State of New Jersey

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FACT SHEET

FOR

Woodbridge Energy Center

RIVERSIDE DRIVE, WOODBRIDGE TOWNSHIP
(MIDDLESEX COUNTY), NEW JERSEY, 07095

Program Interest (PI) Number: 18940 Permit Activity Number: BOP110003

APPLICATION FOR
AIR POLLUTION CONTROL OPERATING PERMIT (TITLE V)
AND
FEDERAL PREVENTION OF SIGNIFICANT DETERIORATION (PSD) OF AIR QUALITY PERMIT
AND
ACID RAIN PERMIT

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Date: May 31, 2012

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TABLE OF CONTENTS

A. FACILITY AND PROJECT DESCRIPTION

CPV Shore, LLC (CPV) submitted an application on June 14, 2011, for a federal Prevention of Significant Deterioration of Air Quality (PSD) permit, a Title V State Operating Permit and an Acid Rain permit to construct and operate a new 700 MW facility, Woodbridge Energy Center (WEC). WEC will be a combined-cycle power generating facility consisting of two General Electric (GE) 207FA.05 combined cycle combustion turbine generators (CTGs), two heat recovery steam generators (HRSG) equipped with duct burners, one steam turbine electric generator (STG), one 14-cell (2x7 configuration) wet mechanical draft cooling tower, and ancillary equipment. WEC will be located at Riverside Drive, Woodbridge Township (Middlesex County), New Jersey, 07095.

The CTGs and duct burners will use natural gas as fuel. Each combustion turbine will have a maximum rated heat input of 2,307 million British thermal units per hour (MMBtu/hr) at an ambient temperature of -8^0F, based on higher heating value of fuel (HHV) (not including supplemental duct-firing), and a maximum heat input rate of 2,807 MMBtu/hr HHV with supplemental duct-firing. The combined maximum hourly electricity generated by the two combustion turbines will be 480 MW.

Ancillary equipment will include a 91.6 MMBtu/hr (HHV) auxiliary boiler equipped with low NOx burners that will operate on natural gas for 2000 hrs per year or less, one small 9.5 MMBtu/hr (HHV) natural gas fired fuel gas heater operating for 8760 hrs/yr, a 1500 KW (13.5 MMBtu/hr HHV) emergency diesel generator, and a 315 HP (2.1 MMBtu/hr HHV) diesel fire pump. The emergency diesel generator and fire pump will be operated for 100 hrs per year or less, per equipment, and would use ultra low sulfur distillate (ULSD) fuel oil with sulfur content of 15 ppm by weight or less. Ancillary equipment will also include storage tanks.

WEC is situated in close proximity to the Middlesex County Utilities Authority (MCUA) sewage treatment plant and will use treated effluent diverted from the MCUA river discharge for non-contact cooling tower makeup. Cooling tower blow down and process wastewater could be discharged back into the MCUA.

B. AIR CONTAMINANT EMISSIONS

WEC will be located in Middlesex County which is designated as attainment for National Ambient Air Quality Standards (NAAQS) for criteria pollutants i.e. Nitrogen Oxides (NO_x), Carbon Monoxide (CO), Sulfur Oxides (SO_2), Particulate Matter (PM), Particulate Matter less than 10 microns (PM_{10}), and lead. It is designated as non-attainment for the 8-hour ozone NAAQS and Particulate Matter less than 2.5 microns ($PM_{2.5}$)

Table 1 lists proposed emissions of all criteria pollutants from WEC in pounds per hour (lbs/hr), parts per million on dry volume basis at 15% oxygen (ppmdv @ 15% O_2), and pounds per million British thermal units (lbs/MMBtu). The proposed emission limits from the combustion turbines would be achieved after the application of air pollution control technologies that are discussed in Section C.

TABLE 1

MAXIMUM ALLOWABLE EMISSIONS FOR EACH COMBUSTION TURBINE/HRSG UNIT
(Operating Conditions: 100% load; - 8^0F ambient temperature)
(Base load Operations with Supplemental Duct-firing)

Air Contaminant units	Maximum Allowable Hourly Emissions Natural Gas
Nitrogen Oxides (as NO_2)	
lbs/hr[1]	19.8
ppmvd @ 15% O_2[2]	2.0
Carbon Monoxide (CO)	
lbs/hr	12.1
ppmvd @ 15% O_2	2.0
Volatile Organic Compounds (VOCs)[3]	
lbs/hr	6.9
ppmvd @ 15% O_2	2.0
Sulfur Oxides (SO_2)	
lbs/hr	4.9
Total Suspended Matter (TSP)	
lbs/hr	8.2
lbs/MMbtu	0.0038
Particulate Matter less than 10 microns (PM_{10})	
lbs/hr	19.1
lbs/MMbtu	0.0084
Particulate Matter less than 2.5 microns ($PM_{2.5}$)	
lbs/hr	19.1
lbs/MMbtu	0.0084
Ammonia (NH_3)	
ppmvd @ 15% O_2	5.0
CO2e (for Green House Gasses) lbs/hr	312,885

NOTES:
1. lbs/hr = Pounds per hour emissions per turbine.
2. ppmvd (@ 15% O_2) = parts per million by volume on a dry basis (corrected to 15 percent oxygen).
3. lbs/MMbtu = pounds per million British thermal units

Table 2 shows the proposed annual emissions of all criteria pollutants in tons per year (tpy) for the WEC. The Hazardous Air Pollutant (HAP) emissions from the project are included in Attachment I (Fact Sheet of the air dispersion modeling and risk assessment from Bureau of Technical Services). The applicability threshold for a major PSD of air quality source is equal to or greater than 100 tpy of emissions of any criteria pollutant for stationary sources that are one of the 28 named source categories in 40 CFR 52.21. WEC is one of the 28 source categories i.e. fossil fuel-fired steam electric generating plant of greater than 250 MMBTU/hr heat input. Based on the potential annual emissions in Table 2 (given in tons per year), the facility is considered a new major PSD source for NOx, CO, PM, PM_{10}, and H_2SO_4. The facility is also a new major PSD source for Green House Gases (GHG). The applicability threshold for PSD for GHG emissions is 100,000 tpy of Carbon Dioxide equivalent (CO_2e) for a new source.

TABLE 2
Facility Potential Emissions, PSD Applicability Thresholds and PSD Applicability

Air Contaminant	Proposed Maximum Potential Emissions from WEC (TPY)[1]	PSD Applicability Threshold (TPY)	PSD Applicable (TPY)
Carbon Monoxide (CO)	293.8	100	Yes
Nitrogen Oxides (NO_x)	149.4	40	Yes
Sulfur Dioxide (SO_2)	33.1	40	No
Particulate Matter (PM/TSP)	55.9	25	Yes
PM_{10}	103.7	15	Yes
[2] $PM_{2.5}$	98.7	N/A	N/A
Volatile Organic Compounds (VOC)	33.6	40	No
Lead	0.01	0.6	No
Sulfuric Acid Mist	22.7	7	Yes
Green House Gasses (CO_2e)	2,073,645	100,000	Yes

NOTES:
[1] Maximum potential emission based on the following:

- Worst case potential to emit calculations are based on 8,760 hours of natural gas-fired combustion turbine operation including 356 hours of natural gas-fired start-up/shutdown operation, and 685 hours of natural gas-fired duct burning operation.
- One cooling tower: 8760 hrs per year;
- Auxiliary boiler: 2,000 hours per year on natural gas,
- Fuel Gas Fuel heater: 8760 on natural gas
- Limited operation (100 hrs/yr) of emergency diesel fire pump and emergency diesel generator

[2] Middlesex County is designated non-attainment for $PM_{2.5}$.

