Cricket Valley Energy

Application for Prevention of Significant Deterioration and Part 201 Air Permit

Cricket Valley Energy Project

Dover, Dutchess County, New York

March 2010

ARCADIS
Infrastructure, environment, buildings

Cricket Valley Energy Project

Dover, Dutchess County, New York

Application for Prevention of Significant Deterioration and Part 201 Air Permit

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March 2010

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°F	degrees Fahrenheit
°K	degrees Kelvin
$\mu g/m^3$	micrograms per cubic meter
%	percent
AAR	Authorized Account Representative
ACC	air cooled condenser
ACT	Alternative Control Techniques
ADR	Acid Deposition Reduction
AEGL	Acute Exposure Guideline Level
AGC	Annual Guideline Concentration
ALOHA	Areal Locations of Hazardous Atmospheres Model (USEPA)
AP-42	*Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*
AQRV	Air Quality Related Values
ASOS	Automated Surface Observing Systems
BACT	Best Available Control Technology
Be	beryllium
BPIP	Building Profile Input Program
Btu	British thermal units
CAIR	Clean Air Interstate Rule
CARB	California Air Resource Board
CATEF	California Air Toxics Emission Factor
CEMS	continuous emissions monitoring systems
CFR	Code of Federal Regulations
CI	compression ignition
CO	carbon monoxide
CO_2	carbon dioxide
ConEd	Consolidated Edison Company of New York
CTG	combustion turbine generator

CVE	Cricket Valley Energy Center, LLC
DAR-1	NYSDEC Policy DAR-1: Guidelines for the Control of Toxic Ambient Air Contaminants
DB	duct burner
DLN	dry low NO_x
EJA	Environmental Justice Area
ERC	emission reduction credit
F^-	gaseous fluoride
FGD	flue gas desulfurization
FLM	Federal Land Manager
GEP	Good Engineering Practice
g/hp-hr	grams per horsepower-hour
g/kW-hr	grams per kilowatt-hour
$g/m^2/yr$	grams per square meter per year
g/s	grams per second
Ha	hectare
HAP	hazardous air pollutant
HHV	higher heating value
hp	horsepower
HRSG	heat recovery steam generator
H_2S	hydrogen sulfide
H_2SO_4	sulfuric acid mist
Iroquois	Iroquois Natural Gas Transmission System LP
ISO	International Organization for Standards
Kg/Ha/yr	kilograms per hectare per year
km	kilometer
KPOU	Poughkeepsie-Dutchess County Airport
kV	kilovolts
kW	kilowatts
LAER	Lowest Achievable Emission Rate
lb	pounds

lb/hr	pounds per hour
lb/MMBtu	pounds per million British thermal units
lb/MW-hr	pounds per megawatt-hour
m	meters
m/s	meters per second
msl	above mean sea level
MMBtu/hr	million British thermal units per hour
MW	megawatts
n/a	not applicable
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NED	National Elevation Dataset
NEOTR	Northeast Ozone Transport Region
NESHAP	National Emission Standards for Hazardous Air Pollutants
ng/J	nanograms per Joule
NH_3	ammonia
NNSR	Nonattainment New Source Review
NO	nitrogen oxide
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPS	National Park Service
NSPS	New Source Performance Standards
NYAAQS	New York Ambient Air Quality Standards
NYCRR	New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
NYSDEC	New York State Department of Environmental Conservation
O_2	oxygen
Pb	lead
PM_{10}	particulate matter with a diameter equal to or less than 10 microns
$PM_{2.5}$	particulate matter with a diameter equal to or less than 2.5 microns
ppm	parts per million

ppm_v	parts per million by volume
ppm_w	parts per million by weight
PSD	Prevention of Significant Deterioration
psia	pound per square inch absolute
RACT	Reasonably Available Control Technology
RBLC	RACT/BACT/LAER Clearinghouse
RGGI	Regional Greenhouse Gas Initiative
SCF	standard cubic feet
SCR	selective catalytic reduction
SEQRA	State Environmental Quality Review Act
SGC	Short-term Guideline Concentrations
SIA	Significant Impact Area
SIL	Significant Impact Level
SIP	State Implementation Plan
SMC	Significant Monitoring Concentration
SO_2	sulfur dioxide
SO_3	sulfur trioxide
STG	steam turbine generator
tpy	tons per year
TSP	total suspended particulates
ULSD	ultra low sulfur diesel
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VCAPCD	Ventura County Air Pollution Control District
VOC	volatile organic compounds

1. INTRODUCTION

1.1 Project Overview

Cricket Valley Energy Center, LLC (CVE) is proposing to construct a nominal 1,000 megawatt (MW) combined cycle electric generating facility, firing natural gas as the combustion turbines' sole fuel. The project is comprised of three units capable of operating independently to respond to energy demand with the maximum efficiency. Each unit consists of one F-Class Technology combustion turbine generator (CTG), one heat recovery steam generator (HRSG) with supplemental duct firing, one steam turbine generator (STG), and an associated air cooled condenser (ACC). The project is intended to operate as a base load facility and is proposing to be available to operate up to 8,760 hours per year, incorporating a range of load conditions. In addition to the combustion turbines, the facility will contain ancillary combustion equipment including one natural gas fired auxiliary boiler, one diesel fired fire pump engine and three diesel fired black-start generators.

CVE proposes to construct the project within an approximately 57-acre project development area located within an approximately 131-acre industrially zoned site off of Route 22 in Dover, Dutchess County, New York. The project will be constructed in the location of existing inactive industrial buildings and will take advantage of the previously disturbed footprint to the maximum extent possible. Building demolition will be a component of early-stage project construction. The address of the project site is 2241 NY Route 22, Dover, New York.

Air emissions from the proposed facility primarily consist of products of combustion from the combustion turbines, HRSG duct burners and ancillary equipment. Pollutants that are regulated under federal and New York State programs include carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter with a diameter equal to or less than 10 microns (PM_{10}), particulate matter with a diameter equal to or less than 2.5 microns ($PM_{2.5}$), volatile organic compounds (VOC), lead (Pb), and sulfuric acid mist (H_2SO_4). Potential emissions from the proposed project are presented in Table 1-1.

1.2 Regulatory Overview

Dutchess County is in attainment of all National Ambient Air Quality Standards (NAAQS) and New York Ambient Air Quality Standards (NYAAQS) except for ozone. Dutchess County is included in the Mid-Hudson Ozone Nonattainment Area, which is classified as moderate nonattainment with respect to the 8-hour ozone standard; the entire state and

most of the Northeast are within the designated Northeast Ozone Transport Region (NEOTR), which is also treated as a moderate ozone nonattainment area.

As indicated in Table 1-1, the proposed project will be a major source of ozone precursors and will be subject to Nonattainment New Source Review (NNSR) for NO_x and VOC. As such, the project is required to apply Lowest Achievable Emission Rate (LAER) technology for these pollutants and obtain emissions offsets.

Table 1-1: Summary of Proposed Potential Emissions and Applicable Regulatory Thresholds

Pollutant	Annual Emissions (tpy)	NNSR Major Source Threshold (tpy)	PSD Significant Emission Rate (tpy)	PSD/NNSR Applies? (Yes/No)
NO_x	276.1	100[a]	40[b]	Yes[a]
VOC	156.6	50[a]	40	Yes[a]
CO	680.5	n/a	100	Yes
PM_{10}	196.1	n/a	15	Yes
$PM_{2.5}$	196.1	n/a	10	Yes
SO_2	50.1	n/a	40	Yes
H_2SO_4	10.3	n/a	7	Yes
Pb	3.3×10^{-4}	n/a	0.6	No

a. Project is subject to NNSR for this pollutant.
b. PSD significant emission rate for nitrogen dioxide (NO_2).

The project will require a Part 201 Air State Facility Permit (Part 201 permit) issued by the New York State Department of Environmental Conservation (NYSDEC). At the time of this application, NYSDEC has not been delegated authority to administer the Prevention of Significant Deterioration (PSD) program. Thus, the U.S. Environmental Protection Agency (USEPA) currently maintains PSD permitting authority. Under the PSD regulations, since annual emissions of at least one criteria pollutant will exceed 100 tons per year (tpy), the project will be subject to PSD review. PSD review requirements are applicable to those pollutants that exceed significant emission rates. These requirements include application of Best Available Control Technology (BACT), an ambient air quality modeling analysis that includes a demonstration of compliance with ambient air quality standards and PSD

increments, and other additional impacts analyses. PSD review will be required for NO_x, VOC, CO, SO_2, $PM_{10}/PM_{2.5}$, and H_2SO_4.

1.3 Application Overview

1.3.1 Application Organization

This permit application is divided into six sections. Section 2 provides a detailed description of the proposed project, including a facility description and estimated emissions. Section 3 provides a review of applicable regulations for the proposed project. Section 4 provides the BACT/LAER control technology evaluations. Section 5 provides the air quality modeling analysis. Section 6 provides references.

The NYSDEC permit application forms are included as Appendix A of this document. This application seeks a PSD permit and a Part 201 permit for the emission sources at the proposed facility. No Title V permit application is being filed at this time. It is anticipated that a Title V operating permit application will be submitted within one year of commencing operation, as required by NYSDEC regulations. Emission calculation spreadsheets providing supporting calculations for the application are provided in Appendix B. A copy of the modeling protocol and agency correspondence is provided in Appendix C. The supporting documentation for the modeling analysis is provided in Appendix D, and the modeling files are provided on compact disc in Appendix E.

1.3.2 Application Contacts

To facilitate NYSDEC review of this application, individuals familiar with the project and this application are identified below.

