAPs as defined under the Clean Air Act (Section 112b) and 40 CFR 63 Subpart C (updates to the CAA 112b list)
- e) Indicates compound classified as Polycyclic Organic Matter (POM). POM is defined as any compound with two or more benzene rings and boiling point greater than or equal to 100°C.
- f) Indicates compound classified as a Dioxin or Furan (D/F).
- g) POM subtotal includes D/F
- h) Test which resulted in a clear outlier (ID "E942.002") was removed from database. This test reported an acrolein emission factor several orders of magnitude higher than any other acrolein test including a test performed by a different analytical method on the same emission unit and same day.
- i) Xylene emission factors were reported in databases only for total xylene (all isomers) and o-xylene. Each isomer (o-, m-, p-) is an individually regulated HAP.
- j) Subtotal includes estimated emissions from compounds which are not individually regulated HAPs but are classified as POM, a group which is regulated as an individual HAP.
- k) Selected emission factor represents uncontrolled emissions based on blend of wood fuels and calculations as specified in Tables 2-3A through 2-3F.
- l) Maximum based on upper limit of 95% confidence interval for representative fuel woods tested as indicated in Table 2-3D.
- m) HCl and HF emission reduction estimated at 81.5% based on dry in-duct sorbent injection (DSI).
- n) Ton per year (TPY) estimates based on boiler heat input of 758 MMBtu/hr, appropriate average emission factor (i.e., lbs/MMBtu) and 8,760 hours per year. The emission factor employed is a long term average, including curtailment and scheduled outages. Short term emissions may exceed this average factor.

**Calculation Method:**

PTE (tpy) = Representative Emission Factor (lb/mmBtu) x Maximum Heat Input (mmBtu/hr) x Annual Operating Hours (hr/year) / (2000 lb/ton)  
 Controlled PTE (tpy) = PTE (tpy) x [1 - Control Efficiency]; as applicable to pollutants with specific controls (noted above).

Maximum heat input is defined as approximately 758 MMBtu/hr.