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AIR QUALITY

October 9, 2006
AL021-06

Mr. Kenneth Hartzler
Air Quality Program
Pennsylvania Department of Environmental Protection
Southcentral Regional Office
909 Elmerton Avenue
Harrisburg, Pennsylvania 17110

Subject: **United Corrstack, LLC Solid Fuel Fired Evergreen Community Power Project in Reading, Berks County, Pennsylvania Submittal of Air Plan Approval Application**

Dear Mr. Hartzler:

Enclosed are three (3) copies of the Air Plan Approval Permit Application for the proposed United Corrstack, LLC solid fuel fired Evergreen Community Power Project to be located at the existing United Corrstack corrugated medium manufacturing facility in Reading, Berks County, Pennsylvania. A check in the amount of $1,700, made payable to the Pennsylvania Clean Air Fund, is also enclosed to cover the permit application filing fees for this project.

The proposed project is based on an Austrian Energy & Environment Von Roll (AE&E) 482 MMBtu/hr circulating fluidized bed (CFB) boiler and a nominal 30 megawatt steam turbine generator. The proposed boiler will provide process steam to the facility, allowing the retirement of one of the two boilers used to generate steam on-site. Electricity generated will be primarily for facility use, with surplus power sold to the local utility. Additional equipment to be installed as part of the project includes an exhaust stack with a height of 220 feet, a mechanical draft cooling tower, fuel and ash handling equipment and an above ground aqueous ammonia storage tank and No. 2 oil storage tank(s), each with a capacity no greater than 10,000 gallons.

Emissions of all regulated pollutants from the proposed project will be below Prevention of Significant Deterioration, Non-Attainment New Source Review, Hazardous Air Pollutant and Title V major source thresholds. Consequently, the facility is not required to evaluate Lowest Achievable Emission Rate, Best Available Control Technology, or Maximum Achievable Control Technology. The revised application does include a Pennsylvania Best Available Technology (BAT) review and the control equipment/emission levels proposed as BAT are among the best available for biomass fuel-fired fluidized bed boilers. Additionally, in accordance with PaDEP's request, the application contains an atmospheric dispersion analysis that demonstrates that emissions from the proposed facility will not cause or contribute to a violation of National Ambient Air Quality Standards.

1200 Wall Street West, 2nd Floor • Lyndhurst, New Jersey 07071
Telephone 201-933-5541 • Fax 201-933-5601

Notice of submission of this application has been sent to the City of Reading and the Berks County Commissioners via Certified Mail. Copies of the Act 14 notification letters are included in Appendix B of this air permit application. Copies of the returned Certified Mail Receipts will be forwarded under separate cover when they are received. Note that copies of the application have been sent to Tim Leon-Guerrero (including a CD-ROM of modeling files) and Roger Fitterling directly. In accordance with your instructions, only the original signature copy of the application sent to you contains the CD of modeling files.

If you have any questions, please feel free to call Chris Fell, UCI's Manager of Engineering, at 610-374-3000, ext. 270, or me at 201-933-5541, ext. 115.

Yours truly,

TRC Environmental Corporation

Anthony P. Letizia
Vice President

APL/ey

Enclosure

cc: R. Davis, PaDEP Southcentral Regional Office (w/o enclosure)
T. Leon-Guerrero, PaDEP Headquarters Office (w/ enclosure)
R. Fitterling, PaDEP Reading Office (w/ enclosure)
C. Fell, Interstate Resources (w/ enclosure)
TRC Project 42819

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PLAN APPROVAL APPLICATION FOR THE UNITED CORRSTACK, LLC EVERGREEN COMMUNITY POWER PROJECT

Prepared for:

United Corrstack, LLC
Reading, Pennsylvania

Submitted to:

Commonwealth of Pennsylvania
Department of Environmental Protection
Southcentral Regional Office
Harrisburg, Pennsylvania

Prepared By:

TRC Environmental Corporation
1200 Wall Street West, 2nd Floor
Lyndhurst, NJ 07071

October 2006

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Section 1.0

1.0 INTRODUCTION

1.1 Project Overview

United Corrstack, LLC, (UCI) currently operates a corrugated medium manufacturing facility at 720 Laurel Street in the City of Reading, Berks County, Pennsylvania. The facility has been in operation for over 12 years. UCI produces on average 430 tons per day of corrugated medium and employs 75 full-time people. The UCI facility currently purchases electricity from Metropolitan Edison, a First Energy Company (Met-Ed) and generates process steam using two of the three Cleaver Brooks boilers currently on-site. The main Cleaver Brooks boiler is rated at 99 million British Thermal Units (MMBtu) per hour, and can fire natural gas or No. 2 distillate fuel oil. The remaining two Cleaver Brooks boilers are each rated at approximately 12.55 MMBtu/hour. One of these units has the capability of burning natural gas or No. 2 fuel oil. The second unit, while still permitted, had been decommissioned prior to this plan approval application, and was capable of operating on natural gas only.

UCI (the "applicant") is proposing to purchase and install a circulating fluidized bed (CFB) boiler and steam turbine generator to meet its current and future energy requirements. The boiler will be specifically designed to burn a range of biomass (as well as other residual) fuels at a thermal fuel efficiency approaching 90%. The construction of the new CFB boiler is driven by UCI's need to survive in a competitive marketplace by significantly reducing its energy costs. The project will make beneficial use of UCI's waste stream as well as other residual materials currently directed to landfill disposal. The proposed project is designated the "Evergreen Community Power (ECP)" project. ECP will assume ownership upon project completion and initial operation of the CFB boiler. UCI will be the operator of the ECP facility and will be responsible for compliance with all applicable environmental regulatory requirements.

The CFB boiler is designed to produce superheated steam at 1,200 psig at 850 °F. The proposed plant will be designed to produce 330,000 lb/hr of steam (or 110% of the boiler's maximum continuous rating (MCR)). Of this total steam production, up to 30,000 lb/hr of steam could be used for auxiliary steam demands resulting in 300,000 lb/hr net steam flow to the steam turbine. It is proposed that the boiler will have a heat input capacity of 482 MMBtu/hour (based on Higher Heating Value of fuel mixture) at 110% MCR and will provide up to 30 MWe of power for facility use and/or sale to the electrical grid, as well as process steam for the facility's drying requirements.

The CFB boiler will utilize a variety of residual waste stream fuels, including waste wood (plywood and particleboard), paper mill sludge, rejected materials from UCI's stock preparation area (UCI log), sorted construction and demolition (C&D) untreated wood, burlap, residual food streams (such as candy wrappers and waste chocolate), carpet, tire derived fuel (TDF), pre- and post-consumer plastic/rubber waste and various agricultural-based fuels (agro-fuels). Creosote-treated and non-creosote railroad ties and utility poles, which are not classified as biomass fuels, are included in the fuel mix and are capable of being combusted in the CFB boiler. The proposed CFB boiler is capable of firing up to 30% coal or residual coal (culm). This air plan approval application has not identified coal or other waste coal fuels in the listed portfolio of fuels. If there is a future need to combust these fuels, an investment in fuel handling and storage will be required, as well as an air permit modification submittal for qualifying these fuels as viable components of the fuel mix consistent with the air plan approval limits of a "synthetic minor" source.

Since the new CFB boiler will be the primary source of steam and electricity at the plant, the natural gas or oil-fired 12.55 MMBtu/hr boiler will be shut down, and the remaining 99 MMBtu/hr package boiler will be reserved for standby operation after successful completion of a "construction check-out and commissioning" phase of the new CFB boiler and when the CFB boiler is down for scheduled maintenance outages. Standby operation would allow the package boiler to be brought online (from a cold start) in the event that the CFB is down. The project scope will include a steam turbine generator, a mechanical draft cooling tower to condense steam from the steam turbine, an aboveground storage tank for aqueous ammonia (19% by weight) to be used for the control of nitrogen oxides (NO_x) emissions, one or two distillate fuel oil-fired emergency generators and aboveground storage tank(s) (capacity of 10,000 gallons or less) for the emergency generator(s) fuel. The facility will be constructed on a 4.8 acre parcel of land that is part of a 19.15 acre parcel of land purchased by UCI and located adjacent to the existing UCI facility.