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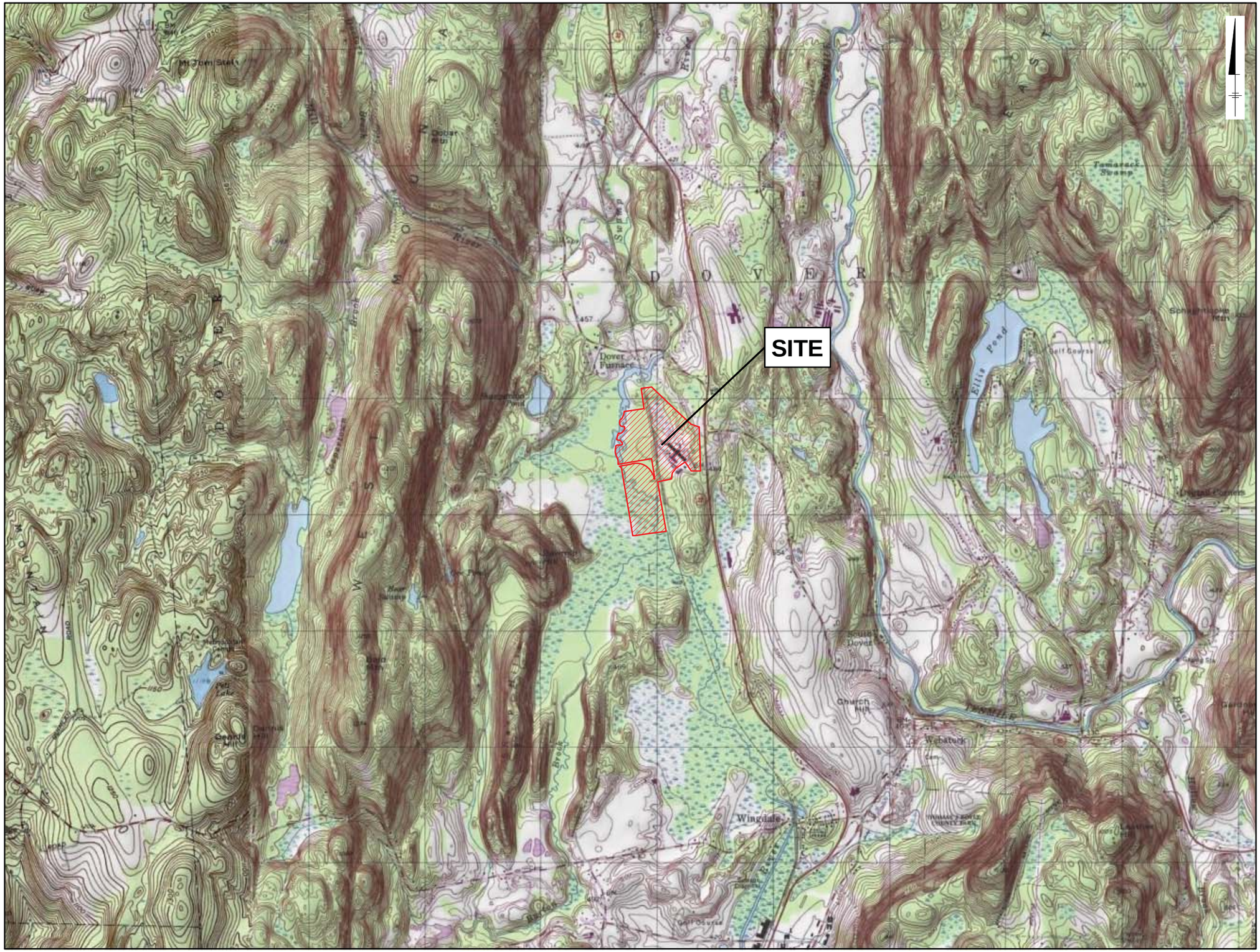
2. PROJECT DESCRIPTION

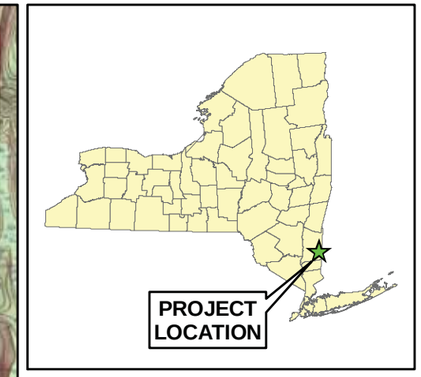
2.1 Overview

CVE proposes development of a nominal 1,000 MW electric generating facility at a previously developed industrial site in Dover, New York. Figure 2-1 presents the proposed project location on a topographic map. The facility will be comprised of three independent units, exclusively firing natural gas. Each unit consists of one F-Class Technology CTG, one HRSG with supplemental duct firing, one STG, and an associated ACC. In addition to these three units, major project equipment will also include:

- Selective catalytic reduction (SCR) and oxidation catalyst systems
- Continuous emissions monitoring systems (CEMS)
- Two 30,000-gallon 19 percent (by weight) aqueous ammonia (NH_3) storage tanks
- One 1 million-gallon raw water storage tank
- One 250,000-gallon demineralized water storage tank
- One natural gas fired auxiliary boiler
- One diesel fire pump and associated 650-gallon distillate oil tank
- Three diesel black-start generators, each with an associated 1,000-gallon distillate oil tank (integrated with the unit)
- A water treatment system including a zero-liquid-discharge system

Natural gas will be delivered via an interconnection with the Iroquois Gas Transmission System LP (Iroquois) interstate pipeline. Electrical interconnection will be to the Consolidated Edison Company of New York (ConEd) 345-kilovolt (kV) transmission system. The Iroquois pipeline and ConEd transmission line rights-of-way abut the site's northern property line. The natural gas is assumed to have a higher heating value (HHV) of approximately 966 British thermal units (Btu)/standard cubic foot (SCF) and a sulfur content of 0.5 grains per 100 SCF.





Legend

Site Boundary

SOURCE:
U.S. Geological Survey, 7.5 x 15 Minute Quadrangle, Dover Plains, NY/CT, Verbank, NY

0 2,000 4,000 Feet

GRAPHIC SCALE

ARCADIS

CRICKET VALLEY ENERGY

FIGURE 2-1
SITE LOCATION

Dutchess County, New York

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2.2 Site Location

CVE proposes to construct the project within an approximately 57-acre project development area located within an industrially zoned site off of Route 22 in Dover, New York. The site is located in a north-south facing valley with surrounding complex terrain. The terrain features of the site have been considered in the modeling analysis (Section 5.0) through the choice of meteorological data and in the assignment of terrain heights for receptor locations.

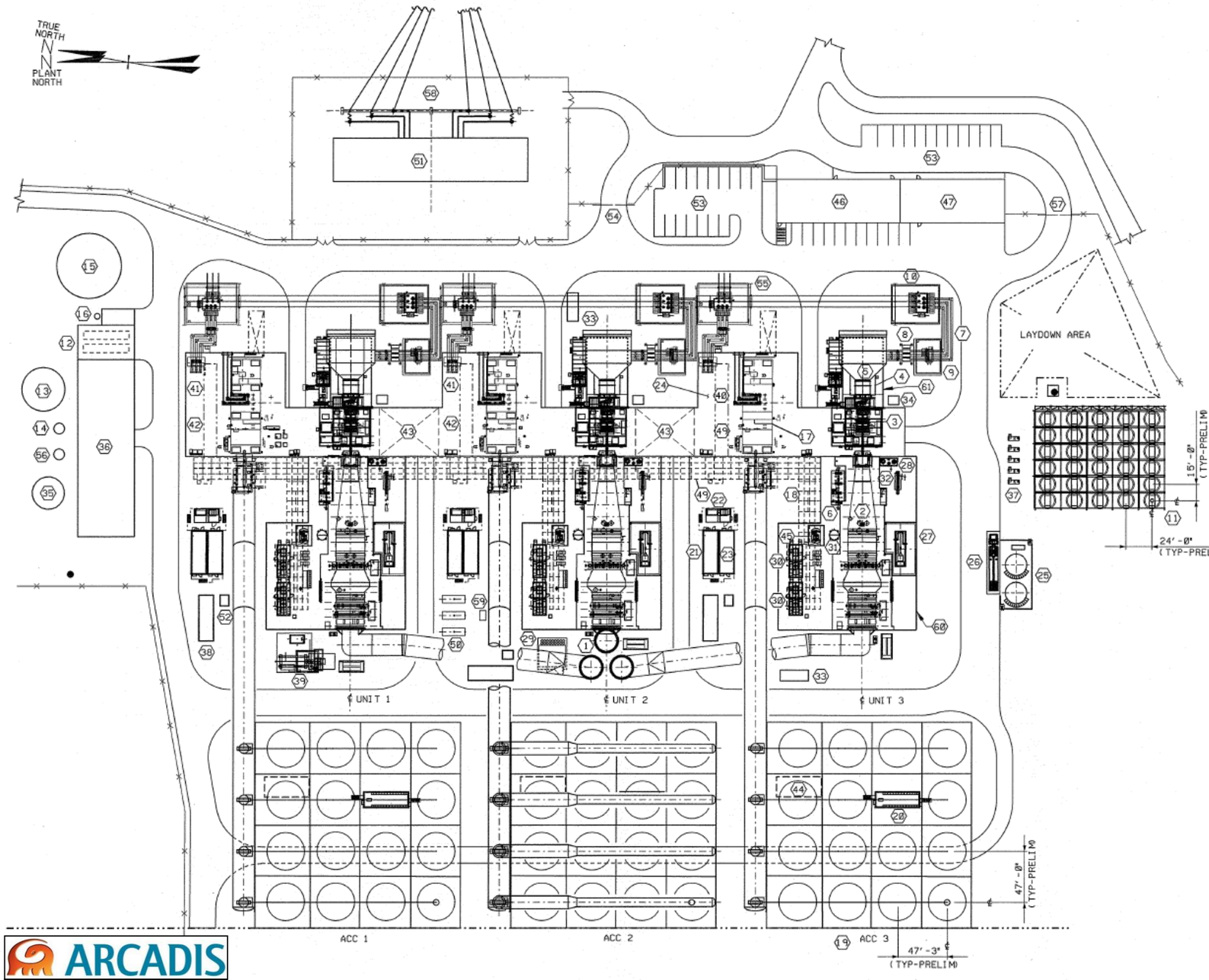
The site is bounded to the east by State Route 22 and to the north by the existing ConEd 345-kV transmission corridor. An active commuter rail line, owned and operated by Metro-North Railroad, transects the site in a north-south direction; the proposed project development area is located entirely to the east of the rail line. Figure 2-2 presents a general arrangement drawing showing the proposed equipment locations. The property extends further west to the Swamp River. As the property extends south, a portion is located on the west side of the Swamp River. The property east of the railroad is bordered to the south by existing industrial structures.