According to Table 3, The WEC is subject to Non Attainment New Source review requirements at N.J.A.C 7:27-18 (Subchapter 18 Control and Prohibition of Air Pollution from New or Altered Sources Affecting Ambient Air Quality (Emission Offset Rules)) for NOx, and VOC. This is because the potential emissions of NOx, and VOC which are precursors for ozone, are greater than the N.J.A.C 7:27-18 thresholds of 25 tpy.

Table 3 also shows that the proposed CO and PM_{10} emissions from WEC are greater than the N.J.A.C 7:27-18 thresholds of 100 tpy. As per N.J.A.C 7:27-18.2(b)2, the facility is required to conduct an air quality impact analysis to show that the proposed emissions of NOx, VOC, CO and PM_{10} would not equal or exceed the significant air quality impact level, nor result in a violation of an National Ambient Air Quality Standard (NAAQS) and the New Jersey Ambient Air Quality Standard (NJAAQS).

The attached air quality modeling analysis (Section G) shows that the increase in CO, and PM_{10} emissions would not result in an increase in the ambient concentration of CO and PM_{10} in an area that is attainment for CO and PM_{10} nor would the ambient concentration of CO or PM_{10} equal or exceed the significant impact levels.

As mentioned above, WEC is located in Middlesex County which is designated non-attainment area for $PM_{2.5}$. The Department has evaluated the WEC $PM_{2.5}$ emissions consistent with its December 14, 2010 Memorandum of Division of Air Quality "Revised Interim Permitting and Modeling Procedures for New or Modified Sources Emitting between less than 100 Tons per Year of $PM_{2.5}$ (Fine Particulate) and Proposing between a 10 – 99 ton per year increase in $PM_{2.5}$". Based on the guidance outlined in its December 14, 2010 the Department required WEC to conduct Air Quality Modeling. The air quality modeling analysis demonstrated that the proposed $PM_{2.5}$ emissions from WEC would not cause or create $PM_{2.5}$ NAAQS or NJAAQS violations in areas designated non-attainment for $PM_{2.5}$

Table 3: Facility Potential Emissions and Non Attainment New Source Review (N.J.A.C 7:27-18) Thresholds and Applicability

Air Contaminant	Proposed Maximum Potential Emissions from WEC (TPY)[1]	(N.J.A.C 7:27-18) Applicability Threshold (TPY)	N.J.A.C 7:27-18 Applicable
Carbon Monoxide (CO)	293.8	100	Yes
Nitrogen Oxides (NO_x)	149.4	25	Yes
Sulfur Dioxide (SO_2)	33.1	100	No
Particulate Matter (PM/TSP)	55.9	100	No
PM10	103.7	100	Yes
[2]PM-2.5	98.7	100	No
Ozone (Volatile Organic Compounds)	33.6	25	Yes

NOTES

1. Maximum potential emissions determined using worst case potential to emit calculations are based on the following operating scenarios for two turbines and associated duct burners:
   - 8,760 hours of natural gas-fired combustion turbine operation which includes up to 356 hours of natural gas-fired start-up/shutdown operation, and 685 hours of natural gas-fired duct burning operation.
   - One cooling towers: 8760 hrs per year;
   - Auxiliary boiler: 2,000 hours per year on natural gas;
   - Fuel Gas Fuel heater: 8760 on natural gas;
   - Limited operation (100 hrs/yr) of emergency diesel fire pump and emergency diesel generator

[2] December 14, 2010 Memorandum of Division of Air Quality regarding $PM_{2.5}$ Permitting and Modeling Procedures.

The facility is also required to meet State of the Art Control Technology (SOTA) of New Jersey Air Pollution Control Regulations (N.J.A.C. 7:27-22.35). SOTA includes performance limits that are based on air pollution control technology, pollution prevention methods, and process modifications or substitutions that will provide the greatest emission reductions that are technologically and economically feasible. Compliance with BACT and LAER requirements also satisfies SOTA requirements.

C. AIR POLLUTION CONTROL TECHNOLOGIES FOR BACT/LAER

Woodbridge Energy Center is subject to federal PSD requirements including evaluation of the Best Available Control Technology (BACT) for each PSD affected pollutant (NO_x, H_2SO_4, CO, PM, PM_{10} and GHG). BACT must be applied to control emissions to the maximum degree for each regulated pollutant taking into account technical feasibility, energy, economics and other environmental factors.

Woodbridge Energy Center is also subject to N.J.A.C.7:27-18 requirements including evaluation of Lowest Achievable Emission Rate (LAER) for each non-attainment pollutant (NO_x and VOC). LAER is the most stringent emission limitation contained in the implementation plan of any State for a particular source category, or which is achieved in practice by a particular source category, whichever is most stringent.

1. Nitrogen Oxide (NO_x) Control Technologies

a. Description of NOx Control Technologies

NOx Control Technologies for Turbines

The two major ways in which NO_x is formed in the combustion process are known as fuel NOx formation and thermal NO_x formation. Fuel NO_x is formed when nitrogen and nitrogen compounds present in the fuel combine with oxygen present in the combustion zone to form NO_x. Generally, fuel NO_x can be reduced by decreasing the amount of nitrogen in the fuel. Thermal NO_x is formed when nitrogen from the air in the combustion zone combines with oxygen in the combustion zone at high temperature. The rate of formation is proportional to temperature in the combustion chamber.

WEC evaluated the following four technologies for controlling NO_x emissions from the proposed combustion turbines:

1. Selective Catalytic Reduction System (SCR)

Selective catalytic reduction system (SCR) is a process in which ammonia is injected directly into the flue gas and then passed over a catalyst to react with NO_x, converting the NO_x and ammonia to nitrogen and water. This reaction normally requires higher temperatures in order to take place. However, the insertion of a catalyst into the gas path of the HRSG allows this reaction to take place at a lower temperature, within the operating range of the HRSG.

2. Selective Non-Catalytic Reduction (SNCR)

SNCR is another method of post combustion control of NOx emissions. SNCR selectively reduces NOx into nitrogen and water vapor by reacting the flue gas with a reagent. The SNCR system is dependent upon the reagent injection location and temperature to achieve proper reagent/flue gas mixing for optimum NOx reduction. SNCR systems require a fairly narrow temperature range for reagent injection in order to achieve a specific NOx removal efficiency. The optimum temperature range for ammonia injection is 1,500° to 1,900°F. The NOx removal efficiency of an SNCR system decreases rapidly at temperatures outside the optimum temperature window. Operation below this temperature window results in excessive ammonia emissions, also referred to as ammonia slip. Operation above the temperature window results in increased NOx emissions.

3. Dry Low-NOx Combustors

Dry Low-NO_x (lean pre-mix) combustors stage fuel combustion, lowering flame temperatures, thus reducing the amount of thermal NO_x formation without the use of diluents such as steam or water.

4. Lean Burn Combustion

Typical gas turbines are designed to operate at a nearly stoichiometric ratio of fuel and in the combustion zone, with additional air introduced downstream. This is the point where the highest combustion temperature and quickest combustion reactions (including NOx formation) occur. Fuel-to-air ratios below stoichiometric are referred to as fuel-lean mixtures (i.e., excess air in the combustion chamber). The rate of NOx production falls off dramatically as the flame temperature decreases.

Thus, very lean, dry combustors can be used to control emissions by reducing thermal NOx formation within the combustion chamber. The lean combustors typically are two-staged premixed combustors designed for use with natural gas fuel. The first stage serves to thoroughly mix the fuel and air and to deliver a uniform, lean, unburned fuel-air mixture to the second stage.

NOx Control Technologies for Auxiliary Boiler

In addition to SCR, and SNCR the following three control technologies for NOx were evaluated by WEC for auxiliary boiler:

1. SCR and SNCR

SCR emission control technology is not considered technically feasible for the proposed auxiliary boiler because the design effectiveness of an SCR is not achieved until the flue gas temperature reaches between 400 and 800°F. The proposed auxiliary boiler will be required to supply steam in an expedited manner to minimize the duration of the combined cycle unit start-up, which produces elevated pollutant emission concentrations from the turbine during each start-up procedure. For this same reason, SNCR was also not found to be technically feasible for the auxiliary boiler.

