TECHNICAL EVALUATION
&
PRELIMINARY DETERMINATION

APPLICANT

ADAGE Hamilton, LLC
225 Wilmington West Chester Pike, Suite 302
Chadds Ford, Pennsylvania

ADAGE Biomass Power Plant
ARMS Facility ID No. 0470016

PROJECT

Project No. 0470016-001-AC

53 Megawatt (net) Woody Biomass Power Plant

COUNTY

Hamilton County, Florida

PERMITTING AUTHORITY

Florida Department of Environmental Protection
Division of Air Resource Management
Bureau of Air Regulation
Special Projects Section
2600 Blair Stone Road, MS#5505
Tallahassee, Florida 32399-2400

October 8, 2009

1. APPLICATION INFORMATION

1.1. Applicant Name and Address

ADAGE Hamilton LLC (ADAGE)
225 Wilmington West Chester Pike, Suite 302
Chadds Ford, PA 19317

Authorized Representative: Mr. F. Reed Wills, President

1.2. Processing Schedule

- May 20, 2009 Received air construction permit application from ADAGE.
- June 10 Met with ADAGE to discuss details of the project and air pollution control devices.
- June 19 Received additional information from ADAGE proposing lower emission limits.
- June 26 ADAGE published Notice of Application in The Suwannee Democrat.
- July 2 ADAGE published Notice of Application in The Jasper News.
- July 17 Received additional information from ADAGE related to ambient air modeling.
- September 9 Received additional information from ADAGE related to carbon monoxide emissions.
- October 8 Department distributed Written Intent to Issue Air Permit and posted documents.

1.3. Facility Location

The proposed plant will be located in Hamilton County at State Road 6 and County Road 146, just west of the Interstate 75 and State Road 6 interchange. The location is approximately 45 kilometers (km) southeast of Valdosta, Georgia and approximately 11 km west of Jasper, Florida. The approximate UTM coordinates for this site are Zone 17; 301.650 km East and 3,377.350 km North.

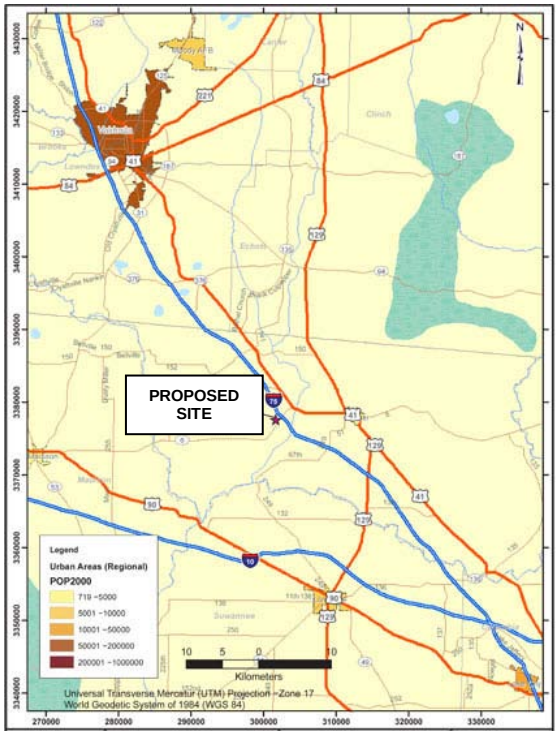

Figure 1 - ADAGE site, Hamilton County

The location and layout of the proposed site is shown in Figures 1 and 2. The proposed site outlined by the yellow dashed lines comprises 215 acres. The footprint of the proposed plant will occupy roughly 50 acres in the southeast corner of the property. Figure 3 is a view of the ADAGE reference woody biomass power plant.

Figure 2 - Project Layout On site

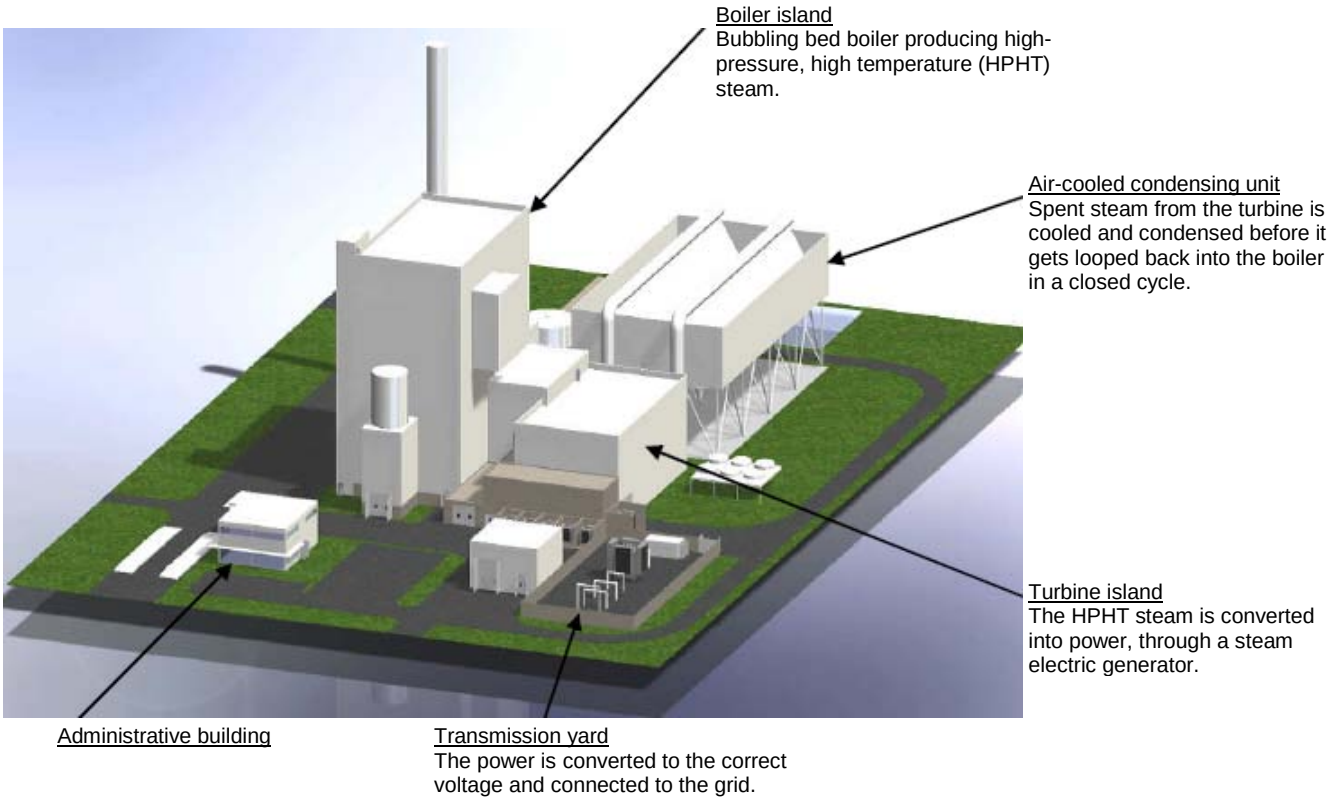

Figure 3 – View of ADAGE Reference Woody Biomass Power Plant

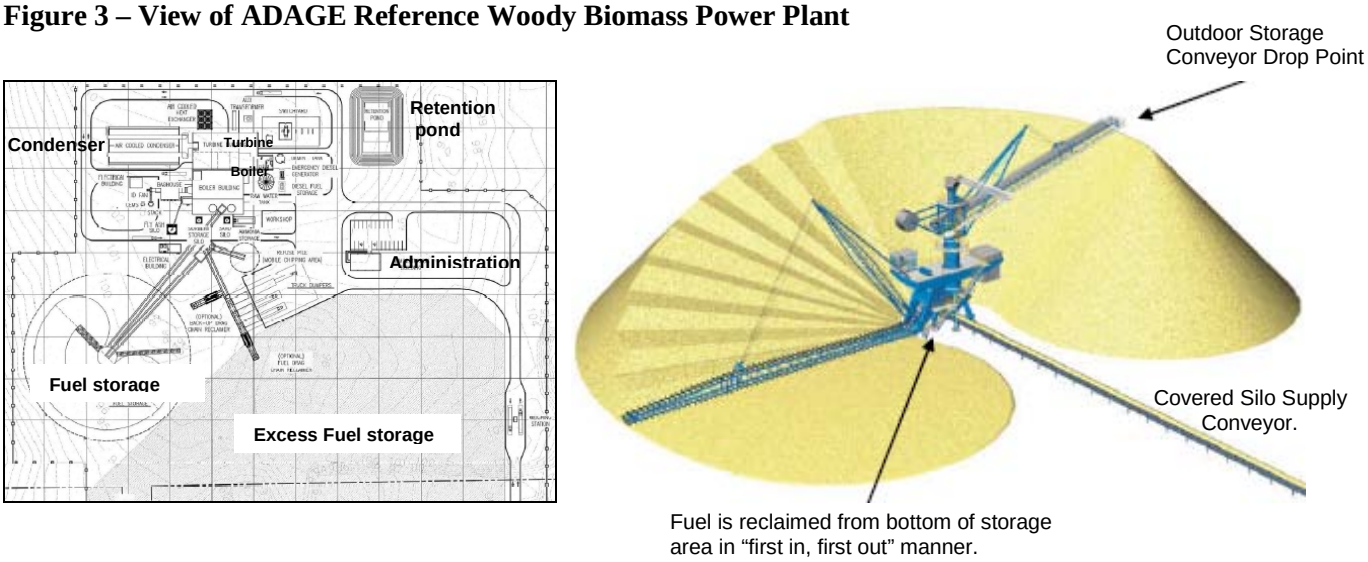

Figure 4 – Proposed Layout of Plant, View of ADAGE Reference Outdoor Storage Design

1.4. Regulatory Classification

Provided below is a summary of regulatory categories that apply to the proposed net 53-megawatt (MW) woody biomass power plant.

Standards of Performance for New Stationary Sources

- 40 CFR 60, Subpart A – General Provisions;
- 40 CFR 60, Subpart Db – Industrial, Commercial, Institutional Steam Generating Units; and
- 40 CFR 60, Subpart IIII – Stationary Compression Ignition Internal Combustion Engines (ICE).

National Emissions Standards for Hazardous Air Pollutants (NESHAP)

The facility is not a major source of hazardous air pollutants (HAP) because it will not have the potential to emit (PTE) 10 tons per year (TPY) of any single HAP or 25 TPY of all HAP. However, the following NESHAP applies to emergency equipment:

- 40 CFR 63, Subpart ZZZZ – Stationary Reciprocating Internal Combustion Engines (RICE).

Title IV, Acid Rain Provisions

The facility will be subject to the Title IV, Acid Rain Provisions of the Clean Air Act. The proposed plant will serve an electric generator capable of generating 25 MW or more of electricity and will sell the resultant electricity.

Title V, Permits

The facility is a Title V or "Major Source" of air pollution because the potential to emit (PTE) of at least one regulated pollutant will exceed 100 TPY. Key regulated pollutants include carbon monoxide (CO), nitrogen oxides (NO_X), particulate matter ($PM/PM_{10}/PM_{2.5}$), sulfur dioxide (SO_2) and volatile organic compounds (VOC).

Prevention of Significant Deterioration (PSD)

The facility is not classified as a "Major Stationary Source" because it will not have the PTE 250 TPY or more of a PSD regulated air pollutant and is not one of the facility categories with the PSD applicability threshold of 100 TPY as described in Rule 62-210.200, Florida Administrative Code (F.A.C.).