2.3 Combined Cycle Combustion Turbines

The proposed project will be comprised of three combined cycle combustion turbine units. Each unit is a 1x1x1 configuration which consists of one CTG, one HRSG with supplemental duct firing, one STG, and an associated ACC. The sections below provide more detailed descriptions of this equipment.

2.3.1 Combustion Turbine Generators

Thermal energy is produced in each of the three CTGs through the combustion of natural gas. The thermal energy is converted to mechanical energy in the CTG turbine that drives the CTG compressor and electric generator. CVE is proposing to install three F-Class combustion turbines firing natural gas as the only fuel. The maximum heat input rate of each CTG for 100 percent load at International Organization for Standards (ISO) temperature and relative humidity (59 degrees Fahrenheit [°F] and 60 percent, respectively) and a site pressure of 14.5 pounds per square inch absolute (psia) is 2,000 million Btu per hour (MMBtu/hr) at the HHV for natural gas.



NOTES

1. CURRENT LAND/RECORD OWNER: HOWLANDS LAKE PARTNERS, LLC PO BOX 285, MOUNT KISCO, NY 10549.
2. PARCELS' GRID NUMBERS: 7060-00-493989; 7061-00-465190; 7061-00-580190; 7061-00-585063.

LEGEND

1. STACK (HRSG)
2. HEAT RECOVERY STEAM GENERATOR
3. GAS TURBINE
4. GAS TURBINE GENERATOR
5. GAS TURBINE INLET FILTER
6. ROTOR AIR COOLER (KETTLE BOILER TYPE)
7. ISOPHASE BUS DUCT
8. GENERATOR CIRCUIT BREAKER
9. AUXILIARY TRANSFORMER
10. GAS TURBINE GENERATOR STEP UP TRANSFORMER
11. FIN FAN COOLER
12. DEMINERALIZED WATER TRAILER AREA
13. DEMINERALIZED WATER STORAGE TANK
14. POTABLE WATER STORAGE TANK
15. SERVICE/FIRE WATER STORAGE TANK
16. FIRE PROTECTION PUMP HOUSE
17. STEAM TURBINE/GENERATOR
18. CONDENSATE PUMPS
19. AIR COOLED CONDENSER (ACC)
20. AIR COOLED CONDENSER PCC
21. BALANCE OF PLANT PCC
22. SECONDARY UNIT SUBSTATION
23. STEAM TURBINE PCC
24. TURBINE GENERATOR BUILDING
25. AMMONIA STORAGE TANK & FORWARDING PUMPS
26. AMMONIA UNLOADING AREA
27. SCR SKID
28. FUEL GAS PREHEATER
29. CONTINUOUS EMISSIONS MONITORING
30. BOILER FEEDWATER PUMPS
31. BOILER BLOWDOWN FLASH TANK
32. DUCT FIRING SKID
33. OIL/WATER SEPARATOR
34. GAS TURBINE WATER WASH DRAIN TANK
35. WASTE WATER HOLDING TANK
36. WATER TREATMENT BUILDING
37. CLOSED COOLING WATER PUMPS
38. MEDIUM VOLTAGE SWITCHGEAR
39. AUXILIARY BOILER
40. AIR COMPRESSORS/DRYERS/RECEIVER
41. CHEMICAL FEED SYSTEM
42. SAMPLE PANEL
43. LAYDOWN AREA
44. MECHANICAL BUILDING (VACUUM PUMPS/SJAE/DRAIN TANK)
45. BLOWDOWN DRAIN TANK
46. ADMINISTRATION/CONTROL ROOM BUILDING
47. MAINTENANCE SHOP/WAREHOUSE BUILDING
48. FUEL GAS CONDITIONING & PRESSURE REDUCING STATION
49. RACK
50. BLACK START GENERATOR/EMERGENCY GENERATOR AREA
51. GIS SWITCHYARD BUILDING
52. STATIC FREQUENCY CONVERTERS
53. PARKING
54. MAIN GATE
55. STEAM TURBINE GENERATOR STEP UP TRANSFORMER
56. DRAIN COLLECTION TANK
57. SECONDARY GATE
58. SWITCHYARD AREA
59. BREAKER CABINET
60. HRSG ENCLOSURE
61. GAS TURBINE GENERATOR ENCLOSURE

PRELIMINARY MAJOR EQUIPMENT COORDINATES (FEET)

LEGEND NO	EQUIPMENT	℄ NORTH	℄ EAST	STACK/ EXHAUST DIAM	STACK/ EXHAUST HEIGHT
1	STACK - UNIT 1	611,539	705,509	19'	LATER (BY ARCADIS)
1	STACK - UNIT 2	611,529	705,535	19'	LATER (BY ARCADIS)
1	STACK - UNIT 3	611,511	705,514	19'	LATER (BY ARCADIS)
11	FIN FAN COOLER SOUTH WEST CORNER CELL'S FAN	611,051	705,747	13'	30'
16	FIRE PROTECTION PUMP EXHAUST	612,043	705,752	8"	12'
19	ACC 1 - SOUTH WEST CORNER CELL'S FAN	611,644	705,271	34'	113'
19	ACC 2 - SOUTH WEST CORNER CELL'S FAN	611,410	705,311	34'	113'
19	ACC 3 - SOUTH WEST CORNER CELL'S FAN	611,177	705,350	34'	113'
39	AUXILIARY BOILER STACK	611,539	705,509	•	•
50	BLACK START GENERATOR STACK	611,539	705,509	•	•

ALL STACK/EXHAUST DIAMETERS AND HEIGHTS ARE PRELIMINARY
• EQUIPMENT EXHAUSTS THROUGH THE STACK FOR UNIT 1

MAJOR EQUIPMENT DIMENSIONS

LEGEND NO	EQUIPMENT	SIZE (FEET)
2	HEAT RECOVERY STEAM GENERATOR	60WX190LX115H
11	FIN FAN COOLER	75W150LX30H
13	DEMIN WATER STORAGE TANK	40DIAX30H
14	POTABLE WATER STORAGE TANK	8DIAX15H
15	SERVICE/FIRE WATER STORAGE TANK	60DIAX50H
19	AIR COOLED CONDENSER	190WX190LX113H
35	WASTE WATER HOLDING TANK	30DIAX30H
56	DRAIN COLLECTION TANK	10DIAX18H

ALL DIMENSIONS ARE PRELIMINARY

MAJOR STRUCTURE DIMENSIONS

LEGEND NO	EQUIPMENT	SIZE (FEET)	AREA (FT^2)
24	GENERATION BUILDING	670WX100LX65H	67000
36	WATER TREATMENT BUILDING	50X195LX25H	9750
46	ADMINISTRATION/CONTROL ROOM BUILDING	40WX115LX15H	4600
47	MAINTENANCE SHOP/WAREHOUSE BUILDING	40WX95LX30H	3800
60	HRSG ENCLOSURE	128WX160LX113H	20480

ALL DIMENSIONS ARE PRELIMINARY

GRAPHIC SCALE

0 25' 50' 100' 150'

1" = 50.0'

ARCADIS

CRICKET VALLEY ENERGY

FIGURE 2-2
General Arrangement

Dutchess County, New York

Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr
G	ISSUED FOR PERMITTING	10/6/09	JGF		
H	REVISED TO INCLUDE HRSG AND GENERATOR ENCLOSURES	10/29/09	JFH		

Drawing Control

Purpose	Approved By	Date	Released By	Date
For Information				
For Comment				
For Bid				
For Fabrication				
For Construction				

JOSEE E. FERRERO
Oct 29, 2009
STATE OF NEW YORK
JOSEE E. FERRERO
No. 082862-1
LICENSED PROFESSIONAL ENGINEER
NEW YORK PROFESSIONAL ENGINEER NO. 082862-1

Engineering Review

Disc	Engr	Date
Mech		
Elec		
Civil		
Arch		
Instr		

Drawn JGF | Designed JGF | Checked

Lead Engineer | Date | Scale 1"=50'-0

Approved for Construction | Chief MECHANICAL Engineer

advanced power

CRICKET VALLEY ENERGY
TOWN OF DOVER
DUTCHESS COUNTY, NEW YORK

GENERAL ARRANGEMENT
POWER ISLAND PLANT

BURNS AND ROE ENTERPRISES, INC.
Engineers and Constructors - Oradell, NJ
New York Certificate of Authorization No. 0004677

Work Order	Drawing No	Sh	Rev
3000	M210		H

M210.DGN 13:27 29-OCT-2009

2.3.2 Heat Recovery Steam Generators and Duct Burners

In the combined-cycle configuration, each CTG will exhaust through a dedicated HRSG to generate steam from the waste heat energy in the exhaust gas. The HRSGs will be multi-pressure, horizontal units. Each HRSG will be equipped with supplemental fuel firing via a duct burner. The duct burners provide additional energy to the HRSG, which produces more steam that can be fed to the STGs. The duct burners will be natural gas fired and each will have a maximum input capacity of 596.8 MMBtu/hr (HHV). A duct burner associated with a HRSG will only operate when the CTG is operating at full load.