The details provided in the plan approval application form for the proposed CFB boiler design and associated emission control technologies are based upon the scope of supply as contracted with the supplier of the CFB boiler, which is Austrian Energy and Environment (AE&E), and relevant and supportive data as provided by emission control technology vendors. AE&E is a recognized as a world leader in the design and manufacture of CFB boilers using residual waste fuel mixtures in the capacity range for the ECP project. The heat input capacity, steaming rate, and all stated uncontrolled emission limits will be achieved by AE&E per their contractual obligations. The "to be selected" emission control technology vendor(s) will achieve the controlled emission limits required to allow the facility to retain its current classification as a "synthetic minor".

1.2 Facility Emissions, Applicable Requirements and Controls

1.2.1 Best Available Technology

Best Available Control Technology (BACT) must be applied to control emissions of pollutants that are subject to PSD review based on potential emissions of each pollutant. Non-Attainment New Source Review (NSR) is required for emissions of NO_x and volatile organic compounds (VOC) from a facility located in the ozone transport region and having potential emissions of NO_x exceeding 100 tons/year and/or VOC exceeding 50 tons/year. A component of NSR is a requirement to meet Lowest Achievable Emission Rate (LAER) limits. Since the facility emissions for the ECP project have been limited below the PSD and NSR thresholds, it is not necessary to examine BACT or LAER for any pollutants.

Although the proposed installation is not subject to major source BACT or LAER requirements, Section 127.12(a)(5) of the Pennsylvania regulations requires applicants to "show that emissions from a new source will be the minimum attainable through the use of Best Available Technology" (BAT). The facility is proposing to meet BAT requirements by using the demonstrated advantages of CFB combustion technology for control of carbon monoxide (CO) and VOC emissions as a function of the combustion process, limestone injection in the CFB for SO_2 control, and dry sorbent injection of natural sodium bicarbonate or "Trona" for effective control of sulfur dioxide (SO_2) emissions as well as hydrogen chloride (HCl) (also expected to control sulfur trioxide (SO_3)/sulfuric acid mist (H_2SO_4) and hydrogen fluoride (HF) emissions). A multi-clone system at the CFB boiler outlet followed by an electrostatic precipitator (ESP) will be installed for the control of PM/PM-10 emissions. To address the needed NO_x emissions removal rates, the facility will capitalize on the inherently low-NO_x generating CFB furnace technology (w/ staged over-fire air introduction) and Selective Catalytic Reduction (SCR) in the boiler flue gas stream. Flue gas recirculation will be utilized as a fluidized bed temperature control measure for NO_x concentration trim control. BAT analyses are also included in this application for ammonia (NH_3) and Hazardous Air Pollutants (HAPs) from the CFB boiler and PM/PM-10 from the cooling tower and material handling and storage activities.

Hartzler, Kenneth

From: Leon-Guerrero, Timothy
Sent: Tuesday, November 07, 2006 8:56 AM
To: Hartzler, Kenneth
Cc: Fitterling, Roger
Subject: Corrstack Modeling

Ken,

I just talked with Roger about the modeling Corrstack sent in with their plan approval application (06-05079D). I'm pretty much done my review and don't have any problems with their methodology or their final concentrations. I will try and get my review memo finalized by next Tuesday. Let me know if you find a problem with their analysis which would affect the stack parameters or if the company plans any changes that would alter their stack parameters. In either case I would have to redo the modeling. Thanks in advance.

Timothy A. Leon Guerrero
Chief, Air Quality Modeling Section
Harrisburg, PA

717 783-9243
tleonguerr@state.pa.us

1.3 Atmospheric Dispersion Modeling

Although not typically required for facilities of this size, PaDEP requested that an atmospheric dispersion modeling analysis be performed as part of the plan approval application. The results of the analysis demonstrates that the proposed facility will result in maximum concentrations that are well below the applicable National Ambient Air Quality Standards (NAAQS) and PSD Class II increments (note that PSD requirements are not applicable to the proposed project). Therefore, the proposed facility poses no threat to the local or regional ambient air quality.

1.4 Conclusions

The conclusions reached from the results of the engineering and modeling analyses are that the ECP project will: 1) not be subject to PSD or Non-Attainment New Source Review; 2) meet all control technology requirements resulting from BAT; 3) result in ground level air quality concentrations that will not cause or contribute to a violation of any applicable air quality standard; and 4) comply with all other applicable federal and Pennsylvania air quality requirements.

1.5 Summary of Proposed Emission Limits

Table 1-1 presents a summary of the permit limits proposed for the ECP project. These limits reflect the application of BAT control technology for the CFB boiler and have been shown to result in air quality concentrations that are in compliance with the NAAQS. In addition, emissions from the insignificant sources have been included to demonstrate that the facility wide potential-to-emit (PTE) is below Title V, PSD and NSR major source thresholds.

1.6 Contents of Application Support Document and Appendices

The remainder of this plan approval application support document includes the following major components:

- Project description detailing all existing and proposed emission sources with associated material handling and storage activities, air pollution control technologies, and the basis for potential emission rates (Section 2);
- Applicable regulatory analysis identifying all specific regulatory requirements for the proposed project (Section 3);
- Control technology analysis evaluating BAT for each applicable pollutant from the proposed CFB boiler (Section 4); and

- Atmospheric dispersion modeling analysis demonstrating compliance of the proposed facility emissions with respect to the NAAQS (Section 5).

Appendix A of this plan approval application contains the PaDEP plan approval application form for the CFB boiler. Also included in Appendix A are plan approval application forms for the existing package boiler and the multiple cell mechanical draft cooling tower. Additionally, General Information Form (GIF) and Air Pollution Control Act Compliance Review forms are included in Appendix A. Copies of the Act 14 notification letters to local officials are included in Appendix B. Emission calculation spreadsheets providing supporting calculations for the application forms are included as Appendix C of this application. Appendix D consists of summary tables from a search of U.S. EPA's RACT/BACT/LAER Clearinghouse (RBLC) database in support of the BAT analyses included in Section 4.

1.7 Project Schedule

Schedule milestones for the proposed project are as follows:

- Draft Plan Approval issuance — January 2007
- Final Plan Approval issuance — March 2007
- Start construction of CFB Boiler — April 2007
- First fire — April 2008
- Commence commercial operation — May 2008

Table 1-1: Summary of Proposed Emission Limits

Pollutant and Source(s)	Facility Emissions		
	lb/MMBtu	lb/hr	tons/year
Nitrogen Oxides (NO_x)			**96.1**
CFB Boiler	0.042	20.2	
Package Boiler – natural gas	0.036	3.6	
Package Boiler – No. 2 fuel oil	0.111	11.0	
Volatile Organic Compounds (VOC)			**17.0**
CFB Boiler	0.008	3.9	
Package Boiler – natural gas	0.00005	0.005	
Package Boiler – No. 2 fuel oil	0.0002	0.02	
No. 2 Fuel Oil Storage Tank	N/A	N/A	
Carbon Monoxide (CO)			**99.1**
CFB Boiler	0.047	22.6	
Package Boiler – natural gas	0.017	1.7	
Package Boiler – No. 2 fuel oil	0.025	2.5	
Filterable Particulate Matter (PM)			
CFB Boiler	0.029	13.9	**61.3**
Package Boiler – natural gas	0.0076	0.8	
Package Boiler – No. 2 fuel oil	0.021	2.1	
Cooling Tower	N/A	0.2	
Filterable + Condensable Particulate Matter (PM-10)			**96.1**
CFB Boiler	0.046	22.1	
Sulfur Dioxide (SO_2)			**92.0**
CFB Boiler	0.044	21.1	
Package Boiler – natural gas	0.0006	0.1	
Package Boiler – No. 2 fuel oil	0.304	30.1	
Sulfuric Acid Mist (H_2SO_4)			**6.9**
CFB Boiler	0.003	1.6	
Hydrochloric Acid (HCl)			**9.6**
CFB Boiler	0.005	2.3	
Ammonia (NH_3)			**12.9**
CFB Boiler	0.006	3.0	