Clean Air Interstate Rule (CAIR)

The ADAGE facility is subject CAIR in accordance with the Final Department Rules issued pursuant to CAIR as implemented by the Department in Rule 62-296.470, F.A.C.

Power Plant Siting

The facility is not subject to certification pursuant to the power plant siting provisions of Rule 62-17, F.A.C. because it will produce less than 75 MW of steam power.

2. PROPOSED PROJECT

2.1. Project Description

The applicant proposes to construct a woody biomass electric power plant. The proposed plant will be capable of generating approximately 62 MW (i.e. gross) of electrical power by combusting woody biomass in a bubbling fluidized bed (BFB) boiler and associated steam turbine-electrical generator (STG). The plant will export approximately 53 MW (i.e. net) after deducting the parasitic load required to operate the plant.

The power plant will be comprised of four process areas. These process areas include:

- Fuel receiving, handling, storage and processing;
- Power island (steam generating unit), including a BFB boiler, air cooled condenser and STG;
- Ash handling, storage and shipment; and
- Emergency support equipment.

2.2. Additional Project Features

Fuel

ADAGE proposes to fuel the new BFB boiler with only clean woody biomass under normal operation. Natural gas (NG), propane or ultralow sulfur distillate (ULSD) fuel oil (FO) will be used for startup, shutdown and bed stabilization of the boiler only. NG may be provided to the site via a pipeline depending upon completion of gas projects planned in the region. Propane, if utilized, will be provided by an aboveground storage tank. ULSD FO will be stored on site.

Air Pollution Controls

The proposed power plant will utilize the following control devices and techniques to control air pollutants, as described below:

Fuel Receiving, Handling, Storage and Processing

- Employment of a first-in/first-out stacking and reclaiming system with minimal drop lengths to minimize dust generation, biological degradation and odors.
- All conveyor systems in the fuel receiving, handling, storage and processing system will be designed to minimize emissions of $PM/PM_{10}/PM_{2.5}$ through the use of Best Management Practices (BMP).
- BMP will include covered conveyors, to the extent possible enclosed chutes for dropping fuel to and from conveyors, and maintenance of paved roads to minimize fugitive dust generating materials on the roadway surface.
- Other reasonable precautions as described in Rule 62-296.320(4)(c), F.A.C.

Power Island

- Emissions of $PM/PM_{10}/PM_{2.5}$ from the BFB boiler will be controlled by a fabric filter baghouse.
- SO_2 and sulfuric acid mist (SAM) from the BFB boiler will be controlled by use of inherently low sulfur wood and fossil fuels and a dry in-duct sorbent injection system (IDSIS) to meet emission limits.
- NO_X from the BFB boiler will be controlled by an ammonia (NH_3) based selective catalytic reduction (SCR) system.
- Emissions of CO and VOC from the boiler will be controlled by the BFB design including good combustion practices (GCP).
- Emissions of HAP from the BFB boiler will be controlled by use of GCP, use of untreated woody biomass (inherently low in chloride), the IDSIS, the fabric filter baghouse and the SCR system.

Ash Handling, Storage and Shipment

- Emissions of $PM/PM_{10}/PM_{2.5}$ from the fly ash silo will be controlled by a baghouse or similar filter.
- Best Management Practices will be utilized during truck loading operations to minimize PM/PM_{10} emissions.

Emergency Support Equipment

- Emergency Equipment will be designed to meet the emission limits given in NSPS Subpart IIII and NESHAP Subpart ZZZZ.
- ULSD FO will be utilized and operation of support equipment will be limited to 250 hours per year or less per unit.

3. PROCESS DESCRIPTION

3.1. Principle

The steam generating unit will utilize a nominal 758 million Btu per hour (mmBtu/hr) BFB boiler with a 4-hour total maximum heat input capacity of 834 mmBtu/hr. The maximum heat input capacity of the fossil fuels portion to the unit is 240 mmBtu/hr. The steam produced will then be sent to a STG that will generate approximately 62 MW (gross) of electricity of which approximately 53 MW will be delivered to the power grid.

The fuel receiving, handling, storage and processing operations will be capable of receiving, handling, storing and delivering the clean woody biomass to the BFB boiler.

Residual ash collected by the boiler system baghouse will be conveyed and stored for future shipment offsite by truck. An emergency generator, fire pump and BFB coolant pump will be used in the event emergency situations arise at the plant. Figure 5 is a general process flow diagram of the operations at the proposed ADAGE plant. Details of a Babcock and Wilcox (B&W) BFB boiler and its fluidized bed are provided in Figure 6.

3.2. Fuel Slate and Sources

The feedstock to the BFB boiler will consist of woody biomass. Most of the woody biomass will be processed at a remote fuel preparation area (or areas) where it will be sorted, screened and chipped to size.

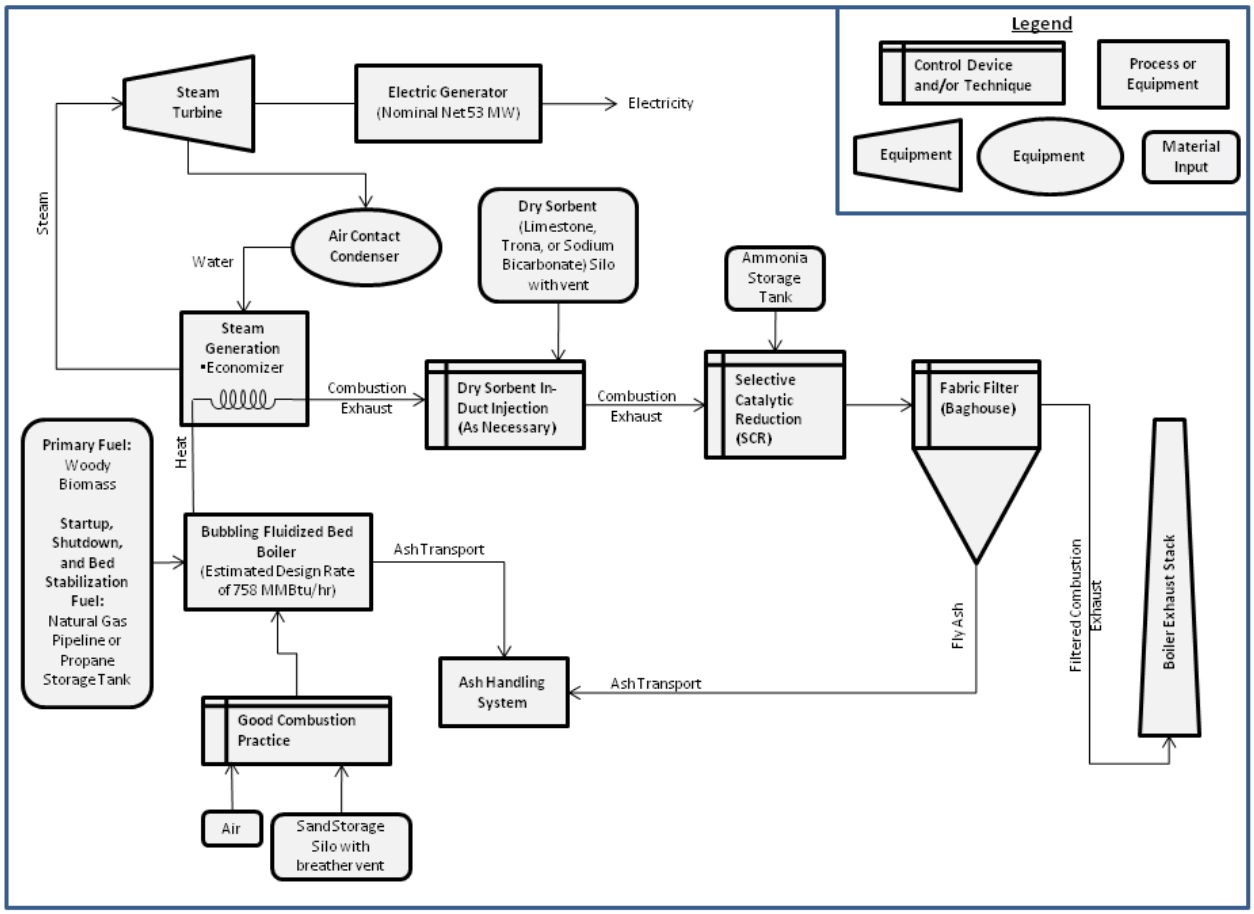

Figure 5 – Process Flow Diagram of ADAGE Woody Biomass Power Plant

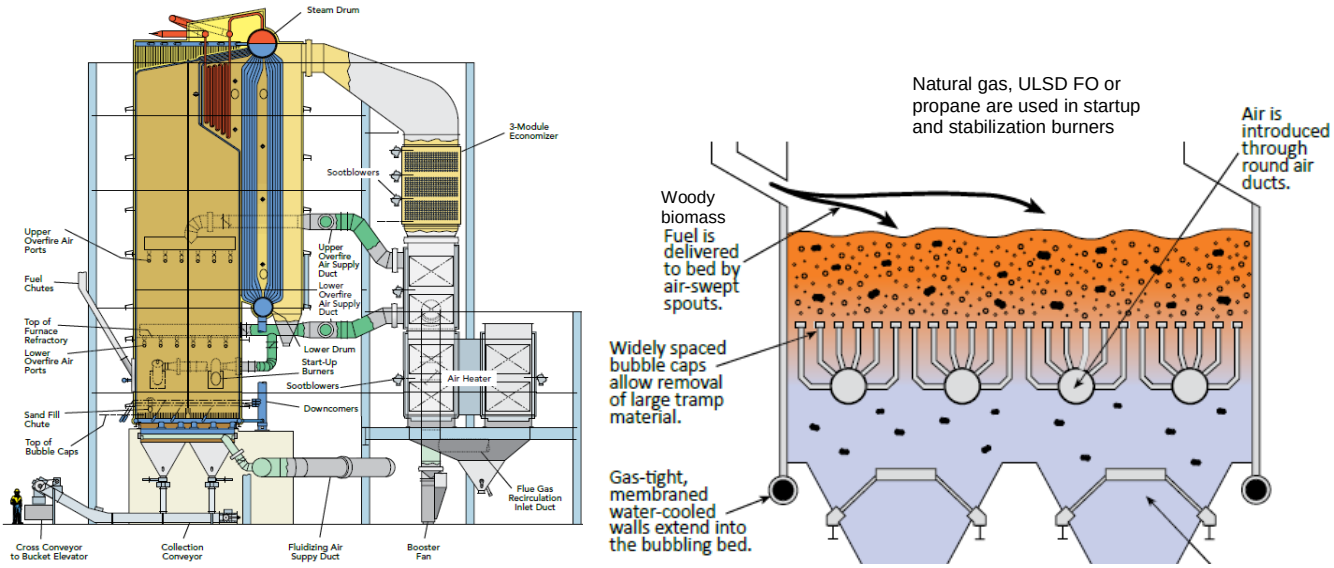

Figure 6 – B&W BFB Boiler for Woody Biomass, Operating Principle of Bubbling Fluidized Bed

ADAGE will only use clean woody biomass in the proposed BFB boiler. The clean, untreated woody biomass will include: clean untreated lumber; tree stumps; tree limbs; slash; wood residue, bark; sawdust; sander dust; wood chips; scraps; slabs; millings; shavings; and processed pellets made from wood or other forest residues.

Table 1 below further identifies types of woody biomass to be combusted in the BFB boiler.