2.3.3 Steam Turbine Generator

Steam generated in the HRSGs will be expanded through an STG to generate additional electricity. Each HRSG will have a dedicated STG, which will be a multi-stage, non-reheat, condensing turbine and associated electric generator.

2.3.4 Air Cooled Condenser

Discharged steam will enter a steam distribution manifold located on top of the ACC structure. The steam will be distributed into heat exchangers arranged in a “roof structure.” Flowing down inside the heat exchanger tubes, steam will condense due to the cooling effect of ambient air drawn over the heat exchanger surface by the fans. Condensate will drain from the heat exchanger tubes into condensate manifolds and return back to the process. The ACC does not constitute a source of air emissions; as such, it is not considered further in this application, except that the structures are included in the building profile analysis for air quality impact modeling.

2.4 Air Pollution Control Equipment

The emission control technologies proposed for the combustion turbine and duct burner exhaust gases include dry low-NO_x (DLN) combustors which are integrated within the combustion turbines, and SCR systems and oxidation catalysts which are located within each HRSG to control NO_x, CO and VOC emissions. The DLN combustion controls NO_x formation by pre-mixing fuel and air immediately prior to combustion. Pre-mixing inhibits NO_x formation by minimizing both the flame temperature and the concentration of oxygen at the flame front. Oxidation catalysts control emissions of CO and VOC. Emissions of SO_2, PM_{10}/$PM_{2.5}$, and H_2SO_4 will be minimized through the exclusive use of pipeline quality natural gas in the combustion turbines. The SCR and oxidation catalyst are discussed further in the sections below.

2.4.1 Selective Catalytic Reduction

SCR, a post-combustion chemical process, will be installed in the HRSGs to treat exhaust gases downstream of the CTGs. The SCR process will use 19 percent aqueous NH_3 as a reagent. Aqueous NH_3 will be injected into the flue gas stream, upstream of the SCR catalyst, where it will mix with NO_x. The catalyst bed will be located in a temperature zone of the HRSG where the catalyst is most effective. The mixture will pass over the catalyst and the NO_x will be reduced to nitrogen gas and water. The SCR system will reduce NO_x concentrations to 2.0 parts per million by volume (ppm_v) at 15 percent oxygen (O_2) with or without duct firing at all load conditions and ambient temperatures. A small amount of NH_3 will remain un-reacted through the catalyst, which is called the "ammonia slip." The NH_3 slip will be limited to 5.0 ppm_v at all load conditions and ambient temperatures.

2.4.2 Oxidation Catalyst

An oxidation catalyst system will be located within each HRSG to control emissions of CO and VOC. Exhaust gases from the turbines will be passed over a catalyst bed where excess air will oxidize the CO and VOC to form carbon dioxide (CO_2) and water. The oxidation catalyst system will reduce CO concentrations to 2.0 ppm_v in the exhaust gas under all load conditions and ambient temperatures. The oxidation catalyst will also reduce VOC emissions to 1.0 ppm_v without duct firing at baseload conditions and 2.0 ppm_v with duct firing at baseload conditions.

2.5 Ancillary Equipment

The proposed project will utilize a variety of ancillary equipment to support the facility including an auxiliary boiler, three black-start generators, an emergency fire pump, and storage tanks. This equipment is discussed further in the sections below.

2.5.1 Auxiliary Boiler

An auxiliary boiler will operate as needed to keep the HRSG warm during periods of turbine shutdown and provide sealing steam to the steam turbine during warm and hot starts. The auxiliary boiler will have a maximum input capacity of 48.6 MMBtu/hr and will be limited to 4,500 hours per year of operation.

2.5.2 Black-Start Generators

Black-start generators will be used to start the combustion turbines in the event of a total power failure. There will be three diesel fired generators, each with a maximum power rating of approximately 3 MW. All three generators will be required to start one of the combined cycle turbines. Once one turbine is up and operating, power from that turbine will be used to start the other turbines. The black-start generators will fire ultra-low sulfur diesel (ULSD) fuel and would only be used in case of emergency; as such, their potential operating hours are proposed to be limited to 500 hours per year for required readiness testing and to respond to an emergency.

2.5.3 Emergency Diesel Fire Pump

The project will have a back-up fire pump to provide on-site fire fighting capabilities independent of the utility grid. The emergency fire pump will fire ULSD fuel and will typically only operate for testing and to maintain operational readiness in the event of an emergency. It will be limited to a maximum of 500 operating hours per year, with each testing event limited to 35 minutes.

2.5.4 Aqueous NH_3 Storage Tank

The proposed facility will have two 30,000-gallon tanks that will store 19 percent aqueous NH_3 for use in the SCR system. Each of these tanks will be equipped with secondary containment sized to accommodate the entire volume of each tank. The tanks will be located within an impermeable containment area, surrounded by a wall. The floor of the containment area will be covered with plastic balls designed to float on the liquid surface in the event of a spill, thereby reducing the exposed surface area. Section 5.3.1 includes an analysis of potential impacts that would result from an accidental release of NH_3.

2.6 Emissions Estimates

The combined cycle units will typically operate at or near full load capacity to respond to electricity demands as needed. Depending upon the demand, each unit can operate at loads ranging from 50 percent combustion turbine load without supplemental duct firing to 100 percent combustion turbine load with supplemental duct firing (full capacity). Combustion turbine performance and emissions are affected by ambient conditions: humidity, pressure and temperature; with turbine fuel consumption, power output and emissions increasing at lower ambient temperatures. Supplemental duct firing performance and emissions are affected indirectly by ambient conditions, with fuel

consumption, heat output and emissions increasing at higher ambient temperatures. As the combustion turbine decreases heat output to the HRSG at higher ambient temperatures, the supplemental duct firing increases to make up the loss of heat output to maintain maximum steam production to the steam turbine.

Because of the different emission rates and exhaust characteristics, a matrix of operation modes is employed in the various analyses presented in this application. Exhaust parameters and emission rates for three different ambient temperatures (105°F, 59°F and -8°F), three turbine loads (100 percent, 75 percent, and 50 percent), and with and without duct firing are incorporated into the analyses presented in this application. Table 2-1 presents a summary of the proposed limits for pollutants emitted from combined cycle combustion turbines. The limits reflect the application of BACT and LAER (Section 4.0), and have been shown, through dispersion modeling, not to cause or significantly contribute to a violation of the NAAQS or NYAAQS (see Section 5.0).

Table 2-1: Summary of Proposed Emission Limits for Combined Cycle Combustion Turbines (Steady State Full Load Operation)[a]

Pollutant	Case	Emission Rate (lb/MMBtu)[b]	Emission Rate (ppm_v)[c]	Represents
NO_x	CT only	0.008	2.0	
	CT w/ DB[d]	0.008	2.0	LAER
VOC	CT only	0.001	1.0	
	CT w/ DB	0.003	2.0	LAER
CO	CT only	0.005	2.0	
	CT w/ DB	0.005	2.0	BACT
$PM_{10}/PM_{2.5}$	CT only	0.006	n/a	
	CT w/ DB	0.007	n/a	BACT
SO_2	CT only	0.0017	n/a	
	CT w/ DB	0.0017	n/a	BACT
H_2SO4	CT only	0.00014	n/a	
	CT w/ DB	0.0005	n/a	BACT

a. Facility may exceed these limits during defined periods of startup and shutdown.
b. Pounds per million Btu.
c. Concentrations are ppm_v at 15% O_2.
d. Duct burner.

Combined cycle startup and shutdown scenarios are also addressed in this air permit application. Startup and shutdown conditions refer to times when the CTG operates below the minimum operating load (50 percent), which may, for some pollutants, result in an increase in short term (pounds per hour [lb/hr]) emission rates. There is a minimum

turbine downtime and maximum duration associated with each type of startup. There is also a maximum duration associated with each shutdown. Potential annual emissions estimates for the proposed project include emissions from startup and shutdown. The startup and shutdown scenarios are described in greater detail in the section below.

The following sections present estimated emissions from the combined cycle combustion turbines and from the ancillary facility equipment. Emissions of air contaminants from this equipment have been estimated based upon vendor emission guarantees, USEPA emission factors, mass balance calculations and engineering estimates.

2.6.1 Combined Cycle Combustion Turbine Emissions – Steady State Operation

As described above, exhaust and emission parameters for the proposed combustion turbines have been developed for three ambient temperatures, three load conditions and duct burner operation. Table 2-2 presents short term (lb/hr) emissions estimates from each combined cycle turbine under ISO conditions at several load conditions including duct burner operations. These emissions were developed from vendor estimates. The PM_{10}/$PM_{2.5}$ emissions estimates include filterable and condensable particulate matter and an allowance for sulfate and/or ammonia salt formation due to the reaction of sulfur trioxide (SO_3) with water and/or excess NH_3 in the SCR and oxidation catalyst systems. Emission rates for all operating conditions are presented in Appendix B.