Notes:

1) Proposed emission limits apply at all times except during periods of start-up, shutdown or malfunction. Applicable 40 CFR 60 Subpart Db emission limits apply during any mode of operation with compliance demonstrated on a 30-day rolling average basis.
2) Lb/hr emission limits based on application of appropriate controls on emission source at full rated capacity.
3) CFB boiler PM-10 and VOC compliance is to be based on a 3-hour average, determined by the average of three one-hour stack tests.
4) CFB boiler CO compliance is to be based on a 3-hour average, as measured by continuous emissions monitoring (CEM) system.
5) CFB Boiler NO_x and SO_2 compliance is to be based on a daily rolling 30-day average basis, as measured by CEM system.
6) CFB boiler annual emission limits based on full load operation for 8,500 hours per year.
7) Compliance with annual limits will be demonstrated on a rolling 12-month basis.
8) Facility annual emission totals include emissions from all sources, including the CFB boiler, package boiler, cooling tower, small natural gas-fired combustion sources (process heaters/dryers) and emergency generators.

2.0 PROJECT DESCRIPTION

UCI currently manufactures an average of 430 tons per day of corrugated medium at its facility in Reading, Pennsylvania. Currently, the facility purchases its electrical power from Met-Ed and generates on-site process steam from two natural gas and No. 2 oil-fired boilers. In order to stop escalating energy costs, UCI is proposing to install a residual solid fuel-fired circulating fluidized bed (CFB) boiler to generate up to 30 MWe of electricity while satisfying on-site process steam (drying) needs. Once the CFB boiler is fully operational, two of the three boilers located at the plant will be decommissioned with the third package boiler used for back-up steam supply. A local materials processor/recycler will deliver a specified fuel mix by trucks, which will be used in addition to the waste materials generated in the recycling activities on-site, to fuel the CFB boiler. Ash from the CFB combustor will be transported off-site by truck to the materials processor's permitted facility.

The proposed Evergreen Community Power (ECP) project will be installed on property adjacent to UCI's current facility. Figure 2-1 shows a site map and the project location.

2.1 Existing Emission Sources

Existing emission sources at the UCI facility consist of fossil fuel-fired boilers, insignificant natural gas combustion sources, and an aboveground fuel oil storage tank.

2.1.1 Steam Boilers

Currently, there are three boilers located at the UCI facility. Two of these boilers are currently used to provide steam to the paper mill process and for building heat. The largest boiler is rated at 99 MMBtu/hr, and is capable of firing either natural gas or No. 2 fuel oil. The two other boilers are both rated at 12.55 MMBtu/hr. Both of these units can fire natural gas, and only one of these units can fire No. 2 fuel oil. The unit which can only fire natural gas has already been decommissioned. Upon completion of the start-up and commissioning phase of the ECP project, the second 12.55 MMBtu/hr boiler will be retired. The 99 MMBtu/hr boiler will remain operational for standby purposes only. The unit will not operate while the CFB boiler is in operation, except during startups, shutdowns, and periods of transfer of the steam load between the two boilers. When the CFB boiler is shut down for planned outages, the existing package boiler will be permitted for unrestricted operation on natural gas, and for operation for up to 21 days per year (504 hours per year) on No. 2 fuel oil, which is equivalent to 49,896 MMBtu/yr.

Section 2.0

2.1.2 Insignificant Combustion Sources

In addition to the steam boilers that are located at the facility, there are a total of four insignificant natural gas combustion sources. There are three natural gas air heaters, one rated at 80,000 cubic feet of exhaust flue gas per minute and two rated at 60,000 cubic feet of exhaust flue gas per minute each. There is also one natural gas process dryer rated at 60,000 cubic feet of exhaust flue gas per minute. The corresponding total maximum heat input rating of these small natural gas-fired sources is 14.6 MMBtu/hr (each source is less than 10 MMBtu/hr and exempt from plan approval requirements).

2.1.3 No. 2 Fuel Oil Storage Tank

There is one 10,000-gallon above ground storage tank that is used to store the No. 2 fuel oil that is burned in the existing boilers. This tank will remain in use at the site, and continue to store No. 2 fuel oil for the standby operation of the 99 MMBtu/hr package boiler.

2.2 Proposed CFB Combustor and Boiler

UCI is proposing to install a CFB boiler that has been designed to burn a range of residual waste materials. The combustor will be operated in conjunction with a high-pressure water wall steam boiler that will generate steam to be used to produce electricity in a Steam Turbine Generator capable of delivering 30 MWe of electric power. The maximum heat input capacity for the CFB boiler will be 482 MMBtu/hr, Higher Heating Value (HHV). Extraction steam from the steam turbine will be used in the paper making process. Steam turbine exhaust steam will be condensed in a condenser cooled by circulating water from a mechanical draft evaporative cooling tower. UCI is proposing to inject limestone in the fluidized bed to minimize SO_2 emissions from the CFB boiler. Additionally, products of combustion will pass through a series of cyclones, an electrostatic precipitator (ESP) and selective catalytic reduction (SCR) system before exhausting to a stack with a height of 220 feet above grade. The CFB boiler flue gas will also be treated by dry sorbent injection (Trona) that will occur at the inlet of the hot ESP, and as-needed, at the inlet of the multi-clone system as a secondary injection point.

The CFB boiler will be equipped with supplemental fossil fuel-fired burners and bed lances used primarily during start-up mode. There will be four start-up burners each rated at 40 MMBtu/hr and six bed lances rated at 14.5 MMBtu/hr each. The total maximum heat input capacity of the four start-up burners and six bed lances is 247 MMBtu/hr. Each of these burners will be designed to fire natural gas only.

The CFB boiler will combust a mixture of waste wood (plywood and particleboard), paper mill sludge (consisting of moist paper fiber and filler materials), the rejected waste materials from UCI's stock preparation process (referred to as the UCI log), creosote-treated and non-creosote railroad ties and utility poles, construction and demolition (C&D) untreated wood, burlap, residual food streams (such as candy wrappers and chocolate waste), carpet, pre- and post-consumer plastic/rubber waste, various agro-fuels (mustard bran and prune pits) and tire derived fuel (TDF), all of which constitutes "the fuel". Tire derived fuel or a "dry" biomass material will be used as "high calorific fuel" components to regulate the heat input to the boiler to stabilize bed temperature and/or maintain the steaming rate.

Supporting equipment, such as a multiple cell cooling tower, an aqueous ammonia storage tank (19% by weight), one or two emergency generators (total of 1.56 MW for either option), aboveground distillate fuel oil storage tank(s) for the emergency generator(s), and a solid fuel storage containment unit with associated conveying equipment will be installed as part of the ECP project.

A plot plan showing proposed equipment locations is presented in Figure 2-2. A conceptual flow diagram for the proposed facility is presented in Figure 2-3.

2.2.1 Air Pollution Control Equipment for CFB Boiler

The proposed CFB boiler for the UCI project will be equipped with various add-on emission control technologies to reduce emissions of NO_x, SO_2, H_2SO_4 mist, HCl, HF and PM/PM-10 (filterable and condensable) in accordance with BAT requirements.