Table 1 - Summary of Woody Biomass Fuel Descriptions

Fuel Group	Description
Field residuals and slash	Tops, limbs and whole tree soft or hardwoods that result from harvest and/or thinning as well as the residue therefrom
Understory	Forest understory including smaller trees and saplings
Land clearing and storm debris	Tree parts and/or branches that have been cut down for land development or line clearing purposes or that have been gathered after storms.
Production residuals	Butts, sticks, pole ends and tree surgeon material
Saw mill waste	Saw dust and kerf waste from cutting/milling whole green trees
Planer mill shavings	Fines from planing kiln-dried lumber
Source separated construction wood waste	Clean construction wood waste that was a primary mill product and has not been treated in any way such as pallets, dimensional lumber, clean wood trim, clean milled lumber

ADAGE further clarified that clean wood excludes secondary residues, such as plywood, particle board, medium density fiberboard (MDF), oriented strand board (OSB), laminated beams, finger jointed trim, sheet goods. These secondary residues and other materials not on the list cannot be used as fuel without prior approval of the Department.

ULSD FO, NG or propane will also be used in the BFB boiler for startup, shutdown and bed stabilization. The heat input for NG, ULSD FO or propane will not exceed 240 mmBtu/hr.

3.3. Fuel Receiving, Handling, Storage and Processing

Woody Biomass

The fuel receiving, handling, storage and processing area is being designed to accommodate woody biomass, primarily in the form of pre-processed chips. The preliminary schematic of the flows is shown in Figure 7.

Woody biomass of the kinds described above will be brought to the site in covered trucks. The trucks will enter most likely on the south side of the plant and will proceed to the scale station for weighing. The trucks will then proceed to the truck dumping stations where the contents (i.e. chipped biomass) of the truck will be emptied into below ground receiving hoppers. Some receiving hoppers will be accessed by material handling equipment. Most of the woody biomass to be received by the plant will be chipped off site.

The main storage pile will be built and managed on the principle of first-in/first-out as discussed above. The purpose is to allow good chip blending, high stacking and reclaiming, low chip damage, and low operation costs. Such piles are fairly resistant to high winds. As previously mentioned first-in/first-out operation will minimize dust generation, biological degradation and odors.

NG, Propane and ULSD FO

NG, propane or ULSD FO will be used during startup and for stabilization. The extent to which each is used depends on the progress of nearby gas supply projects that may ultimately deliver NG to the proposed plant site. Propane and ULSD FO, if utilized, will be stored in above ground storage tanks.

3.4. Ash Handling, Storage and Shipment

Bottom ash from the BFB boiler will be removed from the boiler and stored in a metal container for future removal off-site. Fly ash captured in the pollution control equipment will be transported by an enclosed conveyor to the fly ash storage silo. The storage silo will be equipped with a small baghouse to minimize dust. Fly ash from the storage silo will be sent to a truck loading operation for removal off-site. The conveyor system will be enclosed and the chute used to dispense fly ash into the truck will be designed to minimize fugitive dust emissions.

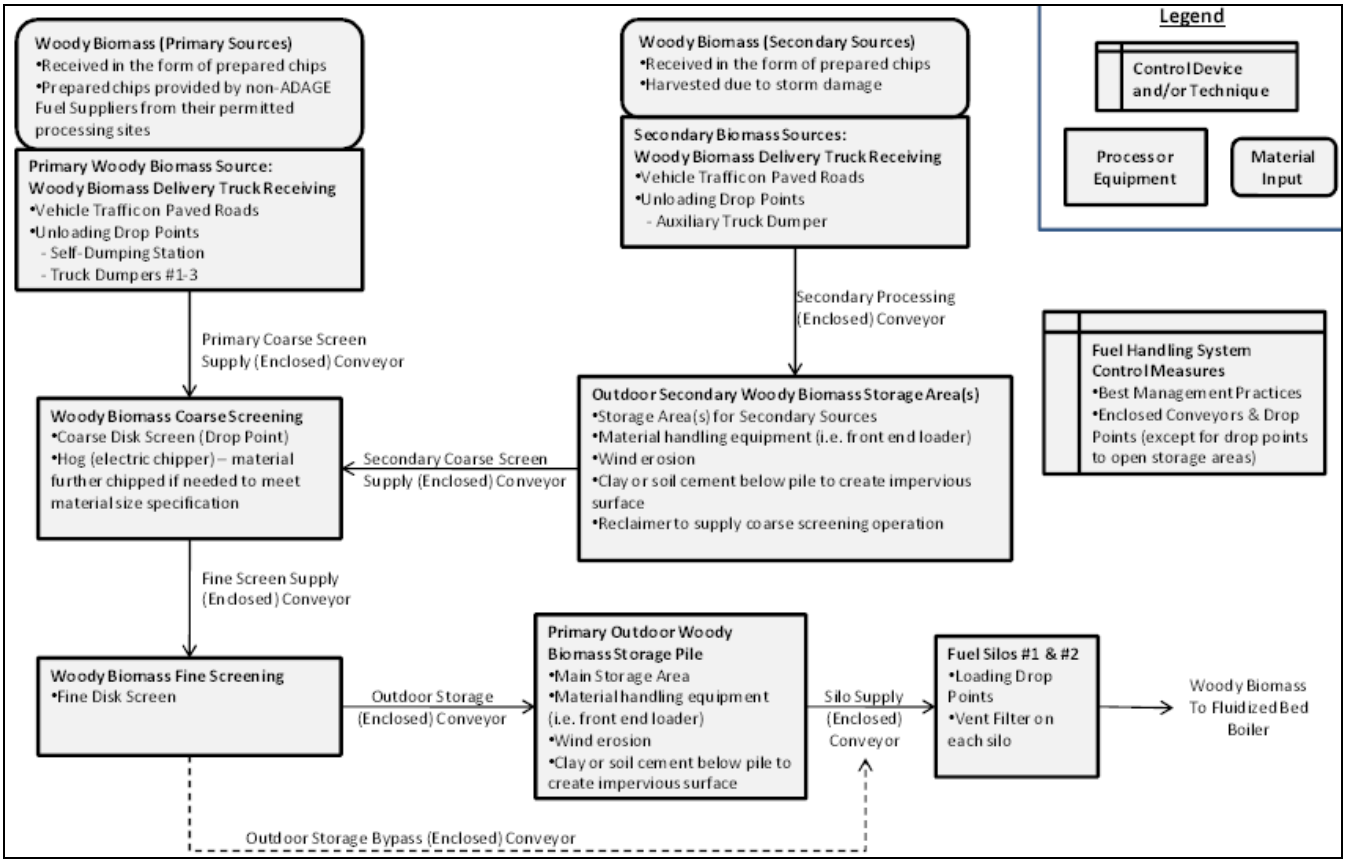

Figure 7 - Fuel Handling, Processing, and Storage Process Flow Schematic Diagram

A process flow diagram of the ash handling, storage, and shipment system is provided in Figure 8 below.

3.5. Emergency Support Equipment

The proposed plant will also require:

- One 1,800 kilowatt (kW) emergency electrical generator (or smaller);
- One 500 horsepower (hp) emergency fire water pump;
- One 500 hp emergency boiler cooling water pump; and
- One 500 gallon above ground storage tank for ULSD FO.

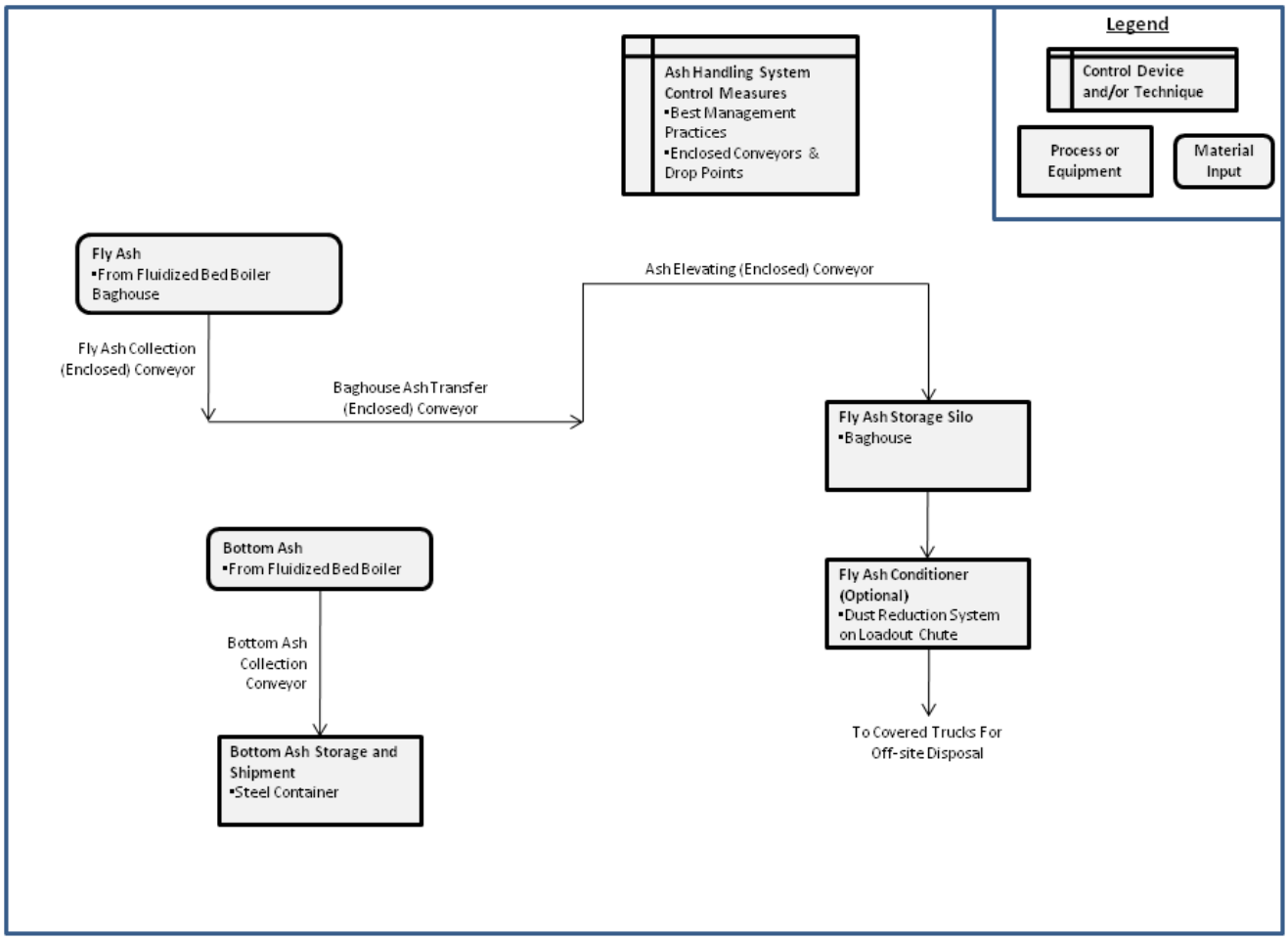

Figure 8 – Ash Handling, Storage and Shipment Process Flow Schematic Design

3.6. State Regulations

The project is subject to the applicable environmental laws specified in Section 403 of the Florida Statutes (F.S.) and to the following rules in the F.A.C.