Potential emissions of Hazardous Air Pollutants (HAPs) and NYSDEC air toxics from operation of the combustion turbines and duct burners were estimated using emission factors presented in USEPA's *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources* (AP-42) and other regulatory sources. The emissions estimates for these pollutants are presented in Appendix B. Air quality modeling for air toxics is presented in Section 5.2.5 of this application.

Table 2-2: Summary of Short Term Emission Rates for a Single Combustion Turbine[a]

Pollutant	100% Load with Duct Burning (lb/hr)	100% Load without Duct Burning (lb/hr)	75% Load without Duct Burning[b] (lb/hr)	50% Load without Duct Burning[b] (lb/hr)
NO_x	18.2	14.5	11.5	8.9
VOC	5.5	2.5	2.0	1.5
CO	11.0	8.8	7.0	5.4
$PM_{10}/PM_{2.5}$	14.8	10.0	10.0	8.0
SO_2	3.8	3.1	2.4	1.8
H_2SO_4	0.78	0.26	0.20	0.18
NH_3	16.8	13.4	10.6	8.2

a. Emissions presented in table are for ISO conditions. These may not represent worst-case conditions for purposes of potential annual emission estimates and air quality dispersion modeling. Appropriate worst-case conditions were used for these analyses, as discussed in Section 5.0.
b. The duct burner will only operate while the combustion turbine is running at 100% load.

2.6.2 Combined Cycle Combustion Turbine Emissions – Startup and Shutdown Operations

Potential emissions associated with startup and shutdown of the combustion turbines were developed using vendor supplied information. Table 2-3 presents the emissions and downtimes (minimum number of hours the turbines would be off before a re-start) associated with startup and shutdown events for the combined cycle turbines. In most cases, emissions from these events are “self correcting” on an annual basis. In other words, the average hourly emissions for each startup event (including downtime) are less than the corresponding steady state emission rate for the minimum downtime that would precede a start. Table 2-3 identifies the pollutants that are self-correcting for each event. Permitted annual emission limits for the facility will incorporate those conditions that are not considered self-correcting. Table 2-4 presents the average hourly emission rates associated with each startup/shutdown event. These emission rates include the downtime associated with each event. These average hourly rates were used to determine if the event was considered self-correcting compared to steady state emission rates.

Table 2-3: Emissions and Downtimes Associated with Startup and Shutdown Events

	Cold Startup	Hot Startup	Warm Startup	Shutdown
Number of Events per Year	50	10	200	260
	Hours			
Minimum Downtime Preceding Event	72	0	8	0
Duration of Event	4	1.83	2.17	0.75
	Emissions Per Event (lb)[a]			
$PM_{10}/PM_{2.5}$	48	22	26	9
SO_2	2.75	0.81	1.41	0.42
NO_x	200	85	100	55
CO	2,500	550	1,000	300
VOC	600	100	210	60
	Self-Correcting			
$PM_{10}/PM_{2.5}$	yes	yes	yes	yes
SO_2	yes	yes	yes	yes
NO_x	yes	no	yes	no
CO	no	no	no	no
VOC	no	no	no	no

a. pounds

Table 2-4: Average Hourly Emissions for Startup and Shutdown Events (including downtime)

Pollutant	Cold Startup (lb/hr)	Hot Startup (lb/hr)	Warm Startup (lb/hr)	Shutdown (lb/hr)
$PM_{10}/PM_{2.5}$	0.63	12.0	2.56	12.0
SO_2	0.04	0.44	0.14	0.56
NO_x	2.63	46.5	9.8	73.3
CO	32.9	300.6	98.3	400.0
VOC	7.9	54.6	20.6	80.0

2.6.3 Ancillary Equipment

This section presents estimated criteria pollutant emissions from the ancillary equipment at the facility. The proposed ancillary equipment includes one auxiliary boiler, one emergency fire pump and three black-start diesel generators. The following assumptions were used in evaluating emissions from this equipment:

- The natural gas fired auxiliary boiler will have a maximum input capacity of 48.63 MMBtu/hr and be limited to 4,500 hours of operation per year.

- The diesel fired emergency fire pump will have a maximum heat input of 2.8 MMBtu/hr (20.3 gallons per hour) and will be limited to 500 hours of operation per year. For load testing, the diesel fire pump will limit operations to 35 minutes in any hour.

- Each diesel fired black-start generator will have a maximum heat input of 29.2 MMBtu/hr (213 gallons per hour) and will be limited to 500 hours of operation per year.

Criteria pollutant emissions from the ancillary equipment were estimated based on vendor supplied information except for SO_2 emissions, which are based on a mass balance. Tables 2-5 and 2-6 summarize estimated short-term (lb/hr) and annual emissions of criteria pollutants from the ancillary equipment. Supporting calculations are provided in Appendix B.

Table 2-5: Short-Term Potential Emissions from Ancillary Equipment

Pollutant	Auxiliary Boiler (lb/hr)	Emergency Fire Pump[a] (lb/hr)	Each Black-Start Generator (lb/hr)
$PM_{10}/PM_{2.5}$	0.24	0.053	1.45
SO_2	0.08	0.003	0.04
NO_x	1.75	1.53	20.55
CO	1.80	0.32	25.08
VOC	0.24	0.058	0.95
Pb	–-	2.36×10^{-5}	4.24×10^{-4}

a. Potential hourly emissions for the fire pump are based on a restriction to 35 operating minutes per hour during testing.

Table 2-6: Potential Annual Emissions from Ancillary Equipment

Pollutant	Auxiliary Boiler (tpy)	Emergency Fire Pump (tpy)	Three Black-Start Generators (tpy)	Total (tpy)
$PM_{10}/PM_{2.5}$	0.55	0.02	1.09	1.66
SO_2	0.18	0.001	0.03	0.21
NO_x	3.94	0.66	15.41	20.01
CO	4.05	0.13	18.81	22.99
VOC	0.55	0.02	0.71	1.28
Pb	–-	1.01×10^{-5}	3.18×10^{-4}	3.28×10^{-4}

Potential HAP and NYSDEC air toxic emissions from the ancillary equipment were estimated using emission factors from AP-42 and other regulatory sources. These emission estimates are presented in Appendix B.

2.6.4 Potential Annual Emissions

Potential annual emissions from the proposed facility were estimated using the following worst-case assumptions:

- Full load operation of the combustion turbines (at 59°F ambient temperature);
- Duct burning during steady state operation of each combustion turbine;
- Incorporation of startup/shutdown events as described in Section 2.6.2; for startup/shutdown events that are not self correcting, a total of 260 combined startup events per year and 260 shutdown events per year were assumed (see Table 2-3); and
- Incorporation of emissions from ancillary equipment as discussed in Section 2.6.3 (see Table 2-6).

Potential annual emissions for the proposed project are summarized in Table 2-7.

Table 2-7: Summary of Annual Potential Emissions

Pollutant	Combustion Turbines (tpy)	Ancillary Equipment (tpy)	Total (tpy)
$PM_{10}/PM_{2.5}$	194.47	1.66	196.13
SO_2	49.93	0.22	50.15
NO_x	256.05	20.01	276.06
CO	657.51	22.99	680.50
VOC	155.28	1.28	156.56
H_2SO_4	10.25	0.01	10.26
NH_3	220.75	0	220.75
Pb	–-	3.28×10^{-4}	3.28×10^{-4}

2.7 Alternative Sites, Sizes and Production Processes

Section 6 of the New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR) Part 231-5.2(b) requires an analysis of alternative sites, sizes, and production processes which demonstrates that the benefits of the proposed project significantly outweigh its environmental and social costs. CVE considered these alternatives as described below.

2.7.1 Alternative Sites

The purpose of this project is to provide a nominal 1,000 MW of electricity to respond to regional energy needs using only clean-burning natural gas technology. The CVE site was selected based on detailed criteria that included proximity to energy infrastructure, appropriate zoning, and sufficient land to create a buffer and minimize impacts to the surrounding community. The proposed site meets all of these criteria:

- It is adjacent to a 345-kV electric transmission line owned by ConEd. No new off-site power lines will be built.

- It is adjacent to a high-pressure natural gas pipeline owned by Iroquois. An approximately 500-foot gas pipeline lateral will be constructed to the project site to interconnect with the 24-inch gas pipeline.

- It is industrially zoned. The site is one of two areas in Dover zoned for manufacturing/industrial purposes. It is specifically designated in the Town of Dover Master Plan (referred to as the "Mica Plant") to be utilized for industrial purposes.

- It has a natural buffer. A 300 to 400 foot buffer of vegetation will be maintained between the project development site and New York State Route 22 to mitigate visual impacts. In addition, existing topography will be maintained as buffer.

Alternative sites were evaluated throughout the southeast region of New York State in addition to several local alternatives in the Town of Dover. The entire region is designated as a moderate ozone nonattainment area; no other site within this region would, therefore, have an advantage over the selected site for this criteria. Further, these sites did not adequately meet the criteria outlined above. Alternative sites identified adjacent to the electric transmission lines and gas pipeline did not offer the appropriate zoning or buffer. Alternative sites identified with appropriate zoning were located away from energy infrastructure and would require the construction of new off-site electric power lines and a natural gas pipeline. The impact to the surrounding community resulting from the need for potentially significant off-site construction eliminated these sites from consideration. Finally, none of the other sites are controlled by CVE.

The proposed site best meets the goals and objectives of the project in the most environmentally responsible manner. In addition, as an inactive industrial site, the project presents an opportunity to turn a potential environmental liability into a productive industrial site by replacing the existing dilapidated structures with a new state-of-the-art clean electric generating station.