2.2.1.1 Limestone Injection

UCI is proposing to inject limestone into the fluidized bed as an initial means of controlling SO_2 emissions. Limestone reacts with the SO_2 formed during combustion and forms a solid sulfate, which can be discarded as a dry solid. The following chemical equations describe the reactions occurring in the fluidized bed upon injection of the limestone:

$$CaCO_3 \Rightarrow CaO + CO_2$$
$$CaO + SO_2 + \frac{1}{2}O_2 \Rightarrow CaSO_4$$

For the proposed CFB boiler, limestone injection is estimated to remove up to 90% of SO_2 emissions when operating at the maximum fuel sulfur loading (1.45% by weight) to the boiler.

2.2.1.2 Multi-Clone System

A multi-clone system will be located at the outlet of the CFB boiler back-pass and consist of a series of cyclones for the initial removal of particulate matter from the flue gas stream. Multi-clones are commonly used as a pre-cleaning particulate matter removal device upstream of an electrostatic precipitator or fabric filter baghouse to capture the larger (>15 microns) particulate in the flue gas.

Particles in the flue gas stream enter the cyclone and the cylindrical shape of the control device forces the flue gas stream to turn. The larger size particles have too much momentum and can not make the turn. These particles collide with the cyclone wall, slide down the wall, and are collected in a hopper. Similar to the funnel of a tornado, the flue gas stream actually turns a number of times in a helical pattern. This provides many opportunities for particles to break through the streamlines, thus hitting the cyclone wall.

UCI will install a "multi-clone system" to achieve up to 85% removal of filterable particulate matter >15 microns in size at the CFB boiler discharge. The "pre-cleaned" flue gas stream will reduce the overall dust loading on the hot electrostatic precipitator (ESP). In addition, the multi-clones protect the ESP from any unforeseen large particle loading discharging from the boiler section.

2.2.1.3 Electrostatic Precipitator

An electrostatic precipitator (ESP) uses electrostatic charges to control particulate emissions. The particles are charged by forcing them to pass through a region in which gaseous ions flow, referred to as a corona. High voltage electrodes in the center of the flow lane create an electric field that forces the charged particles to the walls. The particles are forced out of the gas stream onto collector plates. Once the particles are on the collector plates, they are removed without being re-entrained into the gas stream. With the proposed ESP for the ECP project, this is accomplished by electromagnetic rappers installed on the roof section. These rappers deliver hammer blows of pre-set intensity at pre-set intervals to the plate headers. A vertical shock wave is created in each plate causing the collected material to shear off and fall into a hopper. The particulates are disposed of through the hopper. The ESP proposed for the ECP project will be located at the outlet of the multi-clone system with inlet temperatures controlled to approximately 600°F. This location of the ESP control device results in the unit being termed a "hot ESP". The proposed hot ESP is sized to achieve a 99.63% removal efficiency of filterable particulate matter at maximum levels of inlet dust loading.

2.2.1.4 *Selective Catalytic Reduction*

The formation of NO_x is determined by the interaction of chemical and physical processes occurring during combustion within the CFB boiler. There are two principal forms of NO_x - "thermal" NO_x and "fuel" NO_x. Thermal NO_x formation is the result of oxidation of atmospheric nitrogen in the combustion zone. The major factors influencing thermal NO_x formation are temperature, concentrations of nitrogen and oxygen in the inlet air and residence time within the combustion zone. Fuel NO_x is formed by the oxidation of fuel-bound nitrogen. NO_x formation can be controlled by adjusting the combustion process and/or installing post-combustion controls.

Selective Catalytic Reduction (SCR) is a supplemental NO_x control technology that is placed in the flue gas stream following the particulate removal device (hot ESP for this application). SCR involves the injection of NH_3 into the exhaust gas stream upstream of a catalyst bed. On the catalyst surface, NH_3 reacts with NO_x contained within the flue gas stream to form nitrogen gas (N_2) and water (H_2O) in accordance with the following chemical equations:

$$4NH_3 + 4NO + O_2 \Rightarrow 4N_2 + 6H_2O$$
$$8NH_3 + 6NO_2 \Rightarrow 7N_2 + 12H_2O$$

The catalyst's active surface includes a metal, e.g. titanium or vanadium or equivalent, to promote the NO_x reduction process. The geometric configuration of the catalyst body is designed for maximum surface area and minimum obstruction of the flue gas flow path in order to achieve maximum conversion efficiency of NO_x to N_2.

Aqueous ammonia (19% by weight) is drawn from a storage tank, vaporized, and injected into the flue gas stream ahead of the catalyst bed. Excess NH_3 which is not reacted in the SCR and which is emitted from the stack is referred to as NH_3 slip. The expected levels of ammonia slip are provided in Appendix C.

2.2.1.5 *Dry Sorbent (Trona) Injection*

The project will install and operate a "dry sorbent (sodium) injection system" because there is strong evidence that it provides a more cost effective alternative to traditional spray dry or wet scrubbing system for the removal of SO_2 and HCl (as well as SO_3/H_2SO_4 and HF). The process requires no slurry equipment or reactor vessel since the sorbent is milled and stored on-site then injected directly into the flue gas duct to allow instantaneous reactions with the acid gases. The spent sorbent that has completed needed flue gas chemical reactions is then effectively collected dry in the electrostatic precipitator.

In review of the literature, as well as operating sites, it is clear that sodium bicarbonate and sodium sesquicarbonate are very effective products for use in this application. Once injected into the flue gas stream, both products undergo rapid calcination of contained sodium bicarbonate to sodium carbonate when heated at or above 275°F. The "popcorn-like" decomposition creates large reactive surfaces bringing unreacted sodium carbonate to the particle surface for SO_2 and HCl neutralization. The byproducts of the chemical reactions are sodium sulfate and sodium chloride and are collected by the hot ESP with the fly ash.

UCI will utilize natural occurring sodium sesquicarbonate (known as "Trona") for dry sorbent injection in the flue gas system. The primary point of introduction will be the inlet to the hot electrostatic precipitator. This will provide necessary residence time for the chemical reaction to occur. As a secondary point of control of acid gas emissions, design provisions will be made to allow Trona to be injected at the inlet to the multi-clone system. This multi-staged Trona injection strategy will support a 90% removal efficiency of SO_2 and a 98.5% removal efficiency of HCl. The removal efficiencies previously stated represent the worst-case conditions of sulfur and chlorine content in the residual waste fuel stream.

The decomposition of Trona can be summarized by the following equation:

$$2[Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O] + \Delta \rightarrow 3Na_2CO_3 + 5H_2O + CO_2$$

The acid gas neutralization reactions can be summarized by the following equations:

SO_2: $Na_2CO_3 + SO_2 \rightarrow Na_2SO_3 + CO_2$ and
$Na_2SO_3 + \frac{1}{2}O_2 \rightarrow Na_2SO_4$

HCl: $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

A plant's operating conditions will ultimately affect the performance of Trona in acid gas removal. The most important variables for high removal efficiency are injection temperature (325-900 °F), acid concentration (=>5%), fine particle size (<10 microns), and retention time (the time the acid gases are in contact with the sorbent). ECP's design basis will meet the criteria for achieving high removal efficiency of SO_2 and HCl by Trona injection. Specific literature describing the applications and benefits of Trona are provided in Appendix H. In addition, UCI is compiling further technical data of actual facilities that demonstrate the effectiveness of Trona for this acid gas control application. This information will be submitted as an addendum to Appendix H within two weeks following the initial submittal of the air plan approval application.

2.2.2 Stack Height

A single stack with a height of 220 feet above grade is proposed to vent the combustion gases from the CFB boiler to the atmosphere. The GEP stack height definition is based on the observed phenomenon of atmospheric flow in the immediate vicinity of a structure. It identifies the minimum stack height at which elevated ground-level concentrations caused by adverse aerodynamics (cavity and downwash effects) are avoided.