F.A.C. Rule	Description
62-4	Permits
62-204	Air Pollution Control – General Provisions
62-210	Stationary Sources of Air Pollution – General Requirements
62-212	Stationary Sources - Preconstruction Review
62-213	Operation Permits for Major Sources of Air Pollution
62-214	Requirements for Sources Subject To the Federal Acid Rain Program
62-296	Stationary Sources - Emission Standards
62-297	Stationary Sources - Emissions Monitoring

3.7. Potential Emissions and PSD Non-Applicability Determination

The Department regulates major stationary sources of air pollution in accordance with Florida's Prevention of Significant Deterioration (PSD) program, as defined in Rule 62-212.400, F.A.C. Per Rule 62-210.200, (Definitions), F.A.C., a major stationary source is

1. *Any of the following stationary sources of air pollutants which emits, or has the PTE, 100 TPY or more of any PSD pollutant:*
   - *Fossil fuel-fired steam electric plants of more than 250 mmBtu/hr heat input,*
   - *Coal cleaning plants (with thermal dryers),*
   - *Kraft pulp mills,*
   - *Portland cement plants,*
   - *Primary zinc smelters,*
   - *Iron and steel mills,*
   - *Primary aluminum ore reduction plants,*
   - *Primary copper smelters,*
   - *Municipal incinerators capable of charging more than 250 TPD of refuse,*
   - *Hydrofluoric, sulfuric, or nitric acid plants,*
   - *Petroleum refineries,*
   - *Lime plants,*
   - *Phosphate rock processing plants,*
   - *Coke oven batteries,*
   - *Sulfur recovery plants,*
   - *Carbon black plants (furnace process),*
   - *Primary lead smelters,*
   - *Fuel conversion plants,*
   - *Sintering plants,*
   - *Secondary metal production plants,*
   - *Chemical process plants,*
   - *Fossil-fuel boilers (or combination thereof) totaling more than 250 mmBtu/hr heat input,*
   - *Petroleum storage and transfer units with a total storage capacity exceeding 300,000 barrels,*
   - *Taconite ore processing plants,*
   - *Glass fiber processing plants,*
   - *Charcoal production plants;*
2. *Any stationary source which emits, or has the PTE, 250 TPY or more of a PSD pollutant; or*
3. *Any physical change that would occur at a stationary source not otherwise qualifying as a major stationary source, if the change would constitute a major stationary source by itself.*

The proposed plant category is not among the bulleted stationary sources listed in paragraph 1 above, that would be classified as a major stationary source based on the PTE 100 TPY of a regulated PSD air pollutant. To be considered a major stationary source, it would be necessary for the PTE from this project to equal or exceed 250 TPY of any regulated PSD air pollutant.

The project will result in emissions of NO_X, CO, particulate matter (PM, PM_{10} and $PM_{2.5}$), SO_2, small amounts of SAM (sometimes expressed as H_2SO_4), VOC and HAP.

Table 2 summarizes the applicant's estimates of key regulated air pollutants from the proposed woody biomass electric power plant.

Potential emissions of any regulated PSD air pollutant will not equal or exceed 250 TPY, based on operational design and associated emission limits. Therefore, the proposed woody biomass electric power plant will not be subject to the PSD rules including PSD ambient air modeling or a requirement for a best available control technology (BACT) determination under that program.

Table 2 - Estimated PTE Criteria Air Pollutants (in TPY)

Source Operation	PM	PM_{10}	$PM_{2.5}$	NO_X	SO_2	H_2SO_4	CO	VOC	F
Fluidized Bed Boiler	96.3			232.4	149.4	25.6	245.3	56.4	27.1
Biomass Handling and Processing	15.70	7.43	1.12	--	--	--	--	--	--
Fly Ash Handling	0.10	0.05	0.007	--	--	--	--	--	--
Boiler Support Material Handling	0.03	0.01	0.002	--	--	--	--	--	--
Emergency Generator & Storage Tank	0.09	0.09	0.09	2.9	0.003	0.0002	1.6	2.9	--
Emergency Boiler Coolant Water Pump & Storage Tank	0.02	0.02	0.02	0.4	0.12	0.01	0.3	0.6	--
Emergency Fire Pump & Storage Tank	0.02	0.02	0.02	0.4	0.12	0.01	0.3	0.4	--
In-plant Paved Roads	24.0	4.7	0.7	--	--	--	--	--	--
Biomass Pile Processing	1	0.08	0.01	--	--	--	--	--	--
Biomass Pile Wind Erosion	2.7	1.3	0.2	--	--	--	--	--	--
Project Total PTE Including Fugitive Sources	140	110	98	236	150	26	247.5	60	27

3.8. New Source Performance Standards and National Emissions Standards for HAP

The proposed project is subject to the following NSPS regulations:

- NSPS Subpart A – General Provisions;
- NSPS Subpart Db – Industrial, Commercial, Institutional Steam Generating Units; and
- NSPS Subpart IIII – Stationary Compression Ignition Internal Combustion Engines.

The relevant emission standards presented in Table 3 include the NSPS Subpart Db emission standards applicable to the BFB boiler.

Table 3 - NSPS Subpart Db – Emission Standards Applicable to BFB Boiler

Source	SO_2 limit[1, 4] (lbs/mmBtu)	PM Limit[2] (lb/mmBtu)	Opacity[3] (%)	NO_X[4] (lb/mmBtu)
BFB Boiler	0.32	0.030	20%	0.30

1. Sources that achieve this limit are excluded from other SO_2 reductions under NSPS Db.
2. Filterable PM only.
3. 6-minute average, except for one 6-minute period per hour of not more than 27% opacity.
4. 30-day basis.

Tables 4 and 5 include the NSPS Subpart IIII emissions standards for the emergency generator and the two emergency pumps (fire and coolant).

Table 4 - NSPS Subpart IIII – Emission Standards Applicable to Emergency Generator

Emergency Generator (> 560 kW and ≤ 2,237 kW)	**CO** (g/kW-hr)[1]	**PM** (g/kW-hr)	**SO_2**[2] **(% S)**	**NMHC**[3]**+NO_X** (g/kW-hr)
Subpart IIII (2007 and later)	3.5	0.2	0.0015	6.4

1. g/kW-hr means grams per kilowatt-hour
2. SO_2 emission standard will be met by using ULSD FO in the emergency generator with fuel sulfur (S) content of 0.0015% by weight.
3. NMHC means Non-Methane Hydrocarbons.

Table 5 - NSPS Subpart IIII – Emission Standards Applicable to two Emergency Pumps

Emergency Pumps (≥ 300 hp and < 600 hp)	**CO** (g/hp-hr)[1]	**PM** (g/hp-hr)	**SO_2**[2] **(% S)**	**NMHC+NO_X** (g/hp-hr)
Subpart IIII (2009 and later)	2.6	0.15	0.0015	3.0

1. g/hp-hr means grams per horsepower-hour
2. SO_2 emission standard will be met by using ULSD FO in the two emergency pumps with a fuel sulfur content of 0.0015% by weight.

In addition to NSPS Subparts Db and IIII, other conditions and emission standards are required to insure that the facility-wide PTE of each PSD pollutant (excluding fugitive emissions) will be less than 250 TPY.

The emergency equipment associated with the proposed woody biomass power plant is also subject to the applicable area source requirements of NESHAP Subpart ZZZZ. This subpart requires all affected area source units to meet the applicable emission standards of Subpart IIII.

3.9. Other Department Rules Potentially Applicable to the Project

- Rule 62-296.401, F.A.C. - Incinerators;
- Rule 62-296.410, F.A.C. - Carbonaceous Fuel Burning Equipment;
- Rule 62-296.416, F.A.C. - Waste-to-Energy Facilities;
- Rule 62-296.406, F.A.C. – Fossil Fuel Steam Generators with Less than 250 mmBtu Heat Input, New and Existing Units; and
- Rule 62-296.320, F.A.C. - General Pollutant Emission Limitation Standards.

Incinerators and waste to energy facilities combust waste. The fuel slate authorized by this permit does not constitute a waste or municipal solid waste according to the Department's rules. Therefore, Rules 62-296.401 and 62-296.416, F.A.C. do not apply to this project.

Carbonaceous fuel is defined in Rule 62-210.200, F.A.C. as "solid materials composed primarily of vegetative matter such as tree bark, wood waste, or bagasse". The fuel slate described by the applicant falls into this category. Therefore, Rule 62-296.410, F.A.C. applies to this project. This provision includes a visible emissions standard of 30% opacity, a PM standard of 0.1 lb/mmBtu for the fossil fuel component and 0.2 lb/mmBtu for the carbonaceous fuel part.

The BFB boiler will use ULSD FO, NG or propane for startup, shutdown and bed stabilization. But the fossil fuel capability will be less than 250 mmBtu/hr of heat input. Therefore, Rule 62-296.406, F.A.C. applies to the extent that fossil fuel is burned in the BFB boiler. This section requires a BACT determination for PM and SO_2 and imposes a visible emissions standard of 20%. The BACT requirement for the fossil fuels will be satisfied by use of ULSD FO, propane or NG, the requirements of 40 CFR

Subpart Db, and the permit requirements intended to insure that the facility-wide PTE of PM and SO_2 are less than 250 TPY.

The project is subject to Rule 62-296.320, F.A.C., including provisions on VOC storage and handling; objectionable odor; open burning; visible emissions; and reasonable precautions to control fugitive emissions.

4. EMISSIONS FORMATION AND CONTROL

4.1. Emissions and Controls for the BFB Boiler

NO_X Emissions

Discussion: The BFB biomass fueled boiler has a maximum heat input rate 834 mmBtu/hr on a 4 hour average basis with a maximum of 240 mmBtu/hr of heat input coming from fossil fuel (NG, ULSD FO or propane) for startup, shutdown and bed stabilization. Given in Table 6 below are the general characteristics of the of the BFB biomass-fueled boiler for the ADAGE project:

Table 6 - Characteristics of the BFB Biomass-fueled Boiler

Parameter	Description
Boiler Type	BFB design
Primary Fuel	Clean Woody Biomass at maximum rate of 47 tons per hour (TPH)
Supplemental Fuel	NG assuming that it is available. Otherwise, will fire ULSD FO or propane
Ash Removal	From baghouse to ash storage silo via enclosed conveyors
Heat Input Rate	Nominal 758 mmBtu/hr (maximum 834 mmBtu/hr on a 4-hour basis) of which a maximum of 240 mmBtu/hr is from fossil fuels
Thermal Efficiency	To be established
Steam Production	400,000 – 450,000 lb/hour (to be determined based on efficiency)
Stack Parameters	10.5 feet diameter (maximum); 195 feet tall (minimum)
Flue Gas	278,600 actual cubic feet per minute (acfm) at 310 °F
Particulate Control	Fabric filter baghouse greater than 99% efficiency
NO_X Control	Selective catalytic reduction (SCR) based on ammonia injection
SO_2 Control	Dry sorbent injection into ducting before baghouse, clean stabilization and backup fuel
VOC and CO Control	GCP

NO_X formation may occur by three different mechanisms: fuel NO_X is formed from nitrogen compounds contained in fuel (fuel nitrogen); thermal NO_X is formed from molecular or atomic nitrogen (N_2) and oxygen (O_2) present in combustion air; and prompt NO_X is formed in the proximity of the flame front as intermediate combustion products. The BFB biomass boiler is expected to emit 232.4 TPY of NO_X the majority of which will be thermal NO_X.

There are several NO_X reduction processes available including pre and post combustion control equipment. Selective non-catalytic reduction (SNCR) is a technology whereby NO_X emissions are controlled by reaction with NH_3 or urea at high temperature in the furnace. The products of the reaction are N_2 and water vapor (H_2O). SCR involves the same reaction but in the presence of catalyst and at lower temperature. The catalyst would be located in the dusty, medium temperature zone prior to other control equipment including particulate control devices.
A technology known as regenerative SCR (RSCR) is a recent development. It appears that the RSCR

system can be used as an alternative to SNCR or SCR. However, the RSCR would be placed in a low temperature zone after all other control devices.