2.7.2 Alternative Sizes

CVE proposes to develop a combined cycle power plant using three F-Class combustion turbines. The three units will operate independently, with each unit capable of generating approximately 334 MW (nominally). This will enable the project to respond to changing electric demand conditions. CVE considered alternate turbine sizes. Larger class turbines (G or H), because of their increased electrical output, provide less flexibility. Smaller turbines (aero-derivatives) cannot match F-Class turbines' superior environmental performance (lb/MW-hr). Therefore, CVE proposes to use F-Class turbines.

CVE considered projects with fewer and greater numbers of units. A project with one or two units, while having commensurately lower emission levels, would not afford the

economies of scale with respect to other environmental considerations (e.g., site development, aesthetics, and traffic) and would fail to take advantage of the existing electrical capacity on the adjacent ConEd 345-kV transmission line. A project with more than three units would exceed the transmission system's capacity without substantial upgrade and would exceed site space limitations without substantial wetland and other natural resource impacts. The proposed project, with three units, can be located almost entirely on previously developed portions of the site, and can be interconnected into the ConEd transmission system with minimal upgrade to the system.

2.7.3 Alternative Production Processes

Technology alternatives considered included simple cycle combustion turbine technology and conventional boiler technology. Simple cycle turbines and conventional boilers are not as efficient as combined cycle units in terms of both energy (MW per Btu of fuel) and environmental (lbs of emissions per MW) efficiency.

Simple cycle technology is typically applied to meet intermittent or peak electrical demand. The project is being developed to meet growing base-load electrical demand. As such, combined cycle technology is the superior alternative.

In addition to being less energy and environmentally efficient, all of the electrical output of conventional boiler technology is from the steam cycle, resulting in considerably greater water demand than for a combined cycle project. For these reasons, combined cycle technology was determined to be the superior alternative.

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3. REGULATORY APPLICABILITY EVALUATION

CVE is requesting approval to construct a nominal 1,000 MW combined cycle electric generating facility in the Town of Dover, Dutchess County, New York. The project is considered a new major stationary combustion source under PSD and NNSR regulations because the potential annual emissions from the facility exceed major source thresholds as illustrated in Table 1-1.

This section contains an analysis of the applicability of federal and state air quality regulations to the proposed project. The specific regulations and programs that are included in this review include:

- NNSR
- PSD New Source Review
- Federal New Source Performance Standards (NSPS)
- Federal National Emission Standards for Hazardous Air Pollutants (NESHAP)
- NO_x Budget Program and Clean Air Interstate Rule (CAIR)
- Federal Acid Rain Program
- Other NYSDEC Requirements
- Accidental Release Requirements

3.1 Nonattainment New Source Review

USEPA has established primary and secondary NAAQS for criteria pollutants that are designed to protect public health and welfare. The results of clinical and epidemiological studies were used to establish the primary NAAQS to protect public health, including the health of “sensitive” populations. The secondary NAAQS protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. USEPA has established both short-term and long-term standards.

Under 6 NYCRR Part 257, NYSDEC has adopted the federal NAAQS in addition to including additional standards for total suspended particulate (TSP), gaseous fluorides (F^-), beryllium (Be), and hydrogen sulfide (H_2S). Table 3-1 presents the federal NAAQS and the NYAAQS.

Table 3-1: Summary of Primary Federal and State Ambient Air Quality Standards

Pollutant	Averaging Period	Ambient Air Quality Standards	
		NAAQS ($\mu g/m^3$)[a]	NYAAQS ($\mu g/m^3$)[a]
SO_2	3-hour	1,300	1,300
	24-hour	365	365
	Annual	80	80
PM_{10}	24-hour	150	none
	Annual	revoked	none
$PM_{2.5}$	24-hour	35	none
	Annual	15	none
TSP	24-hour	none	250
	Annual	none	45
CO	1-hour	40,000	40,000
	8-hour	10,000	10,000
NO_2	1-hour	189[c]	–[c]
	Annual	100	100
Pb	3-month	1.5	none
F^-[b]	12-hour	none	3.70
	24-hour	none	2.85
	1-week	none	1.65
	1-month	none	0.80
Be	1-month	none	0.01
H_2S	1-hour	none	14

a. micrograms per cubic meter.
b. This pollutant will not be emitted from the proposed project.
c. The new 1-hour standard for NO_2 was published in the *Federal Register* on February 9, 2010. The new standard has not yet been incorporated into NYSDEC air regulations.

Areas of the country where pollutant concentrations persistently exceed the NAAQS are designated as nonattainment. The proposed project is located in an area designated as attainment or unclassifiable for SO_2, CO, NO_2, PM_{10} and $PM_{2.5}$. Therefore, for these pollutants, the project is required to demonstrate compliance with the NYAAQS and NAAQS shown in Table 3-1 and are subject to PSD New Source Review (see Section 3.2). Dutchess County is designated as a Subpart 2/Moderate nonattainment area with respect to the 8-hour ozone NAAQS and NYAAQS. The major source thresholds for this nonattainment area are:

- 100 tpy of NO_x
- 50 tpy of VOC

Sources whose potential emissions exceed one of these thresholds are considered major and are subject to NNSR for these pollutants. The proposed project is subject to the NNSR requirements, under 6 NYCRR Part 231, for permitting of major sources of nonattainment pollutants.

In addition to the general permit application requirements under 6 NYCRR Part 201-5 (project description, emission limits, project location, etc.), major sources of nonattainment pollutants are also required to comply with the NNSR provisions under 6 NYCRR Part 231-3 through 231-13. Under the NNSR regulations, major sources in nonattainment areas must satisfy several special conditions including:

- Application of LAER technology
- Procurement of emissions offsets
- Compliance certification for existing emission sources owned by the applicant
- Analysis of alternatives

Each of these requirements is discussed in greater detail in the sections below.

3.1.1 Lowest Achievable Emission Rate

Pollutants subject to NNSR are required to implement LAER technology for those pollutants. LAER is defined as the most stringent emission limitation achieved in practice, or which can reasonably be expected to occur in practice for a category of emission sources taking into consideration each air contaminant that must be controlled. The proposed project is considered major for both NO_x and VOC. As such, LAER technology will be applied for these two pollutants as described in Section 4.0 of this application.

3.1.2 Emissions Offsets

A major source or major modification planned in a designated nonattainment area must obtain emissions offsets as a condition of approval. Emissions offsets are generally obtained from existing sources located in the vicinity of the proposed source. The emission reductions must: (1) offset the emissions increase from the new source, and (2) provide a net air quality benefit. These offsets, obtained from existing sources that implement a permanent, enforceable, quantifiable and surplus emissions reduction, must equal the emissions increase from the new source multiplied by an offset ratio. As outlined in 6 NYCRR Part 231-13, major sources in moderate nonattainment areas for ozone, of which VOC and NO_x are precursors, must obtain offsets at a ratio of 1.15 to 1.

6 NYCRR Part 231-5.2(d) requires that the applicant submit emission offset information for VOC and NO_x either with the permit application or before the NYSDEC issues a final permit determination. The required VOC and NO_x offset information includes:

- A list identifying the source(s) of approved or proposed emission reduction credits (ERCs) that will be used for the required emission offsets. This list must include the name and location of the facility, NYSDEC identification number (if applicable), and the emission reduction mechanism. All proposed ERCs must be certified prior to issuance of the final permit.
- A completed "Use of Emission Reduction Credits Form" for each ERC source on the proposed list.
- Documentation of compliance with the contribution demonstration requirement according to NYSDEC ambient air quality policy documents.

Based upon the annual potential emissions estimates, the proposed project will be required to obtain 317.5 tons of NO_x offsets and 180.1 tons of VOC offsets. NYSDEC maintains a registry of ERCs for sources that have fulfilled the requirements for certifying ERCs through enforceable permit modifications. This registry will likely be utilized by CVE in obtaining the required offsets.

3.1.3 Certification of Compliance

6 NYCRR Part 231-5.2(a) requires a certification that all emission sources that are part of any major facility located in New York State or under the applicant's ownership or control are in compliance, or on a schedule for compliance, with all application emission limitations and standards under Chapter III (Air Resources). CVE and its parent company neither

own nor manage any other facilities in New York State. As such, this requirement is not applicable to this project.

3.1.4 Analysis of Alternatives

6 NYCRR Part 231-5.2(b) requires an analysis of alternative sites, sizes, production processes, and environmental control techniques which demonstrates that the benefits of the proposed project significantly outweigh the environmental and social costs imposed as a result of its construction. A discussion of alternative sites, sizes and production processes considered is presented in Section 2.7. Alternative emission control technologies are identified and evaluated as part of the BACT/LAER analyses presented in Section 4.0. The analyses demonstrate that the proposed emission control technologies are representative of BACT and LAER.

3.2 PSD New Source Review

Combined cycle power plants with potential emissions greater than 100 tpy of one or more criteria pollutants are considered new major stationary sources under the PSD program. As shown in Table 2-7, the potential emissions of at least one regulated criteria pollutant will exceed this threshold. As such, the proposed facility is subject to PSD New Source Review. Under the PSD regulations, once a major source threshold is triggered, PSD review must be completed for all pollutants whose potential emissions exceed their significant emission rate increase. As shown in Table 1-1, PSD review is required for NO_x, CO, VOC, SO_2, PM_{10}/$PM_{2.5}$ and H_2SO_4 emissions.

Currently, NYSDEC has not been delegated authority to administer the PSD program. Until delegation status has been granted, PSD review is the responsibility of the USEPA.