The EPA GEP stack height regulations specify that the GEP stack height is calculated in the following manner:

$$H_{GEP} = H_B + 1.5L$$

where: H_B = the height of adjacent or nearby structures, and

L = the lesser dimension (height or projected width of the adjacent or nearby structures)

A facility plot plan showing the locations of all major facility structures is presented in Figure 2-2. The controlling structure for the stack is the boiler, which at a height of 180 feet, results in a calculated GEP stack height of 442 feet above grade. Although the proposed stack height is not designed to be equal to the formula GEP height, a stack height of 220 feet has been shown through atmospheric dispersion modeling to result in ground level concentrations that are well below ambient air quality standards.

2.3 Material Handling, Preparation and Storage Systems

ECP will use selected waste materials as fuel for the project. The materials that are proposed are waste wood (plywood and particleboard), paper mill sludge, UCI log, creosote-treated and non-creosote railroad ties and utility poles, sorted C&D untreated wood, burlap, candy wrappers, chocolate waste, carpet, pre- and post-consumer plastic/rubber waste, various agro-fuels and

TDF. These materials can be burned cleanly and efficiently utilizing CFB boiler technology. These waste materials are less desirable for landfill disposal due to slow rates of degradation and low compaction characteristics. Working in cooperation with a local materials processor/recycler, these materials will be redirected from current means of disposal and processed to an acceptable mix for use as fuel in the CFB boiler. The process will generate "bottom" ash from the boiler combustion section, and fly ash from the back-pass section of the boiler, the multi-clone system, and hot ESP. Sand and limestone will be injected at the CFB boiler to achieve needed fluidization and SO_2 control.

2.3.1 Fuel System

Most of the fuels, except for the paper mill sludge stream and the UCI log, tend to be classified as "dry" fuels (low in moisture content). CFB combustion technology for this application has been designed to burn a range of Btu content fuels providing for maximum fuel flexibility between the range of 4,300 to 7,000 Btu/lb lower heating values (LHV). To achieve this desired moisture content, paper mill sludge and the UCI log will be blended with the other materials. TDF (or another high Btu-type material type) will be metered to the combustor separately.

The residual material will be received, processed, and blended at an "off-site" processing/recycling facility and then delivered to the ECP fuel storage unit via self-unloading trailers. As a standard basis, deliveries will occur on a five days per week basis primarily during the off-peak and night-time hours. Trucks will travel on major highways and the specifically designed industrial connector roadway near the ECP facility. Truck traffic will avoid congested residential areas. A recently completed traffic study has confirmed that there will be no negative impact to the local traffic patterns.

To support the 24/7 ECP facility operation, approximately 50 trucks per day will be processed through the fuel receiving and storage complex. Delivery of fuel on weekends or holidays is not anticipated, unless unusual circumstances dictate otherwise.

Pre-mixed and blended residual material will be received within a series of fuel reclaim hoppers. Once unloaded, the self-unloading trucks will return to the off-site fuel processing area for additional loads. The fuel reclaim hopper will feed covered transport conveyors to the inlet of the totally enclosed fuel storage system.

The fuel storage system will operate on a first-in, first-out basis and will be designed to provide a four or five-day supply of fuel. The storage system will be totally enclosed to avoid the potential for odors and fugitive dust. Enclosed storage will also prevent storm-water contamination. Given the moisture content of the fuel mix, the fuel receiving and storage system will be designed with a leachate collection sump and pumping system. Any leachate will be collected in the sump and disposed of in accordance with established regulatory requirements.

In the event of an outage (planned or unplanned) in the primary fuel storage and delivery systems, a bypass system will be provided to allow truckloads of material (from the reclaim hopper) to be sent directly to the boiler's mixed fuel storage bin(s).

TDF or an alternate "high calorific fuel" will be stored on-site and handled separately from the "base" bio-fuel mix. TDF poses minimal concerns regarding odor or leachate problems. TDF is a high Btu fuel (>12,000 Btu/lb) and will be used primarily to trim the heat input into the CFB boiler and provide a necessary boiler response capability to maintain steam output parameters.

The fuel delivery system is a series of conveyors that will transport the fuel from the fuel storage facility to the fuel feed bins mounted next to the CFB boiler itself. Covered conveyors will control odors and fugitive dust from the process. Future design flexibility will be incorporated in the design of the conveyors to add selective dust collection if deemed necessary based upon initial operation.

Fuel flow from the metering bins will be delivered to the combustor either at the "loop seal" pr the front wall of the combustion section. Each fuel bin delivery system is sized to deliver the full MCR of the CFB boiler.

2.3.2 Ash System

The use of residual materials as fuel will generate ash from the process. Ash will be removed from the combustor's flue gas stream in four locations: bottom drains from the CFB combustion section (referred to as bottom ash), drop hoppers located in the base of the boiler back-pass section, at the base of the multi-clone system and at the bottom sections of the hot ESP. Material removed from the combustion section/CFB bottoms will be segregated into two major components: sand and ash/metals. The sand will be recovered for re-use in the CFB boiler and the bottom ash will be forwarded to an ash storage silo. Ash removed from the boiler back-pass and by the multi-clone system will be forwarded to the same ash storage silo. An ash conditioning system (moisture addition) will be used to control dust. The ash silo will periodically be emptied into a roll-off container or an open top trailer with cover provisions for transport. This ash will be covered for transportation back to the processing/recycling facility and used in multiple soil reclamation applications. Ash removed by the hot ESP will be sent to an independent silo or to the common silo as previously described. Ash will be tested to determine its constituents and appropriately segregated. A metal separation system (magnet) will remove the metal from the ash and sand. Metal will be collected and appropriately disposed of or sold if the market supports this method of removal.

2.3.3 Bed Medium System

Sand and limestone are used to create a "heat-sink" and fluidizing medium within the circulation loop. The residual (bio-fuel) materials are introduced via the loop seal of the CFB where it mixes with the bed medium and gets combusted. Sand and limestone as well as unburned fuel is separated in the cyclone section of the CFB and re-circulated. Once complete combustion is achieved, the flue gases exit the cyclone section and begin the transfer of heat to the boiler water walls and tubes to generate steam at the desired temperature and pressure.

The sand and limestone will be delivered via self-unloading (pneumatic) trucks and stored in separate storage silos. The addition of this material to the CFB boiler will be controlled to maintain the desired mass levels in the circulation loop, as well as the level of SO_2 removal required in the CFB boiler.

2.4 Cooling Tower

Steam from the boiler will be directed to a multi-staged extraction/condensing turbine. That portion of steam leaving as exhaust from the steam turbine enter a condenser, with cooling supplied by circulating water in a counter-flow evaporative cooling tower system. The planned design of the cooling tower is a multiple cell mechanical draft style equipped with its own fan and high efficiency drift eliminators to minimize water losses, as well as limiting the height and impact of the plume.

2.5 Other Exempt and Trivial Auxiliary Equipment

2.5.1 Aqueous Ammonia Storage Tank

The SCR system will use 19% by weight aqueous ammonia injection to control NO_x emissions generated as a function of the "fuel bound" nitrogen and products of the CFB combustion process. A 19% by weight aqueous ammonia mixture will be stored in an above ground, on-site storage tank, with a capacity no greater than 10,000 gallons. The design will incorporate a concrete spill containment area with a capacity of 110% of the tank volume to contain any unexpected ammonia spill condition. The storage tank will be sealed. Ammonia sensors will monitor the aqueous ammonia storage area and will sound an audible alarm in the event of an aqueous ammonia release.