Applicant's Proposal for NO_X: The NSPS Subpart Db establishes a limit of 0.30 lbs NO_X/mmBtu on a 30 day rolling average. The applicant proposes an emissions cap of 232.4 TPY of NO_X from the boiler and to install SCR on the BFB boiler.

Department's Review. The selection of fluidized bed combustion (FBC), specifically of BFB design, is a primary NO_X control measure by itself. Following are some considerations (in quotes) by B&W when comparing the emission characteristics of a typical stoker furnace with a FBC furnace and, more specifically, one of BFB.

[In a stoker boiler] "The combustion zone temperature is typically neither measured nor controlled and can range from 2200 to over 3000 °F." This promotes the formation of thermal NO_X.

"The BFB bed temperature is both measured and controlled to an optimum temperature of approximately 1500 °F." This minimizes thermal NO_X formation but not fuel NO_X formation. According to B&W:

"Due to the improved combustion process previously described for a BFB, the uncontrolled (upstream of any post combustion air quality control systems) NO_X, CO and VOC emissions for a BFB are typically 10 to 25% less for a given biomass fuel than for a stoker. The BFB emissions are also less susceptible to variations in fuel properties that are inherent with any biomass plant. Under normal steady state operating conditions, both the BFB and stoker can be operated reliably within permitted emission limits.

"However, normal day-to-day operations in a typical plant are anything but steady state. Fuel variability is a fact of life, even when a conscious effort is made in the fuel yard to keep the fuel homogeneous. The large mass of bed material in the BFB creates a "flywheel effect," which is better suited to minimize spikes in emissions due to any changes in fuel characteristics. Conversely, the relatively low fuel inventory on a grate will typically be much more susceptible to an upset and potential emissions spikes, under changing fuel conditions."

For reference, some biomass projects comparable to the ADAGE project are listed in Table 7 below. The characteristics of the ADAGE project (though not actually proposed as limits) are given in the first row.

Some of the projects listed in the table triggered PSD for NO_X while others took synthetic minor limits to avoid triggering PSD or Non-Attainment New Source Review. All include use of biomass, wood chips or woody debris. Most projects, especially those imbedded within the RACT/BACT/LAER Clearinghouse (RBLC) survey, rely on SNCR or SCR.

The NO_X emission characteristics of the ADAGE project are comparable to emissions from projects that trigger PSD and a BACT determination as well as projects that took limits to avoid PSD and a BACT determination.

The Department accepts the NO_X proposal submitted by ADAGE but will add a mass emission rate limit that corresponds to the TPY cap requested by ADAGE. Therefore, the Department will set a limit of 53.1 lb/hr on a 12 month average basis, rolled monthly to insure that the PTE remains less than 250 TPY. The applicable NSPS Subpart Db limit of 0.30 lb/mmBtu on a 30-day rolling basis also applies. Compliance will be demonstrated by a NO_X continuous emission monitoring system (CEMS).

The annual cap proposed by ADAGE and the mass emission limit proposed by the Department equate to 0.070 lb/mmBtu at the nominal heat input rate of 758 mmBtu/hr and 0.064 lb/mmBtu at the maximum heat input rate 834 mmBtu/hr if continuously operated.

Table 7 - Emissions in lb/mmBtu – Boilers with Uses or Capacities Similar to Proposed Project

Project Location	CO	VOC	NO_X	PM/PM_{10}	SO_2
ADAGE, Hamilton County, FL BFB – woody biomass ~758 mmBtu/hr (equivalents)	**~0.08** 12-month GCP	**~0.017** stack test GCP	**~0.070** 12-month SCR	**~0.029** stack test fabric filter	**~0.045** 12-month sorbent in ducts
HEF, Highlands County, FL stillage, wood, gas, ULSD FO ~198 mmBtu each (proposed)	0.10 30-day GCP	0.005 stack test GCP	0.075 30-day SNCR	0.01 Stack test fabric filter	0.06 30-day BFB limestone
Wheelabrator, Auburndale, FL grate boiler – wood and tires ~630 mmBtu/hr (1990s)	0.32 30-day GCP	0.035 stack test GCP	0.14 30-day SNCR	0.02 stack test fabric filter	0.10 30-day lime spray
U.S. Sugar Clewiston, FL grate boiler - bagasse ~1,000 mmBtu/hr (2003)	0.38 12-month GCP	0.05 Stack test GCP	0.14 30-day SNCR	0.26 stack test fabric filter	0.06 30-day no control
RBLC Survey All designs – any biomass $\geq$ 100 mmBtu/hr	0.1 – 0.63 typical 30-day GCP	0.005 – 0.05 stack test GCP	0.075-0.45 30-day various	0.0125 – 0.8 stack test various	0.02-1.54 typical 30-day various
Whitefield Power & Light, NH whole tree chips (WTC) 15 MW	Not known	Not known	0.075 guarantee RSCR	Not known	Not known
Boralex Stratton, ME WTC 50 MW	Not known	Not known	0.075 guarantee RSCR	Not known	Not known
Bridgewater Power, NH WTC 16 MW	Not known	Not known	0.075 guarantee RSCR	Not known	Not known
Burlington Electric, VT WTC 54 MW	Not known	Not known	0.065 guarantee RSCR	Not known	Not known
Palmer Springfield, MA construction/demolition (C&D) debris and WTC. 38 MW	Not known	Not known	0.065 guarantee RSCR	Not known	Not known
NSPS Subpart Db NG, wood, ULSD FO $\geq$ 100 mmBtu/hr	No standard	No standard	0.10-0.20 based on heat release rate	0.03 20% opacity wood basis	0.32 if achieved by low S fuels
NESHAP Subpart DDDDD[a] large solid fuel category $\geq$ 100 mmBtu/hr	~0.35 400 ppm @ 3% O_2[b] GCP	No standard	No standard	0.025 stack test	No standard

a. Subpart DDDDD was promulgated and then vacated

b. ppm @ 3% O_2 means parts per million by volume at 3 percent oxygen

SO_2 Emissions

Discussion. SO_2 is formed from sulfur compounds contained in biomass. According to the application, the BFB biomass boiler is expected to emit 149 TPY of SO_2. The clean woody biomass to be used by ADAGE will be typically low in S content. A figure of 0.034% S was originally provided in the application. This value is included in Table 8 along with heating value, ash and sulfur content of various types of biomass and fossil fuels. The values are on a dry basis except as otherwise noted.

Table 8 - Characteristics of Biomass and Fossil Fuels – Heating Value, Ash and S

Fuel Class	Fuel	Gross Heating Value Btu/lb	Ash (%)	S (%)
Bioenergy feedstocks	**ADAGE woody biomass**	**8,500**	**5**	**0.034**
	cellulosic ethanol stillage	4,200 (wet)	7	0.08
	sweet sorghum	6,570	5.5	0.15
	sugarcane bagasse	7,720	3.2-5.5	0.10-0.15
	hardwood	8,745	0.45	0.009
	softwood	8,360	0.3	0.01
	hybrid poplar	8,105	0.5-1.5	0.03
	bamboo	8,085	0.8-2.5	0.03-0.05
	switchgrass	7,810	4.5-5.8	0.12
	miscanthus	7,785	1.5-4.5	0.1
	Arundo donax	7,295	5-6	0.07
Liquid biofuels	bioethanol	11,940	~0	<0.01
	biodiesel	17,050	<0.02	<0.05
Fossil Fuels	coal (low rank)	6,400-8,100	5-20	1.0-3.0
	coal (high rank)	11,500-12,800	1-10	0.5-1.5
	ULSD FO	18,150	negligible	<0.0015
	NG	1,030 Btu/cubic foot	negligible	< 0.002

Applicant's SO_2 Proposal. The applicant proposes a limit of 0.18 lb SO_2/mmBtu on a 30-day rolling average. The applicant also proposes an emissions cap of 149.4 TPY of SO_2 from the boiler and to inject dry sorbent in the duct work prior to the PM control device, which consists of a fabric filter baghouse. The induct sorbent injection system (IDSIS) will use either limestone ($CaCO_3$), trona [$Na_3(CO_3)(HCO_3)\cdot 2(H_2O)$], or sodium bicarbonate ($NaHCO_3$).

Department's Review. According to Table 8, the woody biomass, NG and ULSD FO are all low in S content. Per 40 CFR 60.42b(k)(2), units firing only very low sulfur oil, gaseous fuel, a mixture of these fuels, or a mixture of these fuels with any other fuels with a potential SO_2 emission rate of 0.32 lb/mmBtu or less are exempt from SO_2 emissions limits in 40 CFR 60.42b(k)(1). The language is as follows:

(k)

(1) Except as provided in paragraphs (k)(2), (k)(3), and (k)(4) of this section, on and after the date on which the initial performance test is completed or is required to be completed under §60.8, whichever date comes first, no owner or operator of an affected facility that commences construction, reconstruction, or modification after February 28, 2005, and that combusts coal, oil, natural gas, a mixture of these fuels, or a mixture of these fuels with any other fuels shall cause to be discharged into the atmosphere any gases that contain SO_2 in excess of 0.20 lb/mmBtu heat input or 8 percent (0.08) of the potential SO_2 emission rate (92 percent reduction) and 1.2 lb/mmBtu heat input. For facilities complying with the percent reduction standard and paragraph (k)(3) of this section, only the heat input supplied to the affected facility from the combustion of coal and oil is counted in paragraph (k) of this section. No credit is provided for the heat input to the affected facility from the combustion of natural gas, wood, municipal-type solid waste, or other fuels or heat derived from exhaust gases from other sources, such as gas turbines, internal combustion engines, kilns, etc.

(2) Units firing only very low sulfur oil, gaseous fuel, a mixture of these fuels, or a mixture of these fuels with any other fuels with a potential SO_2 emission rate of 0.32 lb/mmBtu heat input or less are exempt from the SO_2 emissions limit in paragraph (k)(1) of this section.

It is known that the woody biomass categories within Table 8 contain insignificant amounts of sulfur with respect to potential (uncontrolled) emissions of 0.32 lb/mmBtu. Based on Table 8, the woody biomass to be burned by ADAGE will contain approximately 0.034% S by weight on a dry basis. The pre-control SO_2 emission potential is calculated as follows:

(0.034 lb S/100 lb biomass)(2 lb SO_2/lb S)(lb biomass/8,500 Btu)(10^6 Btu/mmBtu) = 0.08 lb SO_2/mmBtu.

This value is 25% of the 0.32 lb/mmBtu value given in 40 CFR 60.42b(k)(2). Any combination of biomass combustion with NG, propane or ULSD FO will result in even lower emissions. Therefore it is reasonable to conclude that the potential (uncontrolled) SO_2 emission rate is less than 0.32 lb/mmBtu and that the project is exempt from any additional SO_2 emission limits in Subpart Db without an additional limit of 0.18 lb/mmBtu.

To insure compliance with the 149.4 TPY cap, the Department will also include a limit of 34.1 lb SO_2/hr on a 12-month average, rolled monthly. The annual cap proposed by ADAGE and the mass emission rate limit proposed by the Department equate to 0.045 lb SO_2/mmBtu at the nominal heat input rate of 758 mmBtu/hr and 0.041 lb/mmBtu at the maximum heat input rate 834 mmBtu/hr if continuously operated at those rates. The 12-month average 34.1 lb/hr limit is, on balance, more stringent than the unnecessary 30-day 0.18 lb/mmBtu limit proposed by the applicant. This is especially true with respect to insuring compliance with the proposed annual cap and avoidance of PSD.