The federal PSD regulations are codified in 40 Code of Federal Regulations (CFR) Parts 51 and 52. The NYSDEC has also promulgated its own requirements for PSD sources in 6 NYCRR Part 231-7, which closely parallel the federal regulations. The PSD regulations state that facilities subject to PSD review must perform several analyses including a BACT analysis, an air quality analysis, and other additional impact analyses. These requirements are described in greater detail in the sections below.

3.2.1 Best Available Control Technology

Pollutants subject to PSD review are required to apply BACT for control of emissions of PSD pollutants. BACT is defined as an emission limitation based on the maximum degree of reduction, on a case-by-case basis, taking into account energy, environmental and economic considerations. In establishing the final BACT limit, USEPA may consider any new information, including recent permit decisions, subsequent to submittal of a complete application. Although the project is required to implement BACT for NO_x and VOC for the PSD program, LAER is also required under NNSR. Since the LAER requirements are at least as stringent as BACT, the LAER analysis will satisfy BACT requirements for NO_x and VOC. The LAER analyses for NO_x and VOC, and the BACT analyses for CO, PM_{10}/$PM_{2.5}$, SO_2 and H_2SO_4 are presented in Section 4.0.

3.2.2 Air Quality Impact Analysis

An ambient air quality analysis must be performed to demonstrate compliance with NAAQS, NYAAQS and PSD increments. Proposed new sources subject to PSD review may not cause or significantly contribute to a violation of the NAAQS or NYAAQS. As part of this demonstration, the USEPA and NYSDEC have established Significant Impact Levels (SILs) for all of the criteria pollutants except for $PM_{2.5}$. SILs represent concentrations of pollutants that are considered to be insignificant with respect to demonstration of NAAQS compliance. By definition, proposed new sources whose air quality impacts are less than SILs neither cause nor significantly contribute to NAAQS or NYAAQS violations. Table 3-2 presents the promulgated SILs and PSD increments for criteria pollutants requiring PSD review. The USEPA is in the process of establishing the SILs for $PM_{2.5}$. In the interim, within their comments on the modeling protocol prepared for the project, the USEPA has requested that CVE use the most stringent proposed SILs for the modeling analysis. Currently, the most stringent proposed SILs for $PM_{2.5}$ are:

- 1.2 µg/m^3 (24-hour average); and
- 0.30 µg/m^3 (annual average).

If modeling of emissions from the project demonstrate maximum predicted concentrations for a specific pollutant are less than the SIL, no further analysis is required for that pollutant. If modeling indicates that the SIL for any pollutant/averaging period is exceeded, then a cumulative modeling study is required to determine the combined impact of the proposed sources plus other major nearby background sources for compliance with NAAQS and PSD increments. Section 5.0 presents an ambient air quality analysis demonstrating compliance with PSD requirements.

Table 3-2: Summary of PSD Increment Value, Significant Impact Levels and Significant Monitoring Concentrations

Pollutant	Averaging Period	PSD Increment Class II ($\mu g/m^3$)	SIL ($\mu g/m^3$)	SMC ($\mu g/m^3$)
SO_2	3-hour	512	25	none
	24-hour	91	5	13
	Annual	20	1	none
PM_{10}	24-hour	30	5	10
	Annual	17	1	none
$PM_{2.5}$	24-hour	pending	pending	pending
	Annual	pending	pending	pending
TSP	24-hour	none	none	none
	Annual	none	none	none
CO	1-hour	none	2,000	none
	8-hour	none	500	575
NO_2	1-hour	not yet proposed	not yet proposed	not yet proposed
	Annual	25	1	14
Pb	3-month	none	none	0.1

In support of these demonstrations, sources subject to PSD review may be required to perform up to one year of pre-construction ambient air quality monitoring for those pollutants exceeding the significant emission thresholds. The USEPA may grant an exemption from monitoring if the proposed source demonstrates that it will have maximum impacts below the pollutant-specific Significant Monitoring Concentrations (SMC) that are presented in Table 3-2, or if representative quality-assured data already exist. The ambient air quality analysis presented in Section 5.0 demonstrates that maximum impacts are predicted to be less than the SMCs, with the exception of the most stringent proposed SMC for $PM_{2.5}$. USEPA has not yet promulgated an SMC for $PM_{2.5}$, but has proposed three SMC valves that are currently under consideration. Project impacts are predicted to exceed the most stringent of the proposed SMC valves. Therefore, CVE has requested a waiver from pre-construction ambient air quality modeling based on the availability of

representative quality-assured monitoring data from the existing network of air quality monitoring stations in the project area.

3.2.3 PSD Class I Area Impact Analysis

PSD regulations require that proposed major sources within 100 kilometers (km) of a PSD Class I area perform an assessment of potential impacts in the PSD Class I area. PSD Class I areas are specifically designated areas of special national or regional value from a natural, scenic, recreational or historic perspective. These areas are administered by the National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), or the U.S. Forest Service (USFS). These Federal Land Managers (FLMs) are responsible for evaluating proposed projects' air quality impacts in the Class I areas and may make recommendations to the permitting agency to approve or deny permit applications.

PSD Class I area impact analyses consist of:

- An air quality impact analysis;
- A visibility impairment analysis; and
- An analysis of impacts on other air quality related values (AQRVs) such as impacts to flora and fauna, water, and cultural resources.

There are no PSD Class I areas within 100 km of the proposed project site. The closest designated PSD Class I area is the Lye Brook Wilderness Area, located 167 km north-northeast of the site in southern Vermont.

Based on the level of proposed emissions from the project and the distances to the nearest PSD Class I area, the project is not required to complete PSD Class I impact modeling. CVE has consulted with the FLM from the nearest PSD Class I area who confirmed that the project would be too distant to warrant a Class I impact analysis. Correspondence from the Federal Land Manager confirming this consultation is provided in Appendix C.

3.2.4 Additional Impact Analyses

Additional impact analyses are also required as part of PSD review and NYSDEC regulations. These additional analyses include an assessment of impacts on community growth resulting from the project, an assessment of visibility impairment and an

assessment of impacts to soils and vegetation. These impact analyses are presented in Section 5.3 of this application.

NYSDEC also requires an assessment of potential acidic deposition on sensitive receptors following the procedures outlined in a March 1993 memorandum (NYSDEC, 1993). The analysis demonstrating compliance with this requirement is presented in Section 5.3.2 of this application.

The Endangered Species Act of 1973 requires that all federal actions such as the issuance of PSD permits will not jeopardize the existence of any endangered or threatened species or result in the destruction or adverse modification of the habitat of such species. CVE has consulted with the USFWS. A copy of correspondence to date is included in Appendix C. CVE is continuing to work with the USFWS to confirm that the project will have no adverse impacts on protected species.

3.2.5 Environmental Justice

Executive Order 12898, entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" (February 1994) requires federal agencies to consider disproportionate adverse human health and environmental impacts on minority and low-income populations. Under this Order, Environmental Justice considerations can be incorporated into PSD review. USEPA Region 2 has issued formal guidance for conducting Environmental Justice analyses. NYSDEC has also developed an Environmental Justice policy. This policy applies to major projects as defined in 6 NYCRR §621.2 and §621.4. The proposed project requires a Part 201 permit and is, therefore, considered a major project under these regulations. A review of Environmental Justice considerations is provided in Section 5.3.4 of this application.

3.3 New Source Performance Standards

NSPS are technology-based standards applicable to new and modified stationary sources. NSPS have been established for approximately 70 source categories. Based upon a review of these standards, several subparts are applicable to the proposed project. The project's compliance with each of these standards is presented in the sections below.

3.3.1 40 CFR 60 – Subpart A – General Provisions

Any source subject to an applicable standard under 40 CFR 60 is also subject to the general provisions under Subpart A. Because the project is subject to other Subparts of

the regulation, the requirements of Subpart A will also apply. CVE will comply with the applicable notifications, performance testing, recordkeeping and reporting outlined in Subpart A.

3.3.2 40 CFR 60 – Subpart KKKK – Stationary Combustion Turbines

Subpart KKKK places emission limits on NO_x and SO_2 from new combustion turbines. The proposed combustion turbines and duct burners would be subject to this standard. For new combustion turbines firing natural gas with a rated heat input greater than 850 MMBtu/hr, NO_x emissions are limited to:

- 15 ppm_v at 15 percent O_2; or
- 54 nanograms per Joule (ng/J) of useful output (0.43 pounds per megawatt-hour [lb/MW-hr]).

Additionally, SO_2 emissions must meet one of the following:

- Emissions limited to 110 ng/J (0.90 lb/MW-hr) gross output; or
- Emissions limited to 26 ng/J (0.060 lb/MMBtu).

As described in Section 2.0, the proposed project will use an SCR system to reduce NO_x emissions to 2 ppm_v at 15 percent O_2 and pipeline natural gas to limit SO_2 emissions to 0.002 lb/MMBtu. As such, the project will meet the emission limits under Subpart KKKK.

Additionally, the provisions of this Subpart require continuous monitoring of water-to-fuel ratio, but allow for the use of either a 40 CFR Part 60 or Part 75 certified NO_x CEMS in lieu of this requirement. CVE is proposing to use a 40 CFR Part 75 certified NO_x CEMS, which will satisfy this requirement.

3.3.3 40 CFR 60 – Subpart Dc – Small Industrial-Commercial-Institutional Steam Generating Units

Subpart Dc is applicable to steam generating units with a maximum input capacity greater than 10 MMBtu/hr and less than 100 MMBtu/hr. The proposed auxiliary boiler has a maximum input capacity of 48.63 MMBtu/hr, and is therefore subject to the standard. For units combusting natural gas, the standard requires initial notifications at the start of construction and at startup. In addition, records must be maintained regarding the amount of fuel burned on a monthly basis; however, since natural gas is the only fuel burned in the proposed boiler, there are no specific reporting requirements to the USEPA under Subpart Dc.