2.5.2 Emergency Generator(s)

UCI is proposing the supply of back-up power to the facility during periods of unplanned disruption of back-up power supply from the grid. This includes the use of one (or multiple) distillate fuel oil-fired emergency generators to produce up to 1.56 MW of electrical power. In this plan approval application for the proposed ECP project, potential emissions from the emergency generator(s) are conservatively estimated by using U.S. EPA AP-42 emission factors and 475 hours per year of potential annual operation. PaDEP regulations allow for a plan approval exemption for internal combustion engines, such as the proposed emergency generator(s), regardless of size with combined NO_x actual emissions less than 100 lbs/hr, 1,000 lbs/day, 2.75 tons per ozone season and 6.6 tons per year on a 12-month rolling basis (Section 127.14(a)(8.6) per the most recent PaDEP plan approval and operating permit exemption list). Upon vendor selection for the proposed emergency generator(s), the actual emission rates will be defined and expected to be much less than the AP-42 emission factors. Additionally, other than during the initial commissioning phase of facility start-up, it is not anticipated to utilize the emergency generator(s) for 475 hours per year. Therefore, UCI believes the proposed emergency generator(s) will meet the plan approval exemption criteria as described above.

2.5.3 Distillate Fuel Oil Storage Tank for Emergency Generator(s)

To support the operation of the proposed emergency generator(s), UCI proposes to install one or two distillate fuel oil storage tank(s) depending on the final emergency generator design scenario. Each tank will have a small capacity (10,000 gallons or less) due to the infrequent operation of the emergency generators. The tank(s) will store No. 2 fuel oil or diesel fuel and will meet the plan approval exemption criteria of Section 127.14(a)(8.17) since either fuel stored in the tank will have vapor pressure less than 1.5 psia. Potential VOC emissions from the new storage tank(s) will be negligible, as demonstrated by the U.S. EPA TANKS program result presented in Appendix C for the existing 10,000-gallon distillate fuel oil storage tank (<1 lb/yr).

2.6 Fuels

UCI is proposing to use a mix of residual solid waste fuels at the ECP facility. Details of the fuel handling system were described in Section 2.3.

2.6.1 CFB Boiler Fuels

The ECP project will utilize a mixture of waste residual materials that are available in reasonable proximity to the mill with a core "biomass" characterization. At present, these materials are being sent to landfills for disposal. Wood derivative materials form the basis of the fuel composition. A representative composition of the residual materials would include waste woods, such as pallets, dimensional wood, plywood, sorted construction and demolition woods, particleboard and creosote-treated and non-creosote railroad ties and utility poles. Additional materials would consist of various paper mill sludge streams along with the excess materials from the UCI stock processing operation, various burlap and residual food processing derivatives from local/regional manufacturing entities, shredded carpet remnants, pre- and post-consumer plastic/rubber waste, various "agro-based" materials (mustard bran and prune pits) and tire derived fuel (TDF) of the proper size. The average fuel mix (exclusive of TDF) is estimated to have a LHV of approximately 6,500 Btu/lb with a range between 4,300 Btu/lb and 7,000 Btu/lb.

2.6.2 Supplemental Fossil Fuels

In addition to the primary residual fuels, natural gas will be used as the start-up and/or supplemental fuel for the CFB boiler. The existing package boiler that is rated at 99 MMBtu/hr will only be used for standby, back-up operation and is capable of firing natural gas or No. 2 fuel oil. Sulfur content of the No. 2 fuel oil will be limited to 0.3% in accordance with currently enforced PaDEP fuel sulfur restrictions.

2.6.3 Residual Waste Fuel Mix Basis

As stated previously, there is a portfolio of residual material that will serve as fuel for the proposed CFB boiler. All of the materials listed in the air plan approval application have been individually tested and properly characterized via proximate and ultimate analysis. The CFB boiler also has been designed for a range of heat input between 4,300 Btu/lb and 7,000 Btu/lb LHV. In addition, some of the residual materials are seasonally available, primarily the agricultural-type fuels (i.e., mustard bran). It is extremely difficult, if not impossible, to identify all of the various residual material mix combinations that will be pre-blended and delivered to the on-site storage facility. To maintain needed flexibility in materials blending and mix combinations, as well as to insure emissions compliance, specific maximum levels of fuel bound elements have been established for the project. These are defined as follows:

Fuel bound sulfur: 1.45% (by weight) of the fuel mix
Fuel bound nitrogen: 1.5% (by weight) of the fuel mix
Fuel bound chlorine: 0.2% (by weight) of the fuel mix

The potential emissions calculations for SO_2, NO_x and HCl in the fuel were based upon these upper limit conditions. Definition and sizing of the air pollution control equipment, along with the particulate loading parameters, were functions of these maximum constituents.

The fuels listed below represent the portfolio of options that, when combined to meet heat input constraint parameters, will not exceed the maximum fuel bound levels identified above:

- Pallets and Wood-waste (Plywood and Particleboard)
- Creosote-treated and non-creosote wood-waste (i.e., railroad ties and utility poles)
- Paper Mill Sludge
- Rejected Materials from UCI's Pulp Preparation Area (UCI Log)
- Sorted Construction and Demolition (C&D) Untreated Wood
- Tire Derived Fuel (TDF)
- Textile wastes (i.e., Hershey's Burlap, scrap carpet and scrap diaper fiber)
- Food Processing Waste (i.e., Hershey's food residuals)
- Pre-consumer plastic waste, rubber waste, elastomer waste and latex materials
- Post-consumer plastic waste with recycling codes of 4 through 6
- Agricultural-based fuels ("agro-fuels") – Mustard Bran and Prune Pits

Appendix G presents UCI's proposed fuel management and testing plan for the ECP project. The plan identifies the fuel supplier, delivery procedures, fuel preparation, sampling procedures and frequencies to insure compliance with all proposed fuel specifications and operating and emission limits.

2.7 Facility Operating Modes and Restrictions

As a must-run steam-electric plant, the facility will operate to meet the steam and electricity demand of UCI's paper mill with the excess amount of electricity being sold to the

Pennsylvania-New Jersey-Maryland (PJM) power pool. The CFB plant will be the principle source of steam and electricity for the UCI paper mill and will be permitted for 8,500 hours of operation per year. Of the two existing and available boilers located at the UCI paper mill, the remaining small heating boiler will be retired and the larger 99 MMBtu/hour package boiler will be placed in back-up service. The package boiler will continue to have the ability to burn either natural gas or No. 2 oil, but the CFB boiler and the package boiler will not operate simultaneously, except during periods of start-up and shutdown when the steam load is being transferred from one steam generator to the other and during the initial "construction check-out and commissioning" phase of the new CFB boiler. The proposed initial "construction check-out and commissioning" phase (or "check-out / centerlining" period) is described below.

- As the installation phase of the ECP project is completed, the project activity at the site will shift to a "construction check-out and commissioning" phase. The initial check-out activities will be of a "static" nature to insure compliance to construction specifications. Following the static testing period, the "dynamic" check-out will occur starting with the auxiliary systems progressing to the more complex and integrated systems. Initially, only natural gas will be fired in the CFB to support the dynamic check-out effort. Once this phase is completed, the CFB will be operated with a combination of natural gas and solid fuel. The levels of solid fuel will be gradually increased (and natural gas reduced) based upon the systems response and level of stability achieved. During this period, control loops will be fine tuned and logic verified. It is anticipated that the CFB complex will be in an "up-and-down" mode as deficiencies with the systems are identified and corrected. Given the scale of the project and number of integrated systems to checkout and commercialize, the "check-out / centerlining" period is projected to last up to 3 months.
- During this period of CFB check-out, it is imperative that the paper mill's operation not be impacted. The existing Cleaver Brooks packaged boiler will continue to operate on natural gas to supply steam needs to the paper machine. All of the steam generated at the CFB will remain within the energy complex, i.e., directed to the steam turbine and condensed. Power generated during this period will be placed on the grid. At no time will the CFB be fired at MCR during the check-out / centerlining period with the standby packaged boiler on-line. It is anticipated that the CFB boiler will operate at a maximum of 70% MCR during this period.