According to 40 CFR 60.49(r),

(r) The owner or operator of an affected facility who elects to use the fuel based compliance alternatives in §60.42b or §60.43b shall either:

(1) The owner or operator of an affected facility who elects to demonstrate that the affected facility combusts only very low sulfur oil, natural gas, wood, a mixture of these fuels, or any of these fuels (or a mixture of these fuels) in combination with other fuels that are known to contain an insignificant amount of sulfur in §60.42b(j) or §60.42b(k) shall obtain and maintain at the affected facility fuel receipts from the fuel supplier that certify that the oil meets the definition of distillate oil and gaseous fuel meets the definition of natural gas as defined in §60.41b and the applicable sulfur limit. For the purposes of this section, the distillate oil need not meet the fuel nitrogen content specification in the definition of distillate oil. ***Reports shall be submitted to the Administrator certifying that only very low sulfur oil meeting this definition, natural gas, wood, and/or other fuels that are known to contain insignificant amounts of sulfur were combusted in the affected facility during the reporting period****; or*

(2) The owner or operator of an affected facility who elects to demonstrate compliance based on fuel analysis in §60.42b or §60.43b shall develop and submit a site-specific fuel analysis plan to the Administrator for review and approval no later than 60 days before the date you intend to demonstrate compliance. Each fuel analysis plan shall include a minimum initial requirement of weekly testing and each analysis report shall contain, at a minimum, the following information:

(i) The potential sulfur emissions rate of the representative fuel mixture in ng/J heat input;

(ii) The method used to determine the potential sulfur emissions rate of each constituent of the mixture. For distillate oil and natural gas a fuel receipt or tariff sheet is acceptable;

(iii) The ratio of different fuels in the mixture; and

(iv) The owner or operator can petition the Administrator to approve monthly or quarterly sampling in place of weekly sampling.

The SO_2 emission characteristics of the ADAGE project are comparable to emission limits from projects that trigger PSD and a BACT determination as well as projects that took limits to avoid PSD and a BACT determination.

The separate Department SO_2 BACT requirement under Rule 62-296.406, F.A.C. for the fossil fuels will be satisfied by use of ULSD FO, propane or NG.

SAM Emissions

Discussion. SAM is formed by further oxidation of SO_2 to sulfur trioxide (SO_3) prior to exiting the process. SO_3 readily combines with water vapor (H_2O) available in flue gas to form SAM (H_2SO_4). SAM condenses on the cool surfaces in exhaust duct, air pollution control equipment or on fly ash particles.

Applicant's SAM Proposal. The applicant does not propose a limit for SAM. According to the application and as a worst case, the BFB biomass boiler is expected to emit 9 lb SAM/hr from the boiler stack when burning woody biomass based on an emission factor of 0.012 lb SAM/mmBtu. Annual uncontrolled H_2SO_4 emissions are estimated at approximately 25.6 TPY from the boiler stack based on an emission factor of 0.0077 lbs/MMBtu.

Department's Review. It is doubtful that a woody biomass unit emitting 149 TPY of SO_2 will also emit 25.6 TPY of SAM. Excessive emissions of SAM are reflected as increased plume opacity. The Department will limit visible emissions to 10% opacity to insure compliance with $PM/PM_{10}/PM_{2.5}$ as discussed below. This requirement will discourage excessive emissions of SAM.

The applicant can specify SCR catalyst for NO_X control that is characterized by low conversion (oxidation) of SO_2 to SO_3. Sorbent injection coupled with fabric filtration will also tend to minimize SAM emissions.

The Department will not establish an actual SAM limit because it is clear that emissions will be much less than 250 TPY. Control of SO_2, opacity limitations and the $PM/PM_{10}/PM_{2.5}$ controls will minimize SAM emissions. The Department will require an initial stack test to determine the SAM emission characteristics of the BFB boiler.

CO Emissions

Discussion. CO is a product of incomplete combustion. Refer to Table 7 above for a listing of CO limits from biomass projects. Refer to the section on NO_X emissions for a discussion on the combustion characteristics of the BFB technology.

Applicant's Proposal. The NSPS Subpart Db does not establish limits on CO emissions. The applicant initially proposed an emissions cap of 232.4 TPY of CO (and no lb/hr limit) from the boiler by GCP on the BFB boiler to be demonstrated by use of a CO-CEMS.

Department's Review. Intimate contact between the bed material and the fuel results in burnout and low CO emissions. The Department will set a mass emission rate limit of 55.9 lb/hr on a 12 month average basis, rolled monthly to insure that the PTE is less than or equal to 245 TPY from the BFB and less than 250 TPY from the facility.

The mass emission rate limit proposed by the Department equates to 0.074 lb/mmBtu at the nominal heat input rate of 758 mmBtu/hr and 0.067 lb/mmBtu at the maximum heat input rate 834 mmBtu/hr if continuously operated.

The CO emission characteristics of the ADAGE project are comparable to emissions from projects that trigger PSD and a BACT determination as well as projects that took limits to avoid PSD and a BACT determination. For reference, the recently vacated NESHAP Subpart DDDDD would have required compliance with a CO limit of 400 ppm @ 3% O_2 as a surrogate for organic HAP. This value is roughly equal to 0.35 lb CO/mmBtu.

The Department agrees that the proposed values represent BACT for CO and VOC.

VOC Emissions

Discussion. VOC is a product of incomplete combustion. Refer to Table 7 above for a listing of VOC limits from biomass projects. Refer to the section on NO_X emissions for a discussion on the combustion characteristics of the BFB technology.

Applicant's VOC Proposal. The applicant does not propose a limit for VOC. The applicant has estimated VOC emissions from the boiler at 13 lb/hr and 56.4 TPY. The basis was an annual average emission factor of 0.017 lb/mmBtu.

Department's Review. The Department will not establish an actual VOC limit because it is clear that emissions will be much less than 250 TPY. However, the Department will require an initial stack test to determine the VOC emission characteristics of the BFB boiler. The Department also notes that incorporation of SCR for NO_X control will help to reduce VOC emissions including organic HAP emissions such as dioxin and furan (D/F).

$PM/PM_{10}/PM_{2.5}$ and Visible Emissions (VE)

Discussion. $PM/PM_{10}/PM_{2.5}$ are formed from ash contained in the biomass, products of incomplete combustion and from chemical reactions between products of combustion that form alkali and ammoniated chlorides, sulfates, nitrates and other such species.

Applicant's Proposal. The applicant proposes a PM/PM_{10} limit of 0.029 lb/mmBtu (filterable *and* condensable fraction of PM/PM_{10}), based on a 3-hour EPA Method 19 performance test. This limit will insure compliance with the NSPS Subpart Db PM limit of 0.03 lb/mmBtu (filterable fraction only) and the carbonaceous fuel PM limit under Rule 62-296.410, F.A.C. of 0.2 lb/mmBtu (filterable fraction only).

The proposal of 0.029 lb/mmBtu will limit emissions of $PM/PM_{10}/PM_{2.5}$ to 96.3 TPY (filterable and condensable) and well below 250 TPY PSD-threshold.

The applicant proposes to comply with a visible emissions (VE) limit of 20% (6-minute average) opacity, except for one 6-minute period per hour of not more than 27% opacity as measured by a continuous opacity monitoring system (COMS).

Department's Review. The Department will set a PM limit of 0.029 lb/mmBtu including filterable plus condensable PM as determined by initial and annual tests using Method 19. It will readily insure compliance with the Subpart Db and with Rule 62-296.410, F.A.C.

The separate Department PM BACT requirement under Rule 62-296.406, F.A.C. for the fossil fuels will be satisfied by use of ULSD FO, propane or NG.

The Department will also set a VE standard of 10% opacity (6-minute average), except for one 6-minute period per hour of not more than 15% opacity as measured by a COMS. The Department will establish a NH_3 limit of 10 parts per million, by volume at 7% O_2 (ppmvd) to be demonstrated by initial and annual tests using EPA Method 320. These limits are necessary for reasonable assurance that the unit will actually meet the applicant's proposed PM standard of 0.029 lb/mmBtu, which includes both the filterable and condensable fractions.

The NH_3 limit will be readily achieved by SCR.

Hydrogen Chloride (HCl) Emissions

Discussion. HCl is formed from chloride (Cl) compounds contained in biomass. According to the application, the BFB biomass boiler has the potential to emit 9.7 TPY of HCl. The woody biomass to be used by ADAGE will be typically low in Cl content. According to the applicant, all types of woody biomass to be combusted by ADAGE are estimated by the applicant to contain less than 0.015% Cl.

If HCl PTE is equal to or greater than 10 TPY, then the source would be a major source of HAP and a case-by-case determination of Maximum Achievable Control Technology (MACT) is required. Such a determination would result in emission limitations for HCl and at least several other pollutants or surrogates for those pollutants such as PM-metals or organic HAP.

Applicant's HCl Proposal. The applicant proposes the following program to control and measure HCl emissions from the proposed BFB boiler:

- *Emission of HCl shall be less than 9.7 tons during any consecutive 12-month rolling total;*
- *In accordance with good operating practices and the manufacturer's recommendations, the fabric filter system will be in operation at all times including startup and shutdown periods. The in-duct sorbent injection system will be in operation in accordance with the manufacturer's recommended operating practices as needed to maintain the minor source HCl emission rate of less than 10 tons during any consecutive 12-month period;*
- *The applicant shall demonstrate compliance with the HCl limit of 9.7 tons per consecutive twelve month period based on CEMS on the BFB boiler stack;*
- *While EPA has established a performance specification for Fourier Transform Infrared spectroscopy (FTIR) CEMS (PS-15) and while an extractive FTIR CEMs could in fact measure HCl, initial evaluation of the potential HCl CEMS suggests that a different technology, such as a non-dispersive infrared (NDIR) technique using gas filter correlation (similar to CO monitoring systems) or a tunable laser diode (TDL) system maybe a more reliable / accurate measurement device. Consequently the provisions of PS-15 will be largely inapplicable to the CEMs technology suggested above. Additionally PS-15 fails to address many of the issues that are critical to the performance of CEMs, such as determining calibration error or drift, setting instrument span range, or determining relative accuracy. These types of requirements are the cornerstone of EPA's other performance specifications for CEMS; and,*
- *Applicant proposes to work with instrument vendors and DEP to develop performance specifications, specific to a non-FTIR HCl CEMS within 90 days of permit issuance. The developed performance specification would be submitted to the Bureau for final approval. The performance specification developed and submitted by applicant will be structured similarly to established EPA performance specification formats for other types of monitoring, (e.g. EPA Performance Specification 2 in 40 CFR 60, Appendix B). The applicant requests that the Bureau approve or deny the performance specification within a reasonable period after receipt to allow adequate time to implement the approved compliance methodology. If applicant cannot find an instrument vendor willing to guarantee the performance specification ultimately approved by the Bureau or if such vendor ultimately fails to provide an instrument that does indeed meet the specification, applicant will provide to the Bureau an alternative compliance approach consisting of utilizing stack testing results and boiler operating parameters. Submission, review and acceptance of that alternative approach must be achieved prior to commercial operation of the woody biomass boiler.*

Department's Review. According to other sources consulted by the Department, untreated woody biomass will contain less than 0.02% Cl. The NG, ULSD FO and propane are even lower in Cl content.

The Cl can be released as HCl and or it can be bound to the ash. Cl can also condense in the form of alkali salts (NaCl and KCl) or as NH_4Cl in the presence of NH_3. Some Cl can react further with organic species forming organic HAP including D/F. Fortunately, the SCR unit installed for NO_X control will tend to destroy D/F.