2. Low-NOx Burners

Dry Low NOx Burners reduce NOx through staged combustion. Staging partially delays the combustion process, resulting in a cooler flame, which suppresses thermal NOx formation. NOx emission reductions of 40 to 85 percent (relative to uncontrolled emission levels) have been observed with Low-NOx Burners.

3. Flue Gas Recirculation (FGR)

In an FGR system, a portion of the flue gas is recirculated from the stack to the burner. The recirculated gas is mixed with combustion air prior to being fed to the burner. The FGR system reduces NOx emissions because the recirculated gas reduces combustion temperatures, thus suppressing the thermal NOx mechanism. FGR also reduces NOx formation by lowering the oxygen concentration in the primary flame zone. Together, Low-NOx Burners and FGR are capable of reducing NOx emissions by 60 to 90 percent.

b. Technical Review of Proposed NOx Controls

NOx Controls for Combustion Turbines and Duct Burners

WEC has proposed to install a DLN combustion system with SCR on each of the two combustion turbines as BACT/LAER to achieve an emission limitation of 2.0 ppmdv, corrected to 15% O_2 on natural gas for all normal operations.

The Department reviewed the proposed emission limitation with emission limitation of similar sized combustion turbines having SCR and DLN in the RACT/BACT/LAER Clearinghouse (RBLC) and found that the proposed emissions are minimal and approvable as both BACT and LAER.

NOx Controls for Auxiliary Boiler

The proposed auxiliary boiler will be limited to natural gas firing only and will be operated for the purposes of supplying steam during the start-up of the combined cycle unit.

WEC has proposed to install Dry Low-NOx Burners along with the use of natural gas to comply with BACT and LAER for the auxiliary boiler. The proposed NO_x emission limit for the auxiliary boiler is 0.010 lbs/MMBtu (equivalent to 0.92 lb/hr or 0.92 TPY). WEC has proposed to take a restriction on the amount of natural gas usage for the boiler equal to 180 MMscf/yr, which is equivalent to 2000 hours annually, operating at 100 percent load.
The Department has reviewed the proposed NOx emission limitations for auxiliary boiler and found them to be BACT and LAER. These proposed NOx emission limitations will also comply with SOTA limit of 0.010 lbs/MMBtu for this size boiler firing natural gas.

NOx Controls for Emergency Engines, and Fuel Gas Heater

WEC has proposed NO_x emission limitations for the emergency diesel generator, emergency diesel fire pump, and Fuel Gas heater to comply with BACT and LAER.

The emergency diesel generator and emergency diesel fire water pump will operate on ULSD exclusively, which is considered a clean fuel with low emissions and will meet the emission limits of NSPS IIII. The proposed NO_x emission limit for the emergency diesel generator is 21.16 lbs/hr or 1.06 TPY and, for the diesel fire water pump, the limit is 1.93 lbs/hr or 0.096 TPY. WEC has also proposed to take restrictions on the hours of operation for emergency diesel generator of less than or equal to 100 hours per year and for the diesel fire water pump of less than or equal to 100 hours per year. The Department has reviewed these and found the proposed emission limitations to be BACT and LAER.

The Fuel Gas heater will operate on natural gas exclusively. The proposed NO_x emission limit for the Fuel Gas heater is 0.035 lbs/MMBtu (equivalent to 0.33 lb/hr or 1.46 TPY). This limit meets BACT and LAER as well as the State of the Art (SOTA) requirement of New Jersey rules.

2. VOC Control Technologies

a. Description of Control Technologies

WEC evaluated the following two technologies for controlling VOC emissions from the proposed combustion turbines:

1. Combustion Control

The emissions of VOC in a combustion process are a result of the incomplete combustion of organic compounds within the fuel. In an ideal combustion process, all carbon and hydrogen contained within the fuel are oxidized to form CO_2 and H_2O. The rate of VOC emissions depends on combustion efficiency. VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times at those temperatures, and turbulent mixing of fuel and combustion air.

2. Oxidation Catalyst:

In an Oxidation catalyst, exhaust gases are passed over a catalyst bed where excess air oxidizes the CO to carbon dioxide (CO_2). CO reduction efficiencies in the range of 80 to 90 percent can be guaranteed. However, at the high temperatures necessary to make the oxidation catalyst optimized for VOC reduction, there is the undesirable result of causing substantially more conversion of SO_2 to SO_3 which may, in turn, react with water and/or ammonia to form sulfuric acid mist and/or ammonia salt and PM_{10} emissions.

b. ***Technical Review of Proposed VOC Controls***

VOC Controls for Combustion Turbines and Duct Burners

Along with good combustion practices, WEC is proposing the installation of an oxidation catalyst for VOC emissions. The oxidation catalyst will reduce VOC emissions to 1.0 ppm without duct firing. The proposed VOC emissions limits when burning natural gas are 2.0 ppmdv corrected to 15% O_2 at 100% load with supplemental duct-firing. The Department has searched the RBLC for VOC emission limitations of similar sized combustion turbines and found the proposed VOC emission limitations to be LAER.

VOC Controls for Auxiliary Boiler

No technically feasible post-combustion control methods have been identified to assure the reduction of VOC emissions from auxiliary boilers. VOC emissions are controlled by good combustion practices. As discussed in the section for CO controls below, an oxidation catalyst used to control CO emissions from a boiler, may also reduce some VOC emissions.

The proposed VOC emission limit for the auxiliary boiler is 0.0015 lbs/MMBtu (equivalent to 0.14 lb/hr or 0.14 TPY), which meets LAER limitations for boilers of this size firing natural gas. The department has found the proposed VOC emission limitations to be SOTA as well.

VOC Controls for Emergency Engines, and Fuel Gas Heater.

WEC has proposed VOC emission limitations for the emergency diesel generator, and emergency diesel fire water pump that meet the New Source Performance Standards (NSPS) Subpart IIII emission limits for these size emergency engines. The proposed VOC emission limit for the emergency diesel generator is 0.036 lbs/MMBtu (equivalent to 0.49 lbs/hr or 0.024 TPY). The proposed VOC emission limitation for the emergency diesel fire pump is 0.074 lbs/MMBtu (equivalent to 0.16 lbs/hr or 0.0078 TPY).

The proposed LAER VOC emission limitation for the Fuel Gas heater is 0.005 lbs/MMBtu (equivalent to 0.05 lbs/hr or 0.21 TPY), which also meet the SOTA requirements. The Department has reviewed the proposed VOC emission limitations for emergency diesel generator, emergency diesel fire pump and Fuel Gas heater and found them to be LAER for VOC.

3. Carbon Monoxide (CO) Control Technologies

a. Description of Control Technologies

Combustion Control
Carbon Monoxide is usually generated due to the incomplete combustion of fuel. CO emissions are minimized by good combustion practices that oxidized all carbon and hydrogen contained within the fuel to form CO_2 and H_2O. Several factors lead to incomplete combustion including insufficient O_2 availability, poor air/fuel mixing, cold wall flame quenching, reduced combustion temperature, decreased combustion residence time and load reduction. By controlling the combustion process carefully, CO emissions can be minimized.

Oxidation Catalyst
After combustion control, the only practical control method to reduce CO emissions from combustion of fuel is the use of an oxidation catalyst. Exhaust gases from the combustion equipment are passed over a catalyst bed where excess air oxidizes the CO to carbon dioxide (CO_2). CO reduction efficiencies in the range of 80 to 90 percent can be guaranteed, although CO reduction may at times be somewhat less than the design value.