The operating regimen for the CFB boiler and the steam turbine generator will be as a base-load steam and electric generator. Steam requirements to the paper mill will be controlled by varying the extraction steam flow of the turbine with the balance of the steam going to the surface condenser. Thus, the CFB boiler is intended to and will typically operate at full load. Nevertheless, there may be exception periods when it is necessary to operate the CFB boiler at loads as low as 40% of MCR. Limitations during part load operation are not included in this analysis, since mass emission rates (in units of lb/MMBtu and lb/hr) during part load operation (40% load or higher) are no greater than at full load.

During CFB start-up conditions, emissions will result from natural gas combustion in the start-up burners and initial combustion of solid fuel. The start-up period for the CFB is completed when the refractory lining is heated up to the standard operating temperature of around 1,600 °F where the guiding measurement is CFB bed temperature measurement. Operations will increase the bed temperature by increasing the firing rate of the natural gas start-up burners according to a temperature gradient at a rate anticipated to be 144 °F per hour. The total CFB start-up time is anticipated to take 10 hours. The introduction of bio-fuels in the CFB can occur when the CFB temperature is in the range of 1,250 to 1,400 °F. The final decision on the conditions for introduction of solid fuels will be following technical reviews with UCI's insurance carrier. Therefore, it is estimated that it will take approximately 9 hours until bio-fuel may be fired and, for the last hour of start-up, emissions will be higher than during normal operation (boiler load may be still below the minimum stable load of 120,000 lb/hr or 40% MCR operation of the CFB). Appendix C, Table C-4, presents a summary of expected stack emissions during the entire start-up period. NO_x emissions are expected to be 0.15 lb/MMBtu during start-up due to high excess air in combination with locally hot areas above the fluidized bed. CO emissions are expected to be 0.148 lb/MMBtu during start-up due to cold bed conditions. Other pollutants are expected to be less than steady-state during start-up conditions. Start-up will be deemed complete once the CFB boiler has operated for a minimum of 1 hour at an average steaming rate of 200,000 lb/hr at 1,200 psig and 850 °F operating conditions. At that point, the permitted BAT emissions levels will be achieved by UCI.

On a short-term basis, hourly emission rates during start-up of the CFB boiler have the potential to exceed the proposed steady-state emission limits as determined from BAT analyses. Therefore, UCI proposes for an exemption from the BAT steady-state emission limits during periods of start-up, shutdown or malfunction. The applicable NSPS (Subpart Db) sets forth emission limits to be achieved on a 30-day rolling average basis for all modes of operation. UCI does not propose start-up emission limits on a lb/hr basis due to fluctuating emission rates during the start-up process, but rather, emission limits on a total lb/event basis corresponding to a specified start-up duration. Please refer to Appendix C for details on start-up emission calculations and proposed limitations.

In order to determine the effect of start-up emissions on the facility's annual PTE, UCI performed a netting-type analysis for each of the criteria pollutants. Each start-up will have an off-line period preceding the start-up process. For a worst-case cold start-up (up to 10 hour duration), it is assumed that the off-line period is a minimum of 24 hours (conservative assumption). The potential steady-state emissions during this defined off-line period is considered an 'emission credit for downtime' since no emissions are emitted during the off-line period. Appendix C presents total pounds of emissions per event during start-up of the CFB boiler. By comparing the total lb/event during start-up to the lb/event from the off-line period, it can be determined if each start-up results in a net increase in PTE for any criteria pollutant. Although it has been noted that short-term emissions may be greater during start-up, the annual emissions analysis determined that start-ups of the CFB boiler will not increase the PTE of any pollutant. The reason for this is that the proceeding off-line period prior to start-up of the CFB boiler will be longer in duration than the actual start-up process.

2.8 Waste Water System

CFB boiler and cooling tower blow-down, and backwash and reject water from the water treatment equipment will be recycled to the paper mill make-up system for reuse. No new industrial wastewater discharges will result from the ECP project.

2.9 Source Emission Parameters

Potential emissions of air contaminants from the CFB combustor have been estimated based upon the CFB vendor emissions guarantees, operating experience with a wide variety of fuels by various CFB boiler end-users, emission factors presented in the USEPA AP-42 emission factor document and mass balance calculations. Details of the emission calculations used to develop the proposed emission limits presented in this application are presented in Appendix C.

2.9.1 CFB Boiler Emissions

The emission rates of criteria pollutants having the highest fuel bound constituents (see Section 2.6.3) have been used as a basis for establishing the short-term and annual emission limits for the steam and electric plant. Proposed short-term criteria pollutant emission rates are presented in Table 2-1. A matrix of CFB combustor emission estimates for the potential operating conditions is presented as Table 2-2. Potential annual emissions for criteria pollutants and HAPs are presented in Tables 2-3 and 2-4, respectively. As previously described in Section 2.6.3, potential emissions of NO_x, SO_2 and HCl (HF is projected to be 10% of HCl emissions based upon experience that the CFB vendor has had with other installations) are based on a "worst-case" fuel content inlet loading concentration of nitrogen, sulfur and chlorine, respectively. Additionally, the control efficiencies for proposed emission control devices were factored into the calculation of potential emission rates from the CFB boiler stack. The CFB boiler vendor provided worst-case emission guarantees for CO, VOC and filterable PM/PM-10 within their scope of supply limits by considering the impacts of their boiler design and combustion controls. PM/PM-10 emission estimates include condensable particulates (including acid gases). This additional quantity of PM-10 has been based upon U.S. EPA's AP-42 guidance for wood combustion (0.017 lb/MMBtu). Emissions of SO_3/H_2SO_4 are conservatively estimated by assuming 5% of SO_2 converts to SO_3 in the SCR system. It is assumed that 100% of SO_3 formed converts to H_2SO_4 before exiting the exhaust stack. Ammonia slip emissions are based on a total slip emission rate of 10 ppm from the use of the SCR system.

For CFB boiler trace metal HAP emissions, UCI utilized the results from Pennsylvania State University's laboratory analysis of the ash from a multitude of samples that represent a composite fuel mixture for the project. Since the PSU results represent only a single set of data and anticipating the metal HAP content in the fuel components will vary during operation, a worst-case metal HAP concentration was applied across the entire range of fuels. Additionally, the worst-case ash content of the fuel mix (14% by weight) was selected for the analysis. Therefore, the metal HAP emissions provided in the results of the analysis are extremely conservative. Metal HAP emissions will be minimized by capture within the hot ESP. Some of the metal HAP constituents (mercury, arsenic and selenium) are volatile components and are expected to exist in the gaseous phase and not controlled or captured in the hot ESP. Organic HAP emissions (i.e., benzene, toluene, naphthalene, etc.) are a subset of VOC emissions, which are inherently low from the combination of CFB boiler technology and residual waste fuel mix. Specific organic HAP emission rates cannot be fully quantified for the residual waste fuel mixtures. However, it was conservatively assumed that 60% of total VOC from the CFB boiler consists of organic HAPs.

Dioxin and furan compounds will not be produced in the CFB boiler. Instead, at the high combustion temperature levels, dioxins and furans (including polychlorinated biphenyls (PCBs)) are destroyed. However, dioxins and furans can form downstream at lower temperatures, as a result of a reaction with chlorinated organics. Formation of dioxins and furans is dependent on the exhaust stream's residence time within a temperature range of approximately 500°F to 800°F. Additionally, high levels of oxygen must be present in the flue gas for the reactions to occur. The most common practice for sources with the potential to emit dioxins and furans is to quickly cool the flue gas to temperatures below the range favoring the formation of dioxins and furans. For the proposed CFB boiler, the temperature of the flue gas is quickly reduced to within a range of 500°F to 600°F in the boiler back-pass section. A flue gas temperature between 500°F and 600°F represents the minimum temperature range for dioxin and furan formation and oxygen levels are low in the boiler flue gas (up to 4% by volume) as well. UCI anticipates that the proposed CFB boiler design will result in negligible emissions of dioxins, furans and PCBs considering the low levels of fuel chlorine content, low amounts of available oxygen and a flue gas temperature in the range of 500°F to 600°F.