If all Cl is converted to HCl, then the pre-control annual HCl emissions from the biomass boiler are calculated as follows:

[(0.02 lb Cl/100 lb biomass)x(2000 lb biomass/ton biomass)x(36.45 lb HCl/35.45 lb Cl)]x
[(ton HCl/2000 lb HCl)x(47 tons biomass/hr)x(8,760 hr/year)] = 84.7 TPY HCl

A conservative estimate is that as much as half of Cl will actually be converted to HCl. To insure that the PTE is limited to a value less than 10 TPY it will be necessary to use the in-duct sorbent injection system (IDSIS) described for SO_2 control to also control HCl. The HCl will be converted to a particulate salt depending on the sorbent used. It will be necessary to control HCl emissions by approximately 80%. This should be easily accomplished by the described IDSIS and fabric filter baghouse.

The Department will set a limit of 9.7 TPY of HCl on a 12-month rolling average, rolled monthly. Compliance shall be demonstrated by an HCl-CEMS on the principle of FTIR and using the procedures described in Performance Specification 15 of Appendix B of 40 CFR part 60. The 12-month limit equates to 2.22 lb/hr HCl. These limits equate to 0.0029 and 0.0026 mmBtu HCl/mmBtu at the nominal heat input rate of 758 mmBtu/hr and the maximum heat input rate of 834 mmBtu/hr, respectively.

The applicant can subsequently request an alternative sampling procedure (ASP) from the Department if the applicant is able to find a vendor with a HCl-CEMS operating on a different principle such as NDIR that can demonstrate with a very high degree of confidence that the hourly emissions of HCl are less than or equal to 2.22 lb/hr and less than 9.7 TPY.

The SCR installation, GCP in the BFB boiler, use of a non-gasification process, low Cl source biomass and control and measurement of HCl emissions will insure that organic HAP emissions including D/F will be adequately controlled.

5 STARTUP, SHUTDOWN AND MALFUNCTIONS – PROPOSED BFB BOILER

The boiler will be designed to accommodate ULSD FO, NG or propane for boiler startup, shutdown and boiler bed stabilization only. The maximum burner heat input will be limited to 240 MMBtu/hr.

Applicant's Proposal. The applicant has requested excess emissions resulting from startup, shutdown, and documented malfunctions shall be permitted, provided that operators employ the best operational practices to minimize the amount and duration of emissions during such incidents.

The applicant requests that excess emissions resulting from startup, shutdown, or documented malfunctions be permitted but not to exceed two hours in a 24-hour block except for the following specific cases.

a. BFB Boiler Startup: For startup of the BFB boiler, excess emissions shall not exceed twelve (12) hours in any 24-hour period. "Startup" is defined as the commencement of operation of any emissions unit which has shut down or ceased operation for a period of time sufficient to cause temperature, pressure, chemical or pollution control device imbalances, which result in excess emissions. [Rule 62-210.200(245), F.A.C.]

b. BFB Boiler Shutdown: For any BFB boiler shutdown excess emissions shall not exceed six (6) hours in any 24-hour period.

c. BFB Malfunctions: For any BFB documented malfunction, excess emissions shall not exceed two (2) hours in any 24-hour period. A "documented malfunction" means a malfunction that is documented within one working day of detection by contacting the Compliance Authority by telephone, facsimile transmittal, or electronic mail.

Department's Review. The applicable CEMS-based SO_2, NO_X, CO and HCl emissions limits are largely 30-day or 12-month rolling limits that do not provide for data exclusion per the applicable NSPS Subpart or the nature of emission caps for the purposes of avoiding PSD. PM/PM_{10} and VOC emissions are measured by a once per year test. The Department will not allow exclusion of any measured emission data.

The only other limit for which the excess emission rule could apply is opacity. In the case of the NSPS Subpart Db requirements, the 20% opacity standard (6-minute average) applies at all times except for one 6-minute period per hour of not more than 27 percent opacity and during periods of startup, shutdown, or malfunction.

The Department proposes a separate 10% opacity standard except for a single 6-minute period per hour of during which VE may not exceed 20% opacity. The Department will allow excess visible emissions as requested by the applicant by applying a standard of 20% during startups, shutdown and malfunctions expect for one 6-minute period per hour of not more than 27% opacity during periods of startup, shutdown and malfunction.

It is important to limit the occurrences of startups, shutdowns and malfunctions as well as the visible emissions (opacity) during those occurrences to insure that PSD is not triggered.

6 BEST MANAGEMENT PLAN TO CONTROL FUGITIVE EMISSIONS

Table 9 is a listing of the estimated fugitive emissions from the project.

Table 9 - Estimated Potential to Emit (PTE) Criteria Air Pollutants (TPY)

Source Operation	PM	PM_{10}	$PM_{2.5}$
Biomass Handling and Processing	15.70	7.43	1.12
Fly Ash Handling	0.10	0.05	0.007
In-plant Paved Roads	24.0	4.7	0.7
Biomass Pile Processing	1	0.08	0.01
Biomass Pile Wind Erosion	2.7	1.3	0.2
Project Total Fugitive Sources	43.5	13.6	2.0

Fugitive emissions are not counted in determining whether this particular project is subject to PSD. However, the Department requires adherence to Rule 62-296.320(4)(c), F.A.C., which specifies the types of reasonable precaution required to control unconfined emissions of PM.

Accordingly, the applicant submitted a Best Management Practices (BMP) plans that describe fugitive, storage pile BMP plans to comply with the rule and another to describe fire prevention and response procedures. The plans are provided in Tables 10, 11, 12 and 13 below.

Table 10 - BMP for Storage Pile Management

- Woody biomass storage areas shall be managed to avoid excessive wind erosion.
- A woody biomass fugitive dust management plan shall be developed and maintained onsite. Plan shall identify warning signs for conditions that could result in excessive fugitive dust formation. Plant personnel shall be trained on what warning signs to look for.
- Mechanical moving of woody biomass by front end loaders and other supporting equipment shall be minimized on high wind event days.
- Daily visual observations of the woody biomass storage areas shall be performed and if conditions are right for fugitive dust formation, procedures from the fugitive dust plan shall be implemented.
- To control odors the clean woody biomass will be utilized in the first in first out basis.

Table 11 - BMP for Minimization of Fugitive Dust Emissions

- Conveyor systems and associated drop points shall be enclosed or partially enclosed.
- Drop points to woody biomass storage areas shall be designed to minimize the overall exposed (or exposed to atmosphere) drop height.
- Periodic equipment maintenance shall be performed to maintain conveyor systems and associated drop point integrity. Appropriate plant records shall be maintained on equipment maintenance performed.
- Fuel silos shall be equipped with vent filters.
- Daily observations of the conveyor systems and associated drop point integrity to identify any equipment abnormalities.
- Plant personnel shall be trained on identification of warning signs for potential equipment malfunction.
- Signs shall be posted identifying potential warning signs of equipment malfunction.
- Procedures shall be established for defining excessive fugitive dust from woody biomass truck unloading operations. Plant personnel shall visually observe truck unloading operations, including self unloading/dumping operations, and if excessive fugitive dust is detected appropriate fugitive dust minimization techniques shall be implemented. Plant personnel shall be trained on procedures for defining and minimizing excessive dust from the truck unloading operations.
- All major roadways at the plant shall be paved.
- Mud, dirt or similar debris shall be removed promptly from the paved roads.
- Plant personnel shall be trained on what constitutes excessive dust on paved road.

Table 12 - BMP for Fire Prevention /Spontaneous Combustion Minimization Practice

- Contact local fire marshal to develop fire management plan. Plan shall be maintained on site.
- 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 b) install and maintain equipment for plant personnel to handle incipient fires. The local fire department shall be invited to participate in onsite training.
- Daily observations of the woody biomass storage areas shall be performed by plant personnel to identify potential fire hazards. Plant personnel shall be trained on identification of potential fire hazards.
- Signs shall be posted at the plant, which identify potential fire hazards.
- Incoming unprocessed materials shall be stored in areas with a clearance between each storage area.
- The stacker reclaimer being used shall maximize the removal of older material in order to minimize the stacking of newer material on top of older material.
- Compaction of woody biomass materials in the storage areas shall be minimized.

Table 13 - BMP for Quality Assurance of Clean Woody Biomass

- The feedstock for the bubbling fluidized bed (BFB) boiler will consist of clean woody biomass that will be processed in designated fuel preparation area (or areas) where it will be sorted, screened, and sized as necessary, placed in the storage areas or sent directly to the BFB boiler.
- The permittee will contract for woody biomass that specifically meets the definition of woody biomass as identified in the permit. The woody biomass will consist of clean untreated wood or untreated wood products including clean untreated lumber, tree stumps (whole or chipped), tree limbs (whole or chipped) and slash. This also includes, but is not limited to, wood, wood residue, bark, or any derivative fuel or residue thereof, in any form, including but not limited to sawdust, sander dust, wood chips, scraps, slabs, millings, shavings, and processed pellets made from wood or other forest residues.
- The woody biomass feedstock will be delivered to the Hamilton County Plant in vehicles designed to prevent release.
- For each shipment of woody biomass, the permittee shall record the date, quantity and a description of the material received.
- The permittee shall inspect each shipment of woody biomass upon receipt for any material not specifically identified in this plan. If the permittee identifies any such material, the material shall be rejected and/or marshaled in specified areas until proper disposal can be arranged. Rejected materials shall be moved off site in a logistically reasonable time period.
- The permittee shall maintain records of rejected shipments and disposition thereof. Such records shall be made available to the Department upon request.

7 AMBIENT AIR QUALITY

7.1 Introduction

The proposed project will not increase emissions at levels in excess of PSD significant amounts. Therefore, an ambient air quality modeling analysis was not required for this project. However, the applicant provided an ambient air quality analysis to show compliance with the Ambient Air Quality Standards (AAQS). The following sections include the AAQS analysis, a review of current air quality in the vicinity of the project, and information regarding this project and how it relates to other nearby sources of pollution.

7.2 Major Stationary Sources Nearest to the Project

The current largest stationary sources of air pollution in Florida counties within approximately 100 miles of the project site are listed below. The information is from annual operating reports submitted to the Department from 2008. The future emissions from the ADAGE project are included for comparison purposes.