Process Controls
Modern data acquisition and control systems, which optimize combustion performance also minimize pollutant emissions, including CO, through a combination of operator and software-driven process adjustments and notifications.

b. Technical Review of Proposed CO Controls

CO Controls for Combustion Turbines and Duct Burners

Both turbines at WEC will be equipped with oxidation catalyst to reduce Carbon Monoxide (CO) emissions. WEC is proposing the use of oxidation catalyst as BACT for CO emissions along with process control and good combustion practices. The oxidation catalyst system will reduce inlet CO concentrations over 77% during all steady-state operating modes. The oxidation catalyst will be located in an optimum temperature region within the HRSG immediately upstream of the SCR ammonia injection grid and downstream of the gas-fired duct burner. The proposed emission limitation when firing natural gas is 2.0 ppmvd corrected to 15% O_2 at 100% load.

The Department has reviewed and found the proposed CO emission limitation of 2.0 ppmvd corrected to 15% O_2 after the application of oxidation catalyst to be BACT for the combustion turbines with duct burners.

CO Controls for Auxiliary Boiler

Although an oxidation catalyst has been used to reduce CO emissions from boilers, it is not considered technically feasible to use it with the auxiliary boiler since the auxiliary boiler is required to supply steam quickly to the combined cycle units during the startup procedure and the oxidation catalyst requires a high flue gas temperature to achieve effective control. A more effective method of reducing emissions, including CO, is by good combustion controls and restricting operation on an annual basis.

WEC has proposed CO emission limitations for the auxiliary boiler of 0.038 lbs/MMBtu (equivalent to 3.44 lb/hr or 3.44 TPY), which meets BACT and the Department's SOTA limitations for boilers < 100 MMbtu/hr.

CO Controls for Emergency Engines, and Fuel Gas Heater.

The facility has proposed the CO emission limitation for the emergency diesel generator of 0.45 gms/bhp-hr (1.99 lbs/hr or 0.1 TPY) and the CO emission limitation for the emergency diesel fire pump of 2.6 gms/bhp-hr (equivalent to 1.81 lbs/hr or 0.09 TPY)) and restricted hours of operation of 100 hrs/yr as BACT. The proposed CO emission limitation for the Fuel Gas heater is 0.05 lbs/MMBtu (equivalent to 0.48 lbs/hr or 2.08 TPY). The Department has reviewed these emission limitations and found them to be BACT.

4. Sulfuric Acid Mist Control Technologies

a. Description of Sulfuric Acid Control Technologies

Sulfur dioxide emissions are formed from oxidation of sulfur in the fuel. A fraction of the SO_2 is further oxidized to SO_3, which in turn may react with water vapor to form sulfuric acid mist. The most practical means for controlling SO_2 emissions from combustion equipment is to use low sulfur content fuel like natural gas and ultra low sulfur distillate oil.

So far, add-on controls have not been used for reducing SO_2 and sulfuric acid mist from combustion turbines, boilers using natural gas, and engines using ULSD.

b. Technical Review of Proposed Sulfuric Acid Controls

Sulfuric Acid Controls for Combustion Turbines and Duct Burners

The New Source Performance Standard (NSPS) sulfur content limit for combustion turbines (40 CFR Subpart KKKK) in natural gas is 20 grains sulfur/100 SCF and 0.06 lb SO_2/MMBtu in liquid fuel. WEC is proposing natural gas an inherently low sulfur fuel, as the exclusive fuels for the combustion turbines and duct burners. The maximum proposed by WEC for fuel sulfur limit for natural gas is 0.63 grains S/100 SCF, the maximum was obtained from one of the potential suppliers of natural gas to the project, Elizabethtown Gas, based on historical information. This maximum limit is well below the NSPS limit.

Sulfuric acid mist emissions are minimized by use of low sulfur fuels. H_2SO_4 emissions will be limited to 0.001 lb/MMBtu (3.4 lb/hr with duct firing, and 2.8 lb/hr without duct firing) when firing natural gas for the combustion turbines. The Department has reviewed the Sulfuric acid mist emissions and found them to be BACT.

Sulfuric Acid Controls for Auxiliary Boiler

The Project proposes to fire natural gas in the auxiliary boiler to meet BACT for sulfuric acid. The maximum proposed H_2SO_4 BACT emission limit is 0.00014 lb/MMBtu or 0.012 lb/hr. The proposed H_2SO_4 emission limit is below the 0.05 lb/hr N.J.A.C. 7:27-22 Appendix, Table A "Thresholds for Reporting Emissions of Air Contaminants"

Sulfuric Acid Controls for Emergency Engines, and Fuel Gas Heater.

WEC has proposed to fire only natural gas in the Fuel Gas Heater as BACT for Sulfuric Acid mist emission. The emission limitations based on average sulfur content of 0.63 grains/100 scf are below the N.J.A.C. 7:27-22 Reporting Thresholds.

For the emergency diesel generator and the emergency diesel fire pump WEC has proposed to use only ULSD fuel oil with a sulfur content limit of 15 ppm by weight or approximately 0.002 lb SO_2/MMBtu, which is well below the NSPS limit of 0.06 lb SO_2/MMBtu. The Sulfuric Acid mist emission limitations for emergency diesel generator and the emergency diesel fire water pump based on 15 ppm sulfur content are below the N.J.A.C. 7:27-22 Reporting Thresholds.

5. PM /PM_{10}/$PM_{2.5}$ Control Technologies

a. Description of Control Technologies

PM, PM_{10} and $PM_{2.5}$ emissions from the combustion equipment like combustion turbines, boilers and engines may be formed from noncombustible constituents in fuel or combustion air, from products of incomplete combustion, or as a result of various chemical reaction, e.g. formation of sulfates and nitrates post combustion.

The use of natural gas (or other low ash content fuels like ULSD) is regarded as BACT for PM, PM_{10}, and $PM_{2.5}$.

b. Technical Review of Proposed PM /PM_{10}/$PM_{2.5}$ Controls

PM /PM_{10}/$PM_{2.5}$ Controls for Combustion Turbines and Duct Burners

A review of approximately 295 natural gas-fired combined cycle facilities from the USEPA's RBLC and recently issued air permit searches lists PM/PM_{10} emission limits ranging from 0.0013 to 0.1400 lb/MMBtu. In many instances, the pollutant listed in the RBLC database is TSP or PM. TSP and PM typically only includes the filterable portion of particulate matter; therefore, many of these limits cannot be compared to the proposed project. Control technologies, good combustion practice and low-sulfur, should be considered the driving factor for proposing BACT.

Particulate matter is formed from non-combustible constituents in the fuel or combustion air, or from formation of ammonium sulfates post combustion. WEC is not aware of any combustion turbine project that has been required to install add on controls for PM, PM_{10} or $PM_{2.5}$. Post-combustion controls, such as baghouses, scrubbers and electrostatic precipitators (ESP) are not technically feasible for combustion turbines due to the high pressure drops, the large flue gas volumes and the low concentrations of PM/ PM_{10}/$PM_{2.5}$ present in the exhaust gas.

The combustion of clean burning fuels is the most effective means for controlling PM emissions from combustion equipment. WEC is proposing exclusive use of natural gas as the fuel for turbines and duct burners.

The proposed emission limits by WEC for $PM_{10}/PM_{2.5}$ is 0.0075 lb/MMBtu (19.1 lb/hr) and for PM/TSP is 0.0032 lb/MMBtu (8.2 lb/hr) when firing natural gas in the combustion turbine with duct burners operating. The proposed emission limits by WEC for $PM_{10}/PM_{2.5}$ is 0.0084 lb/MMBtu (12.1 lb/hr) and for PM/TSP is 0.0038 lb/MMBtu (4.8 lb/hr) when firing natural gas in the combustion turbine without duct burner operating. The proposed limits for PM and PM_{10} have been reviewed by the Department, and found to be BACT. The proposed limits of $PM_{2.5}$ have been found by the Department to be SOTA.