2.9.2 Cooling Tower Particulate Matter Emissions

Potential PM/PM-10 emissions from cooling tower drift (included in Table 2-3) have been estimated based upon emission calculation methods presented in AP-42, which are essentially mass balance starting with solids in the circulating water. Maximum circulating water rates, total dissolved and suspended solids content of the circulating water and drift eliminator drift rate are taken from cooling tower design information provided by the vendor. The total dissolved solids concentration of the circulating water will be monitored by UCI (at a frequency determined by PaDEP) to insure compliance with the proposed PM/PM-10 emission rates from the ECP cooling tower.

2.9.3 Future Potential Emissions from Existing Sources

In order to calculate the future facility PTE, it is necessary to quantify the potential emissions from the existing sources after the completion of the ECP project. While one of the boilers has already been decommissioned, and the second boiler will be decommissioned with the project, a netting analysis that would show the net increase from the project has not been performed. The reasons for this are as follows. First, the facility is proposing to limit the facility emissions below all major source thresholds. Second, the facility is currently tracking the overall fuel usage for both of the boilers that are operational together; fuel usages for individual units are not available. As only one of these boilers is being shut down, it is not possible to determine which portion of the facility fuel use can be attributed to the unit that is being shutdown. As such, not performing a netting analysis provides the most conservative determination of facility-wide increase in emissions.

2.9.3.1 99 MMBtu/hour Package Boiler

The 99 MMBtu/hour package boiler is capable of firing both natural gas and No. 2 fuel oil. Short-term emissions from the 99 MMBtu/hour package boiler have been not altered from the existing synthetic minor permit emission rates. The only exception is for the PM and VOC emission rates while firing natural gas, which were not reported in the existing synthetic minor permit application. The NO_x and CO emissions are based upon vendor emission estimates for both natural gas and No. 2 fuel oil. The PM and VOC emissions while firing No. 2 fuel oil are based on vendor emission estimates, while the emission rates for these pollutants while firing natural gas are based upon AP-42 values. SO_2 emissions have been calculated by assuming that all sulfur in the fuel is converted to SO_2. The maximum sulfur content of the No. 2 fuel oil is 0.3% by weight.

2.9.3.2 No. 2 Fuel Oil Storage Tank

Potential emissions from the fuel oil storage tank (included in Table 2-3) have been predicted using U.S. EPA's Tanks program based upon the storage tank dimensions and throughput. The No. 2 fuel oil storage tank annual throughput is based upon the proposed annual fuel oil firing for package boiler, plus the volume of the tank (i.e., for a year that begins with tank empty and ends with the tank full). Philadelphia, Pennsylvania meteorological data were used for the tank emissions calculation.

2.9.3.3 Insignificant Combustion Sources

The emissions from the insignificant natural gas fired combustion sources have been calculated based upon emission factors from the U.S. EPA AP-42 document and annual operation of 8,760 hours/year.

2.9.4 Facility Total Potential Annual Emissions

The total facility PTE has been calculated based on the evaluation of following various operating scenarios.

- Operation of the CFB boiler only for a maximum of 8,500 hours per year;
- Firing No. 2 fuel oil in the existing package boiler for 21 days per year of full-load firing (during which the CFB boiler is not in operation), and firing the CFB boiler at maximum capacity for the remainder of the year. Note that all emission rates from the existing package boiler are greater while firing No. 2 fuel oil, versus natural gas;
- Unrestricted operation of the existing package boiler, primarily firing natural gas, including 21 days of operation on No. 2 fuel oil. This scenario assumes no operation of the CFB boiler;
- Operation of one emergency generator (1.56 MW) for 475 hours per year and firing the CFB boiler at maximum capacity for the remainder of the year; and
- Operation of two emergency generators (total of 1.56 MW) for 475 hours per year and firing the CFB boiler at maximum capacity for the remainder of the year.

Additionally, a start-up analysis was performed to estimate the emissions from concurrent operation of the CFB boiler start-up burners, and the existing package boiler. It was assumed that there will be one start-up per month that will last a total of ten hours. For all scenarios, the annual total includes the continuous operation of the natural gas-fired insignificant sources.

Table 2-1: CFB Boiler Short-Term Maximum Controlled Emission Rates

[illegible]	NO_x	CO	VOC	SO_2	Filterable PM/PM-10	Fil + Cond PM-10
lb/MMBtu	0.042	0.047	0.008	0.044	0.029	0.046
lb/hour	20.2	22.6	3.9	21.1	13.9	22.1

Table 2-2: Potential Annual Emissions from Various CFB Boiler Operation Scenarios

Scenario	NO_x tons/yr	CO tons/yr	VOC tons/yr	SO_2 tons/yr	Filterable PM/PM-10 tons/yr	Filt. + Cond. PM-10 tons/yr	H_2SO_4 mist tons/yr
1.) Operation of CFB for 8,500 hrs/yr and insignificant combustion sources	91.8	98.7	16.9	89.5	59.5	94.3	6.9
2.) CFB Boiler operation with 21 days of standby operation of the package boiler on oil, includes insignificant combustion sources	89.7	93.8	16.0	92.0	56.6	89.4	6.5
3.) Year Round Operation of the Package boiler with 21 days on oil, includes insignificant combustion sources	23.5	10.1	0.4	7.9	4.1	4.1	0
4.) CFB Boiler operation with 475 hrs of emergency generator operation (one unit), includes insignificant combustion sources	96.1	99.0	16.9	88.5	58.3	92.3	6.7
5.) CFB Boiler operation with 475 hrs of emergency generator operation (two units), includes insignificant combustion sources	96.1	99.1	17.0	88.5	58.5	92.4	6.7
MAX PTE from above Boiler Operation Scenarios	**96.1**	**99.1**	**17.0**	**92.0**	**59.5**	**94.3**	**6.9**

Notes:
All scenarios include uninterrupted operation of the insignificant natural gas sources. Annual Boiler PTE is the maximum of each of the three boiler scenarios.

Table 2-3: Facility Annual Emissions

Source	NO_x tons/yr	CO tons/yr	VOC tons/yr	SO_2 tons/yr	Filterable PM/PM-10 tons/yr	Filt. + Cond. PM-10 tons/yr	H_2SO_4 mist tons/yr
MAX PTE from Boiler Operating Scenarios	96.1	99.1	17.0	92.0	59.5	94.3	6.9
Additional PTE due to Startups	0	0	0	0	0	0	0
Fuel Oil Storage Tanks	0	0	0	0	0	0	0
Cooling Tower	0	0	0	0	1.8	1.8	0
FACILITY PTE	**96.1**	**99.1**	**17.0**	**92.0**	**61.3**	**96.1**	**6.9**

Table 2-4: Annual HAP Emissions

Pollutant	Annual Potential Emission Rate (ton/year)
Beryllium	1.61×10^{-3}
Cadmium	4.84×10^{-3}
Cobalt	2.02×10^{-2}
Chromium	0.18
Nickel	0.10
Lead	1.04
Manganese	0.90
Mercury	3.43×10^{-3}
Arsenic	0.31
Selenium	0.84
Total Organics (60% of VOC)	9.9
HCl	9.6
HF	0.96
Max Individual HAP	9.6 (HCl)
Facility Total	23.9
Title V Major Source Threshold	10 individual / 25 total