Table 14 - Largest Sources of SO_2 Nearest to the Project

Owner	Site Name	TPY
Jacksonville Electric Authority	Northside/St. Johns River Power Park	12,019
Gainesville Regional Utilities	Deerhaven Generating Station	7,622
Smurfit Stone Container	Fernandina Mill	4,340
White Springs AgriChem	White Springs AgriChem	3,369
Buckeye	Buckeye Taylor	2,195
Cedar Bay	Cedar Bay Cogen	1,957
Rayonier Performance Fibers	Fernandina Sulfite Mill	888
IFF Chemical Holdings	IFF Chemical Holdings Duval	746
Millennium Specialty Chemicals	Jacksonville Plant	408
Anchor Glass	Jacksonville Plant	305
Progress Energy	Suwannee River Plant	265
ADAGE Hamilton	**ADAGE (proposed)**	**149**
E.I. Dupont de Nemours & Co	Trailridge Clay	120

Table 15 - Largest Sources of PM/PM_{10} Nearest to the Project

Owner	Site Name	TPY
Buckeye	Buckeye Taylor	689
Smurfit Stone Container	Fernandina Mill	618
Jacksonville Electric Authority	Northside/St. Johns River Power Park	537
Cedar Bay	Cedar Bay Cogen	172
Rayonier Performance Fibers	Fernandina Sulfite Mill	140
Gainesville Regional Utilities	Deerhaven Generating Station	140
ADAGE Hamilton	**ADAGE (proposed)**	**140**
Gilman Building Products	Gilman Building Products	87
Florida Rock Industries	Thomas S. Baker Cement Plant	73
Owens-Corning	Jacksonville Plant	72

Table 16 - Largest Sources of CO Nearest to the Project

Owner	Site Name	TPY
Buckeye	Buckeye Taylor	6,081
Jacksonville Electric Authority	Northside/St. Johns River Power Park	5,988
Rayonier Performance Fibers	Fernandina Sulfite Mill	1.125
Smurfit Stone Container	Fernandina Mill	978
Florida Rock Industries	Thomas S. Baker Cement Plant	676
Suwannee American Cement	Suwannee American Cement	663
Cedar Bay	Cedar Bay Cogen	540
Gerdau Ameristeel	Jacksonville Mill	379
City of Tallahassee	Arvah Hopkins Power Plant	365
ADAGE Hamilton	**ADAGE (proposed)**	**248**
Gainesville Regional Utilities	Deerhaven Generating Station	232
Nassau County	West Nassau Landfill	202

Table 17 - Largest Sources of VOC Nearest to the Project

Owner	Site Name	TPY
Smurfit Stone Container	Fernandina Mill	994
Buckeye	Buckeye Taylor	627
Rayonier Performance Fibers	Fernandina Sulfite Mill	354
Gilman Building Products	Gilman Building Products Taylor	223
Jacksonville Electric Authority	Northside/St. Johns River Power Park	187
Ball Container	Ball Container Gainesville	173
Johnson & Johnson Vision	Vistakon	165
Anheuser Busch	Anheuser Busch Jacksonville	153
Gilman Building Products	Gilman Building Products Union	147
Gilman Building Products	Gilman Building Products Clay	139
West Fraser Inc.	Whitehouse Lumber Duval	107
CMC Steel Fabricators	CMC Joist & Deck Bradford	101
ADAGE Hamilton	**ADAGE (proposed)**	**56**

Table 18 - Largest Sources of NO_X Nearest to the Project

Owner	Site Name	TPY
Jacksonville Electric Authority	Northside/St. Johns River Power Park	20,482
Gainesville Regional Utilities	Deerhaven Generating Station	3,541
Rayonier Performance Fibers	Fernandina Sulfite Mill	2,180
Smurfit Stone Container	Fernandina Mill	2,100
Cedar Bay	Cedar Bay Cogen	1,890
Buckeye	Buckeye Taylor	1,488
FL Gas Transmission Company	Bradford County Station	831
Suwannee American Cement	Suwannee American Cement	683
Progress Energy	Suwannee River Plant	653
Florida Rock Industries	Thomas S. Baker Cement Plant	642
FL Gas Transmission Company	Perry Compressor Station	569
City of Tallahassee	Arvah Hopkins Power Plant	284
ADAGE Hamilton	**ADAGE (proposed)**	**236**
Millennium Specialty Chemicals	Jacksonville Plant	106

By comparison with other sources in the region, the ADAGE project will be a relatively small source of air pollution.

7.3 Regional Ambient Air Quality Monitoring

The Department and Duval County Local Program operate more than twenty-five monitors at eighteen sites measuring nitrogen oxides (NO_2), SO_2, CO, PM_{10}, $PM_{2.5}$ and ozone (O_3). The 2008 monitoring network is shown in the figure below.

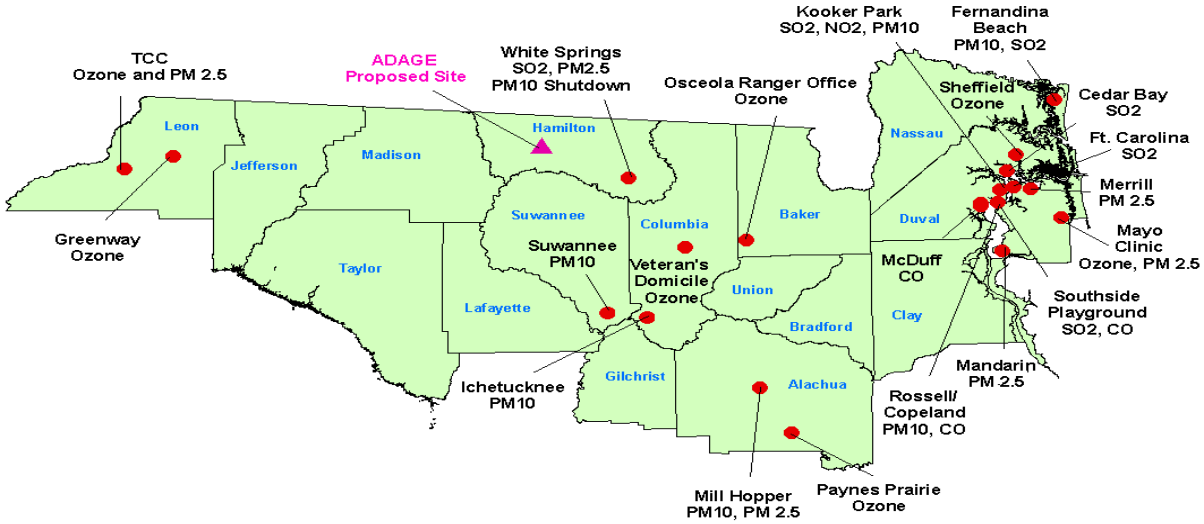

Figure 9 - Ambient Air Monitoring Stations nearest to the Project Location.

As summarized in Table 19 below, all monitors nearest to the project site presently demonstrate attainment with the AAQS.

7.4 Project Ambient Air Quality Impact Analysis

In conducting an ambient air quality impact modeling analysis, the applicant uses the proposed project's emissions at worst load conditions as inputs to the models. The models used in this analysis and any required subsequent modeling analyses are described below. The highest predicted short-term concentrations and highest predicted annual averages predicted by this modeling are compared to the appropriate AAQS to ensure that the proposed project will not cause or contribute to a violation of an AAQS.

A combination of fence line, and non-fence line receptors were chosen for predicting maximum concentrations in the vicinity of the project. The receptor grid consisted of receptors spaced at 50 meter (m) intervals around the facility fence line. The remaining receptors were spaced at 100m intervals from the property boundary out to approximately 1 km, 200m spacing from 1km to 2km, 500m spacing from 2 km to 7 km, and 1000m spacing from 7 km to 12 km.

Models and Meteorological Data Used in the Ambient Air Quality Analysis

The AERMOD modeling system was used to evaluate the pollutant emissions from the proposed project. AERMOD was approved by the EPA in November 2005. The AERMOD modeling system incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including the treatment of both surface and elevated sources, and both simple and complex terrain. AERMOD contains two input data processors, AERMET and AERMAP. AERMAP is the terrain processor and AERMET is the meteorological data processor.

A series of specific model features, recommended by the EPA, are referred to as the regulatory options. The applicant used the EPA recommended regulatory options. Direction specific downwash parameters were used for all sources for which downwash was considered. The stacks associated with this project all satisfied the good engineering practice (GEP) stack height criteria.

The AERMET meteorological data used for this analysis consisted of a concurrent 5-year period of hourly surface weather observations and twice-daily upper air soundings from the Gainesville Regional Airport and the National Weather Service at Jacksonville International Airport respectively. The 5-year period of meteorological data was from 2001 through 2005. The meteorological data used were in accordance with the EPA AERMOD Implementation Guide.

Table 19 - Ambient Air Quality Nearest to Project Site (2008).

Pollutant	Location	Averaging Period	Ambient Concentration				
			High	2nd High	Mean	Standard	Units [a]
PM_{10}	White Springs [i]	24-hour	107	94		150 [b]	$\mu g/m^3$
		Annual			27 [j]	50 [c]	$\mu g/m^3$
PM_{10}	Suwannee	24-hour	62	62		150 [b]	$\mu g/m^3$
		Annual			21	50 [c]	$\mu g/m^3$
PM_{10}	Ichetucknee	24-hour	52	50		150 [b]	$\mu g/m^3$
		Annual			22	50 [c]	$\mu g/m^3$
$PM_{2.5}$	Mill Hopper	24-hour	16	14		35 [d]	$\mu g/m^3$
		Annual			7 [j]	15 [e]	$\mu g/m^3$
$PM_{2.5}$	White Springs [h]	24-hour	24	24		35 [d]	$\mu g/m^3$
		Annual			10	15 [e]	$\mu g/m^3$
SO_2	White Springs	3-hour	103	20		500 [f]	ppb
		24-hour	15	8		100 [f]	ppb
		Annual			2	20 [c]	ppb
NO_2	Kooker Park	Annual			9	53 [c]	ppb
CO	Copeland	1-hour	2	2		35 [f]	ppm
		8-hour	1	1		9 [f]	ppm
Ozone	Columbia	8-hour	70	69		75 [g]	ppb
		4th highest high	67			75 [g]	ppb

a. Units are in: micrograms per cubic meter ($\mu g/m^3$); parts per billion (ppb); or parts per million (ppm).
b. Not to be exceeded on more than an average of one day per year over a three-year period.
c. Arithmetic mean.
d. Three year average of the 98th percentile of 24-hour concentrations.
e. Three year average of the weighted annual mean.
f. Not to be exceeded more than once per year.
g. Three year average of the 4th highest daily maximum.
h. Not a regulatory monitor.
i. No longer operating, data from 2007.
j. Incomplete data for regulatory purposes.

In reviewing this permit application, the Department has determined that the application complies with the applicable provisions of the stack height regulations as revised by EPA on July 8, 1985 (50 FR 27892). Portions of the regulations have been remanded by a panel of the U.S. Court of Appeals for the D.C. Circuit in NRDC v. Thomas, 838 F. 2d 1224 (D.C. Cir. 1988). Consequently, this permit may be subject to modification should EPA revise the regulation in response to the court decision. This may result in revised emission limitations or may affect other actions taken by the source owners or operators. A more detailed discussion of the required analyses follows.

AAQS Analysis

For pollutants subject to an AAQS review, the total impact on ambient air quality is obtained by adding a "background" concentration to the maximum modeled concentration. This "background" concentration takes into account all sources of a particular pollutant that are not explicitly modeled. The maximum predicted annual and high, second high short term impacts for the AAQS analysis are summarized in Table 20 below. As shown in this table, emissions from the proposed facility are not expected to significantly cause or contribute to a violation of an AAQS.

Table 20 - Ambient Air Quality Impacts

Pollutant	Averaging Time	Major Sources Impact ($\mu g/m^3$)	Background Conc. 2003- 2007 ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	Total Impact Greater Than AAQS?	Florida AAQS ($\mu g/m^3$)
PM_{10}	24-hour	29	75	104	NO	150
	Annual	5	27	32	NO	50
NO_2	Annual	1	23	24	NO	100
SO_2	3-hour	67	81	148	NO	1,300
	24-hour	26	34	60	NO	260
	Annual	3	5	8	NO	60
CO	1-hour	586	4,123	4,709	NO	40,000
	8-hour	263	2176	2,439	NO	10,000

The results of the Ambient Air Quality Analysis show that the proposed project will not cause or contribute to a violation of an AAQS. Specifically, the pollutant nearest to the AAQS had a 24-hour high, second-high of 29 $\mu g/m^3$. This value occurs on the property boundary near the facility roadway. The facility road contributes to approximately 80% of the maximum 24-hour PM_{10} impact at this receptor. Therefore, it can be concluded that the truck traffic is the main contributor to the PM_{10} impact from this facility and that the concentrations of PM_{10} will decrease significantly with distance away from the proposed property. In particular, the concentrations drop by approximately 50% at 850 feet from the property line.

8 CONCLUSION

The Department makes a preliminary determination that the proposed project will comply with all applicable state and federal air pollution control regulations as conditioned by the Draft Permit.