PM /PM_{10}/$PM_{2.5}$ Controls for Ancillary Sources

The auxiliary boiler will fire natural gas only. For the emergency diesel generator and the emergency diesel fire pump WEC has proposed very low ash, ULSD oil as PM/ $PM_{10}/PM_{2.5}$ emission control. The use of very low ash fuels such as natural gas and very low ash, ULSD oil is regarded as BACT for PM_{10}, $PM_{2.5}$, and PM.

The Project includes one 14 cell wet mechanical cooling tower with minimum water recirculation rate of 178,000 gallons per minute (gpm). Control of airborne emissions particulate matter from cooling tower drift is achieved with drift eliminators. WEC has proposed to install very high efficiency drift eliminators which will limit the drift to 0.0005% of the re-circulating water rate. At a maximum dissolved solids concentration of 6,240 ppm, the total PM_{10} from drift will be limited to an average of 1.806 lb/hr from the cooling tower or 7.91 TPY. The total $PM_{2.5}$ from drift will be limited to 0.667 lb/hr from the cooling tower or 2.92 TPY. The PM from drift will be limited to 2.78 lb/hr from the cooling tower or 12.17 TPY. The Department has reviewed the proposed drift eliminator efficiency and found it to be BACT.

6. <u>Green House Gases (GHG) Control Technologies</u>

The main sources of GHG emissions for the Woodbridge Energy Center project are the combustion turbines, duct burners, auxiliary boiler and fuel gas heater. GHG emissions are also generated from the operation of the diesel engines, which are intended for limited operation (black start and fire protection).

On June 3, 2010, EPA issued a final rule that "tailors" the applicability provisions of PSD for greenhouse gas (GHG) emissions. Under the tailoring rule, a new source (facility) that commence construction after July 1, 2011 is subject to PSD permitting requirements for GHG emissions, if the potential GHG emissions from the new source are greater than 100,000 tons/year, or if the source is otherwise subject to PSD for another pollutant and its GHG potential emissions are equal to or greater than 75,000 tpy.

Because WEC will be a new source and potential GHG emissions from the Woodbridge Energy Center will be greater than 100,000 tons/year, the proposed facility is subject to PSD permitting requirements for GHG emissions.

For PSD purposes, GHGs are considered a single air pollutant Carbon Dioxide Equivalent (CO_2e) defined as the aggregate group of the following six gases:

- Carbon dioxide (CO_2)

- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydro fluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF_6)

a. ***Description of GHG (CO2e) Control Technologies:***

The major constituent of CO_2e emissions for combustion sources is CO_2, which accounts for over 95% CO_2e emissions, therefore it is necessary to control CO_2 emissions.

<u>Carbon Capture and Sequestration (CCS)</u>

EPA has classified CCS as an add-on pollution control technology that is "available" for large CO_2-emitting facilities including fossil fuel fired power plants. Carbon sequestration is a geo-engineering technique used to remove the CO_2 from an exhaust gas stream and store it permanently in underground reservoirs (typically depleted oil or gas reservoirs) or other geological features. Ideal geological formations for sequestration include depleted oil and gas fields and deep ocean masses. The vicinity surrounding the proposed Woodbridge Energy Center does not contain saline aquifers, depleted oil or gas reservoirs, or deep coal beds and therefore is not suitable for the injection of CO_2 underground.

Alternative sequestration techniques include converting CO_2 to baking soda or algae based carbon capture. Power plants similar in size to the proposed Woodbridge Energy Center may require a significantly larger site area to accommodate the additional process facilities associated with CO_2 capture. Such facilities could include CO_2 compressors, scrubbers, oxygen production plants or other carbon capture equipment. Depending upon the capture technology employed, the site area for the capture equipment may approach the size of the site area of the power generating plant itself. In addition, capturing, scrubbing and compressing CO_2 requires much energy and would increase the fuel needs of the plant. The long term storage of CO_2 is a relatively new concept and has mostly been demonstrated on a pilot-scale.

While current technologies could be used to capture CO_2 from new fossil fuel fired power plants, they have not been demonstrated at the scale necessary to establish confidence for power plant application.[1] Further, the technology has not been demonstrated as suitable for the proposed site location. Therefore, CCS is not considered to be technically feasible for the project.

<u>Thermal Efficiency</u>

The design base load heat rate for GE 20FA.05 turbine is approximately 6,740 Btu/kWhr on a higher heating value (HHV) based on new and clean conditions without duct firing at steady state. This heat rate reflects the projects net power production which means that the output is net of plant auxiliary loads consumed by operation of the plant and is on HHV fuel basis. This heat rate is equivalent to a net plant efficiency of 56.2% Lower Heating Value (LHV). The heat rate and efficiency is based on the gas turbines at base load without duct firing.

The appropriate heat rate limit for the WEC turbines was determined by applying the following compliance margins to the base heat rate, consistent with other recent GHG BACT applications:

[1] See Report of the Interagency Task Force on Carbon Capture and Storage, p.50 (http://www.epa.gov/climatechange/policy/ccs_task_force.html).

- A 3.3% design margin reflecting the possibility that the constructed facility will not be able to achieve the design heat rate.
- A 6% performance margin reflecting efficiency losses due to equipment degradation prior to maintenance overhauls.
- A 3% degradation margin reflecting the variability in operation of auxiliary plant equipment due to use over time.

Based on the above criteria, Woodbridge Energy Center proposes as BACT net heat rate for the Project of 7,605 Btu/kWh (HHV), corrected to ISO conditions of:

- Ambient Dry Bulb Temperature: 59ºF
- Ambient Relative Humidity: 60%
- Barometric Pressure: 14.69 psia
- Fuel Lower Heating Value: 20,646 Btu/lb LHV
- Fuel HHV/LHV Ratio: 1.109
- Gas Turbines at base load with duct firing off
-

The proposed net heat rate for WEC turbines of 7,605 Btu/kWh (HHV) is consistent with other recent GHG BACT determinations for the Calpine Russell City Energy Center in Hayward, California, and the Cricket Valley Energy Center in Dover, New York, which contain CO_2e limits for each facility's natural gas fired combined cycle power plant, and efficiency limits ranging from 7,605 to 7,730 Btu/kWh for the natural gas fired combustion turbines (operating at 100% load, ISO conditions and without duct firing).

b. Technical Review of Proposed GHG Controls

GHG Controls for Combustion Turbines and Duct Burners

Woodbridge Energy Center proposes to operate the combustion turbines in combined cycle mode with natural gas as the exclusive fuel and proposes as BACT a heat rate limit of 7,605 Btu/kWh (57.4% efficiency (LHV)) at full load ISO conditions without duct firing (based on net output).

In addition to the 7,605 Btu/kWh (HHV) heat rate limit WEC is also proposing, as BACT, an emission limit of 925 lb CO_2/MW-hr (gross), for each turbine and its associated duct burner.

WEC is also proposing an annual limit CO_2e of 2,057,875 tons per year for the two turbines and duct burners. Compliance with the proposed CO_2e limit would be demonstrated through the use of CO_2 CEMS along with fuel usage and emission factors for methane and nitrous oxide.

The Department has reviewed the proposed BACT limits for WEC turbines and found them to be consistent with other recent BACT determinations for similar size turbines.

GHG Controls for Auxiliary Boiler and Fuel Gas Heater

To reduce GHG emissions from the Auxiliary boiler, WEC is proposing to use natural gas which has the lowest CO_2 emissions compared to other combustion fuels, to limit its operation 2,000 hours per year and to operate it efficiently.

The Woodbridge Energy Center Project's fuel gas heater at WEC will utilize natural gas as it is the only feasible option for reducing GHG emissions from the Fuel Gas Heater.

GHG Controls for Emergency Engines

A search of the RBLC for "carbon dioxide" did not yield any results for emergency diesel engines similar to that proposed for the Woodbridge Energy Center Project. The reduction of GHG emissions from the emergency diesel generator and fire pump will be achieved by limiting the hours of operation.

D. APPLICABLE REGULATIONS

1. Prevention of Significant Deterioration (PSD) of Air Quality

DEP has determined that the proposed facility is subject to all applicable requirements of the federal PSD regulations codified at 40 CFR 52.21. The threshold for PSD applicability is 100 tons per year of emissions of any regulated pollutant for fossil fuel-fired steam electric plants of greater than 250 MMBTU/hr heat input. PSD applicability is determined on an individual pollutant basis. Based on the potential annual emissions in Table 2, the WEC was determined to be subject to PSD requirements for emissions of nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}), PM, H_2SO_4 and Greenhouse gases (CO2e).

Air Quality Impact Analyses

In addition to the BACT control technology requirements discussed in Section C above, the PSD regulations require the facility to conduct an air quality impact analysis to show that the project emissions would have no adverse effect on:

(1) Visibility, soils and vegetation that would occur as a result of the project itself and general commercial, residential, industrial and other growth associated with WEC,

(2) Air quality projected for the area as a result of general commercial, residential, industrial and other growth associated with it, and,

(3) Endangered species.

WEC has stated that there would be no adverse impacts on visibility, soils and vegetation and projected air quality as a result of the project itself, or due to general commercial, residential, industrial and other growth associated with it.

WEC is located within the geographic range of the federally listed (endangered) Indiana bat (Myotis sodalis). Because no suitable habitat is on the WEC Project Site, no adverse effects will occur to the Indiana bat or its habitat from the proposed Project. No adverse effects are anticipated on other federally listed species either.

Environmental Justice (EJ) Analyses

WEC conducted an Environmental Justice (EJ) analysis to determine whether the construction and operation of the WEC would have a significant adverse and disproportionate effects on an "environmental justice community." The EJ analysis is per the Executive Order 12898 ("EO"), entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low Income populations" (February 11, 1994). The EO requires federal agencies to consider disproportionately high adverse human health or environmental effects of their actions on minority and low income populations. New Jersey has similar order in Executive Order 131 that requires state agencies, including NJDEP, to allow for public participation in decisions that effect environmental quality and public health.

The "USEPA Region 2 Interim Environmental Justice Policy" (USEPA, 2000) (Interim Policy) provides guidance in conducting the EJ Analysis. The Interim Policy defines an "EJ Community" as:

"A minority and/or low income area suffering a disproportionate and adverse environmental burden as a result of the unfair or unequal development, implementation, or enforcement of environmental laws, regulations or policies."

An "adverse environmental burden" is defined by the Interim Policy as:
"When there is an acknowledged health or welfare standard for the burden in question, the burden is adverse only when it exceeds that standard. When there is no standard, the decision is based on additional site-specific analysis"

WEC utilized the Interim Policy guidelines to develop its EJ Analysis that showed the presence of 14 census block groups within a two-mile radius of the project which exceeded the USEPA Region 2 demographic criteria thresholds for minority and/or low-income representation. WEC then furthered its EJ Analysis to identify potential environmental impacts within the 14 census block groups.

EJ Analysis demonstrated that WEC's potential air emission concentrations are less than the NAAQS within the EJ Study area, and therefore are not adverse.

Air Quality Modeling Analyses
The PSD air quality modeling analyses are discussed in detail in Section E. Briefly, the facility has demonstrated that project emissions are in compliance with the NAAQS, NJAAQS, and PSD Class I and Class II increments, and will not have an adverse impact on soils, vegetation, and endangered species. Furthermore, the maximum modeling air quality impact locations do not fall within potential EJ areas, and do not have a disproportionate affect on EJ communities.

2. N.J.A.C 7:27-18

The WEC was determined to be subject to N.J.A.C 7:27-18 for emissions of NO_x, VOC CO and PM_{10}. The WEC is subject to N.J.A.C 7:27-18 for NO_x and VOC as the potential emissions of these two ozone precursors are greater than 25 tons per year (the threshold for severe ozone non-attainment, which applies to the entire state of New Jersey). The potential emissions of CO and PM_{10} are greater than N.J.A.C 7:27-18 threshold of 100 tpy for these two pollutants.

Middlesex county is non-attainment for Ozone (precursors NOx and VOC) and $PM_{2.5}$. Applicable requirements include application of LAER technology and acquisition of emission offsets.

The minimum offset ratio is 1.3:1 for both NO_x and VOC, per N.J.A.C. 7:27-18.5. The use of emission reduction credits (CERs) to offset NO_x and VOC emissions must be within 100 miles for the 1.3:1 ratios to apply. WEC has expressed its intent to secure the required NO_x and VOC emission offsets from sources within 100 miles of its site. Therefore, multiplying the potential to emit (PTE) by 1.3 results in a requirement for 195 tons per year (tpy) of NO_x (PTE = 149.4 tpy) offsets, and 44 tons of VOC (PTE = 33.6 tpy) offsets. These offsets must be secured by WEC before the startup. The facility must also indentify the sources from which these offsets will be acquired and provide the Department a letter of intent from these sources agreeing to sell required NOx and VOC offsets to the WEC, before the draft permit is issued for public comment.

Pursuant to N.J.A.C 7:27-18, the facility is required to obtain 195 tons of NOx offsets, at an offset ratio of 1.3 tons reduction to 1.0 ton of NOx emission increase, and 44 tons of VOC offsets at an offset ratio of 1.3 tons reduction to 1.0 ton of VOC emission increase.

The applicant has proposed to obtain 44 tons of VOC offsets from:

- General Motors Corporation, Linden, Union County

The applicant has proposed to obtain 195 tons of NOx offsets from one or more of the following sources:

Offsets from New Jersey:

a. Chevron USA Products Company, Perth Amboy, Middlesex County
b. Gerdau Ameristeel, Perth Amboy, Middlesex County

Offsets from New York

a. Warbasse Houses and Power Plant, Brooklyn, New York
b. BICC Cables Co. Yonkers, New York
c. National Grid – (formerly KeySpan Gen. LLC), Glennwood Landing, New York
d. Con-Edison – Astoria, Astoria, New York
e. Covanta Babylon, West Babylon, New York

Any offsets from New York would require agreement by New York Department of Environmental conservation (NYDEC) that emissions reductions are enforceable. Such an agreement must be obtained by NJDEP prior to final approval of offsets. If this permit is approved, all offsets would need to be verified and acceptable to NJDEP, and secured and transferred to the applicant prior to initiation of operation pursuant to N.J.A.C. 7:27-18.3(f).

Middlesex County is in attainment for CO and PM_{10}. As per N.J.A.C 7:27-18.2(b)2, the facility is required to conduct air quality impact analysis to show that the proposed emissions of CO and PM_{10} would not equal or exceed the significant air quality impact level, nor result in a violation of an NAAQS or the NJAAQS.

As mentioned above, WEC would be located in Middlesex county which is non-attainment for $PM_{2.5}$, it is subject to December 14, 2010 Memorandum of Division of Air Quality regarding $PM_{2.5}$ Permitting and Modeling Procedures.

In accordance with N.J.A.C. 7:27-18.3(c)2, WEC has conducted an analysis of alternative sites within New Jersey and considered alternative sizes, production processes, including pollution prevention measures and environmental control techniques, demonstrating that the benefits of the newly constructed WEC outweigh the environmental and social costs imposed as a result of the location, construction, and operation of the WEC. The Department has found that the benefits of the WEC will significantly outweigh the potential environmental and social costs imposed as a result of construction and operation of the WEC.

3. Other Regulatory Requirements

a. Federal Regulations

New Source Performance Standards (NSPS)

In addition to PSD regulations codified at 40 CFR 52.21, the WEC is subject to the following subparts of NSPS codified at 40 CFR 60:

- Subpart A: General Provisions
- Subpart Dc, the NSPS for industrial steam generating units greater than or equal to 10 MMBTU/hr but less than 100 MMBTU/hr (auxiliary boiler)
- Subpart IIII, the NSPS for stationary CI internal combustion engine, and
- Subpart KKKK, the NSPS for stationary gas turbines.

The emission limitations proposed by the WEC as shown in Table 1 and discussed in Section C satisfy the NSPS requirements.

Acid Rain Program

The Acid Rain Permit is proposed pursuant to the air pollution control permit provisions of Title IV of the federal Clean Air Act, federal rules promulgated at 40 CFR 72, and state regulations promulgated at N.J.A.C. 7:27-22. These rules require facilities operating "affected units" that are subject to the Acid Rain Program to obtain an Acid Rain Permit for those units. Pursuant to Title IV of the Clean Air Act, the United States Environmental Protection Agency (USEPA) has not previously approved sulfur dioxide allowances for the two units, Unit 1, and Unit 2, proposed for WEC. Each allowance provides authorization to emit up to one ton of sulfur dioxide during a specified calendar year. In accordance with USEPA's rules, WEC may sell or purchase allowances on the open market in order to more accurately reflect current operation. The total numbers of SO2 allowances allocated to the referenced units are as follows: Unit 1: 6, Unit 2: 6 The representative for WEC is Mark Turner.

National Ambient Air Quality Standards

The National Ambient Air Quality Standards (NAAQS) are codified at 40 CFR 50. The dispersion modeling analysis discussed in Section E, demonstrate compliance with the NAAQS requirements.

Maximum Achievable Control Technology (MACT)

The MACT standards are codified at 40 CFR 63 (National Emission Standards for Hazardous Air Pollutants for Source Categories), and are applicable to sources that emit Hazardous Air Pollutants (HAPs).

The combustion turbines along with duct burners, auxiliary boiler and emergency engines are sources of HAPs. The MACT rules for these sources are codified at:

Subpart YYYY:	for Stationary Combustion Turbines.
Subpart JJJJJJ:	Industrial, Commercial, Institutional (ICI) boilers and process heaters
Subpart ZZZZ:	for Stationary Reciprocating Internal Combustion Engines.

WEC will not be a major source HAP. A source is major for HAPS if the total HAPs from the facility are 25 tons per year or greater, or if the emissions of a single HAP is 10 tpy or greater.

The total HAPs from WEC are 5.51 tpy, which are less than 25 tons per year. Formaldehyde would be the single HAP emitted from the combustion turbines with highest estimated annual emission rate of 2.7 tpy. The HAP emissions from all other equipment at WEC are below the reporting thresholds in Table B of Appendix to N.J.A.C. 7:27-22.

Since the WEC is not a major source of HAPs, the combustion turbines are not subject to MACT standards at Subpart YYYY.

The new auxiliary boiler is not subject to Subpart JJJJJJ as it will be burning natural gas.

The new emergency engines will comply with Subpart ZZZZ by complying with NSPS IIII, since WEC is an area HAPs source (those that are not major HAPs sources).

b. ***New Jersey Regulations***

The facility is subject to New Jersey Air Pollution Control Regulations, codified in N.J.A.C. 7:27-1 et seq. for air pollution control, and the New Jersey Ambient Air Quality Standards (NJAAQS). The Department is satisfied that the proposed emission rates in Table 1 and Table 2 satisfy the New Jersey regulations.

E. <u>TESTING AND MONITORING REQUIREMENTS</u>

The WEC will be required to conduct stack testing for NOx, CO, TSP, PM_{10}, $PM_{2.5}$, VOC, and SO_2 to demonstrate the ability of the facility to operate within the approved emission limitations. In addition, Continuous Emission Monitors (CEM) and recorders for NOx, CO, O_2 and CO_2 would be required. The scope of the stack testing and CEMS is detailed in the draft compliance.

Since the facility is proposing $PM_{2.5}$ emissions of 98.7 tons per year, which is very close to 100 tpy threshold for triggering NSR Rule (40CFR Part51, Appendix S) for $PM_{2.5}$, the Department is requiring that the WEC conduct quarterly stack testing for $PM_{2.5}$ for the first two years, and then based on the stack tests results the facility may apply for relaxing this requirement.

F. <u>AIR QUALITY IMPACT ANALYSIS</u>

The Department reviewed the ambient air quality impact of the proposed project. Based on the air quality modeling analysis, the Department found that air contaminant emissions from the proposed Facility will not exceed Federal or New Jersey Ambient Air Quality Standards or PSD increments. The source's Class I impacts at the Brigantine National Wildlife Refuge would be less than allowable EPA Class I increments, and below Class I area Significant Impact Levels (SILs).

The fact sheet of the air dispersion modeling from Bureau of Technical Services, is attached at Section G.

<u>G: ATTACHMENT I</u>

Fact Sheet for air dispersion modeling and risk assessment

ATTACHMENT I

WOODBRIDGE ENERGY CENTER
700 MW ELECTRIC GENERATING FACILITY
MAY, 2012

FACT SHEET: AIR QUALITY EFFECTS

Air Quality Analysis Methodology

Emissions of air pollutants from the proposed Woodbridge Energy Center (facility) were mathematically modeled in order to predict their effect on ambient air quality levels. Maximum predicted concentrations of criteria pollutants were compared with the National and New Jersey Ambient Air Quality Standards (NAAQS and NJAAQS). The primary ambient air quality standards were established to protect public health with an adequate margin of safety. The secondary ambient air quality standards were designed to protect public welfare from adverse effects such as soiling, vegetation damage, or material corrosion. Criteria pollutants, which will be significantly emitted by the proposed facility, include sulfur dioxide (SO_2), nitrogen oxides as nitrogen dioxide (NO_2), carbon monoxide (CO), and particulate matter (PM-2.5 and PM-10). Modeled impacts of SO_2, NO_2, and PM-10 were also compared to the USEPA's Prevention of Significant Deterioration (PSD) increment levels. A PSD increment is the maximum increase in a pollutant's concentration that is allowed to occur above an earlier established baseline value.

The air quality modeling analysis was performed using the U.S. Environmental Protection Agency's atmospheric dispersion model – AERMOD (version 12060). Basic inputs to the dispersion model were the facility's emissions, stack height, stack diameter, stack exit gas temperature and velocity, and the surrounding ground level elevations. Aerodynamic building downwash from the heat recovery steam generators (HRSG), evaporative cooling tower and significant structures at the facility were included in the modeling.

The AERMOD model was used with five years (2006-2010) of National Weather Service hourly surface meteorological data from Newark International Airport and concurrent upper air data from Brookhaven, NY. The Newark International Airport is located approximately 22 kilometers northeast of the proposed facility, while Brookhaven National Labs is approximately 127 kilometers east of the proposed facility. The meteorological data used for the air quality modeling analysis is considered representative of the Woodbridge Energy Center site. A land cover classification analysis was performed to determine whether the urban source modeling option in AERMOD should be used in quantifying ground-level concentrations. The land use classification concluded the site should be represented as rural in the model. The AERMOD modeling analysis examined the Woodbridge Energy Center's impact on the ambient air levels of 1-hour and 8-hour average CO concentrations; 1-hour, 3-hour, 24-hour, and annual average SO_2 concentrations; 1-hour and annual average NO_2 concentrations; 24-hour and annual average PM-10 and PM-2.5 concentrations. The AERMOD model also was used as a screening tool to simulate long-range transport impacts of PSD affected criteria pollutants at the Brigantine Class I Area and to evaluate short-term and annual average concentrations of hazardous air pollutant (HAP) emissions from the facility.

B. Dispersion Modeling Analysis - Single Source Refined Results

The air quality impacts from the proposed Woodbridge Energy Center combustion turbines were examined along with ancillary equipment and alternative operating scenarios (duct firing within the HRSGs, auxiliary boiler, fuel gas heater, and startup and shutdown conditions). Fourteen different combinations of ambient temperatures and varying turbine operating loads were evaluated to determine the worst-case turbine operating scenario for use in the modeling analysis. The results of the single source modeling indicate that the facility had modeled concentrations below the significant impact levels (SILs) for CO, PM-10, annual PM-2.5, SO_2, and annual NO_2 in both Class I and Class II areas. Because impacts were predicted above the SILs, compliance with the 1-hour NO_2 and 24-hour PM-2.5 NAAQS had to be demonstrated with a multiple major source (multisource) modeling analysis. This analysis is discussed in a later section of the fact sheet.

For the averaging times and pollutants predicted to be below their respective significance levels, Table 1 shows that when these impacts are added to background concentrations, the proposed emissions increase due to the proposed Woodbridge Energy Center will not cause or contribute to a violation of a NAAQS or NJAAQS.

TABLE 1
Proposed Woodbridge Energy Center
Maximum Predicted Impacts

Pollutant	Avg. Time	Max. Pred Conc. (ug/m^3)[(a)]	Significance Level (ug/m^3)	Location of Background Air Quality (ug/m^3)	Total Impact (ug/m^3)	NJAAQS/ NAAQS (ug/m^3) [(c)]
SO_2	1-hour	2.3	7.8	49 (Perth Amboy)	51.3	197
	3-hour	2.1	25	47 (Perth Amboy)	49.1	1,300 [(e)]
	24-hour	1.5	5	26 (Perth Amboy)	27.5	260[(d)]/365
	Annual	0.1	1	5.2 (Perth Amboy)	5.3	60[(d)]/80
NO_2	1-hour	51	10	92 (Rutgers)	**b**	188
	Annual	0.91	1	20.8 (Rutgers)	21.7	100
CO	1-hour	773	2,000	3,680 (Perth Amboy)	4,453	40,000
	8-hour	95	500	1,610 (Perth Amboy)	1,705	10,000
PM-2.5	24-hour	3.3	1.2	23.0 (Rutgers)	**b**	35
	Annual	0.2	0.3	8.8 (Rutgers)	9	15
PM-10	24-hour	4.4	5	78 (Jersey City)	82.4	150

a. Values represent maximum predicted block averages.
b. Multisource modeling conducted to determine the total impact.
c. Unless footnoted, values represent the primary ambient air quality standard.
d. Values represent the secondary New Jersey ambient air quality standard.
e. Values represent the national and New Jersey ambient air quality standard.

Dispersion Modeling Analysis - Multisource Modeling Emission Inventories

The multisource modeling analysis was conducted for the two pollutants and averaging times whose impacts exceeded significance levels, 1-hour NO_2 and 24-hour PM-2.5. The multisource modeling was performed to assess the impacts of the Woodbridge Energy Center plus other major sources of PM-2.5 and NO_2 in the surrounding region. Woodbridge Energy Center's impacts were modeled using the worst-case operating scenario identified for the single source modeling.

A modeling methodology similar to that used in the single-source modeling was used in the multisource modeling (AERMOD with the 2006 through 2010 meteorological data). Receptors were only placed within the significant impact area of 1.5 kilometers for PM-2.5. Following EPA guidance on NO_2 modeling, receptors for the NO_2 multisource modeling were placed at locations where the single source modeling predicted maximum modeled impacts above the significance level. The emissions from eighteen nearby major existing or proposed sources were included in the multisource modeling analysis.

Dispersion Modeling Analysis - Multisource Modeling Analysis Results

The results of the multisource modeling analysis are summarized in Table 2. Table 2 demonstrates that emissions from the proposed Woodbridge Energy Center when combined with other nearby sources and background air quality will not cause or significantly contribute to a violation of a NJAAQS or NAAQS.

TABLE 2
Comparison of Predicted Multisource Impacts to NJAAQS/NAAQS

Pollutant	Avg. Time	Predicted Conc. (ug/m^3)	Background Air Quality (ug/m^3)	Total Impact (ug/m^3)	NJAAQS/ NAAQS (ug/m^3)
PM-2.5	24-hour	7.3[(a)]	23	30.3	35
NO_2	1-hour	43[(b,c)]	92	135	188

a. Based upon maximum of 5-year average 1st highest maximum modeled concentrations.
b. Based upon maximum of 5-year average 8th highest maximum modeled concentrations.
c. Assumed 80% of NOx is NO_2 per EPA guidance.

Class I Area Air Quality Impacts

The only PSD Class I area within 300 kilometers of the facility is the Brigantine National Wildlife Refuge which is located approximately 108 kilometers to the south of the facility. The Federal Land Manager (FLM) for Brigantine was contacted by the facility and the FLM determined that an assessment of the facility impacts to air quality related values (AQRVs) such as visibility and sulfate and nitrate deposition was not required. Emissions from the proposed project were evaluated to assess the consumption of the Class I PSD Increments at the Brigantine National Wildlife Refuge Class I area. The Class I impacts were modeled with AERMOD and five years (2006-2010) of hourly surface meteorological data from Newark International Airport with concurrent upper air data from Brookhaven, NY. Maximum modeled concentrations were then compared to both the PSD Class I SILs and increments as presented in Table 3. All were predicted to be below their federal SILs and PSD Class I Increments.

TABLE 3 **Comparison of Maximum Predicted Impacts for Criteria Pollutants to Class I Significant Impact Levels and Increment Levels**				
Pollutant	**Averaging Time**	**Maximum Predicted Impact (ug/m^3)**	**PSD Class I Significant Impact Level (ug/m^3)**	**PSD Class I Increment (ug/m^3)**
SO_2	3-hour	0.06	1.0	25
	24-hour	0.01	0.2	5
	annual	0.0008	0.1	2
$PM_{2.5}$	24-hour	0.035	0.07	2
	annual	0.002	0.06	1
PM_{10}	24-hour	0.04	0.3	8
	annual	0.003	0.2	4
NO_2	annual	0.003	0.1	2.5

Risk Assessment

A risk assessment was conducted to assess the possible adverse health effects due to inhalation exposure to the HAPs emitted from the natural gas fired combustion turbines at the Woodbridge Energy Center facility. A total of 9 HAPs were included in this study. Of the 9 pollutants emitted, 6 are known or suspected to be carcinogenic. The highest 24-hour and annual unit concentrations predicted by the single source AERMOD modeling analysis with the 2006-2010 meteorological data were used to calculate the maximum ambient pollutant concentrations. Modeling results indicate that the long-term cancer risks for individual HAPs are less than one in a million. In addition, hazard quotients for all short-term and long-term pollutants with health effects other than cancer are predicted to be less than 1.0. Table 4 lists the long-term cancer risk assessment performed for the 6 non-criteria pollutants. In summary, the adverse health effects due to HAP emissions from the Woodbridge Energy Center are predicted to be negligible.

Table 4 **Hazardous Air Pollutant Cancer Risks**		
Pollutant	**70-Year Exposure Cancer Risk**	**Level of Concern Above:**
Arsenic (inorganic)	0.018 in a million	1 in a million
Benzene	0.0019 in a million	1 in a million
Benzo(a)pyrene	0.0013 in a million	1 in a million
Cadmium	0.094 in a million	1 in a million
Formaldehyde	0.35 in a million	1 in a million
lead	0.0001 in a million	1 in a million

CONCLUSIONS

1) Criteria pollutants from the proposed Woodbridge Energy Center will not cause or significantly contribute to violations of state or federal ambient air quality standards for SO_2, NO_2, CO, PM-2.5 and PM-10 or the applicable Prevention of Significant Deterioration (PSD) Increments.

2) Impacts at the Brigantine Division of the Edwin B. Forsythe National Wildlife Class I Area were predicted to be below the Class I Significant Impact Levels and Increments for the 3-hour, 24-hour and annual averaging times. Emissions from the facility will not significantly increase regional haze at the refuge.

3) Modeled impacts of hazardous air pollutants from the Woodbridge Energy Center were predicted to have negligible health risks.