3.3.4 40 CFR 60 – Subpart IIII – Stationary Compression Ignition Internal Combustion Engines

Subpart IIII is applicable to owners and operators of stationary compression ignition (CI) internal combustion engines that commence operation after July 11, 2005. Relevant to the proposed project, this rule applies to the emergency fire pump and the black-start generators. For model year 2009 and later fire pump engines with a displacement less than 30 liters per cylinder and an energy rating between 300 and 600 horsepower (hp), Subpart IIII provides the following emission limits:

- 4.0 grams per kilowatt-hour (g/kW-hr) (3.0 grams per horsepower-hour [g/hp-hr]) of VOC + NO_x
- 3.5 g/kW-hr (2.6 g/hp-hr) of CO
- 0.2 g/kW-hr (0.15 g/hp-hr) of particulate matter

The project will install a fire pump meeting these emission standards.

To comply with Subpart IIII, the black-start generators must meet the emission standards for new non-road CI engines (Tier 2). Engines with a model year 2006 or later with a power rating of 560 kW (750 hp) or greater must meet the following limits:

- 6.4 g/kW-hr (4.8 g/hp-hr) of VOC + NO_x
- 3.5 g/kW-hr (2.6 g/hp-hr) of CO
- 0.2 g/kW-hr (0.15 g/hp-hr) of particulate matter

The black-start generators associated with the proposed project will be certified to meet non-road emission standards.

3.4 National Emission Standards for Hazardous Air Pollutants (40 CFR Parts 61 and 63)

There are no 40 CFR Part 61 standards applicable to the proposed facility operations. Current USEPA AP-42 emission factors, other emission factors and vendor information were reviewed in determining if the proposed project was subject to a standard under 40 CFR Part 63. Based on potential emission calculations, the potential emissions of a single HAP will not exceed the major source threshold of 10 tpy. In addition, potential emissions of combined HAPs will be less than the major source threshold of 25 tpy. Therefore, the NESHAP standards under 40 CFR Part 63 are not applicable to this project.

3.5 Acid Rain Program

Title IV of the Clean Air Act Amendments required USEPA to establish a program to reduce emissions of acid rain forming pollutants, called the Acid Rain Program. The overall goal of this program is to achieve significant environmental benefits through reduction in SO_2 and NO_x emissions. To achieve this goal, the program employs both traditional and market-based approaches for controlling air pollution. Under the market-based aspect of the program, affected units are allocated SO_2 allowances by the USEPA, which may be used to offset emissions, or traded under the market allowance program. In addition, in order to ensure that facilities do not exceed their allowances, affected units are required to monitor and report their emissions using a CEMS system, as approved under 40 CFR Part 75.

The project is subject to the Acid Rain Program based on the provisions of 40 CFR 72.6(a)(3) because the turbines are considered utility units under the program definition and they do not meet the exemptions listed under paragraph (b) of this Section. The project will be required to submit an acid rain permit application by 24 months prior to the date on which the affected unit commences operation. CVE will submit an acid rain permit application in compliance with these requirements prior to this deadline.

3.6 NO_x Budget Programs and Clean Air Interstate Rule

6 NYCRR Part 204 establishes the New York State component of the NO_x Budget Trading Program which is designed to mitigate the interstate transport of ozone. Program requirements, including allowance allocations, new source set-asides, banking, trading, account reconciliation, NO_x monitoring and reporting, and regulatory time lines are addressed in Part 204. 6 NYCRR Part 237 establishes the Acid Deposition Reduction (ADR) NO_x Budget Trading Program which is designed to reduce acid deposition in New York State by limiting emissions of NO_x from fossil fuel-fired electricity generating units during the non-ozone season.

Allowances for an affected unit will be based on actual operations during specific, preceding baseline periods, and will be “self-adjusting” based on the affected unit’s operating history. Quantities of NO_x allowances have been set aside for new sources and will be provided to cover actual NO_x emissions for new sources. New sources will continue to have these allowances provided until the facility is able to establish a three-year baseline of operations.

A facility subject to these regulations must identify an Authorized Account Representative (AAR) and establish a NO_x Allowance Trading Account. The AAR is responsible for maintaining the facility's account, including ensuring that enough allowances are in place to meet the regulatory deadlines. Shortfalls in the account can be met by either transferring allowances from another facility, or purchasing allowances as needed.

6 NYCRR Parts 243, 244 and 245 establish New York's CAIR programs. On March 10, 2005, USEPA issued this rule which requires reductions in emissions of NO_x and SO_2 from large fossil fueled electric generating units using a cap and trade system. The rule provides both annual emissions budgets and an ozone season emission budget for each state. On July 11, 2008, the U.S. Court of Appeals for the D.C. Circuit issued an opinion vacating and remanding these rules. However, on December 23, 2008, the Court granted rehearing only to the extent that it remanded the rules to USEPA without vacating them. The December 23, 2008 ruling leaves CAIR in place until the USEPA issues a new rule to replace CAIR in accordance with the July 11, 2008 provisions. The NYSDEC CAIR program operates similarly to the NO_x Budget Program requirements as presented above. Annual and ozone season NO_x allowances for calendar year 2009 were implemented through the provisions of the CAIR program. However, the NO_x Budget Program regulations have not been repealed to date.

Even though the federal rule is under review, the proposed project is required to comply with the provision of the CAIR programs under these regulations. Affected facilities are required to obtain a CAIR permit from the NYSDEC. A complete CAIR permit application is required no later than 12 months before the commencement of operation of the affected units. Applicable permit applications for these programs will be submitted in compliance with these requirements.

3.7 Acid Deposition Reduction SO_2 Budget Program

6 NYCRR Part 238 establishes the ADR SO_2 Budget Trading Program which is designed to reduce acid deposition in New York State by limiting emissions of SO_2 from stationary sources defined as SO_2 budget units. This program closely parallels the ADR NO_x Budget Program outlined in 6 NYCRR Part 237. A facility subject to these regulations must identify an AAR and establish a SO_2 Allowance Trading Account. Affected facilities are required to obtain an SO_2 Budget Permit from the NYSDEC. The annual CAIR SO_2 trading program under 6 NYCRR Part 245 largely supersedes this program starting with calendar year 2009 allowances. A complete CAIR permit application will be submitted in compliance with the regulations.

3.8 Other NYSDEC Requirements

Below is a summary of the applicable NYSDEC requirements that have not been addressed in the program descriptions presented in previous sections.

- 6 NYCRR Part 201 requires existing and new sources to evaluate minor and major source status and certify compliance with all applicable requirements. The proposed project will represent a new major Part 201 source. As such, in addition to a PSD/NNSR permit, CVE is seeking a permit under Part 201-5 with this application. CVE will apply for a Title V operating permit (required under Part 201-6) within one year of commencing operation.
- 6 NYCRR Part 225-1 regulates sulfur content of fossil fuels. CVE will be in compliance with this regulation as it proposes to utilize ULSD with a sulfur content of 15 ppm_v.
- 6 NYCRR Part 227-2 regulates visible emissions (opacity) for stationary fuel-burning equipment. The regulation requires that stationary combustion sources operate such that opacity does not exceed 20 percent (six minute average), except for one six minute period of not more than 27 percent opacity. As a natural gas fired facility, opacity from the equipment will not exceed these limits.
- 6 NYCRR Part 227 sets Reasonably Available Control Technology (RACT) limits for sources of NO_x. The proposed project is required to implement LAER for NO_x, which is considerably more stringent than RACT. Recordkeeping and reporting requirements under this regulation will still apply.
- 6 NYCRR Part 242 establishes New York State's CO_2 Budget Trading Program. The CO_2 Budget Trading Program is a mandatory cap-and-trade program to reduce greenhouse gas emissions as part of the Regional Greenhouse Gas Initiative (RGGI). RGGI is a cooperative effort between ten Northeast and Mid-Atlantic states to limit greenhouse gas emissions, and is comprised of individual budget programs in each of the ten participating states. These ten programs are implemented through state regulations, based on a RGGI Model Rule, and are linked through CO_2 allowance reciprocity. Sources will need to acquire, from auctions or directly from NYSDEC, one allowance for every ton of CO_2 that they emit. The proposed project will acquire CO_2 allowances in compliance with this regulation.

3.9 Accidental Release Requirements

Aqueous NH_3 will be used as the reducing agent in the project's SCR system for controlling NO_x emissions. Aqueous NH_3 will be stored on site for use in the SCR emissions control system for NO_x. An aqueous solution of 19 percent by weight will be stored in two 30,000 gallon tanks. Facilities that store aqueous NH_3 solutions containing less than 20 percent ammonia by weight are not subject to the Accidental Release requirements contained in §112r of the Federal Clean Air Act. However, to address the general duty clause of §112r, an analysis of potential impacts from a hypothetical ammonia spill has been conducted. This analysis is provided in Section 5.3.1 of this application.

4. CONTROL TECHNOLOGY EVALUATION – BACT/LAER

Pre-construction review for new major stationary sources involves an evaluation of BACT for PSD sources and LAER for NNSR sources. A control technology analysis has been performed for the proposed facility based upon the USEPA guidance document New Source Review Workshop Manual (USEPA, 1990). The PSD and NNSR requirements for each pollutant were defined in Section 3.0 of this application, and are briefly summarized in the sections below.

4.1 Regulatory Applicability of Control Requirements

This section provides a brief summary of the control technology requirements under the PSD and NNSR programs for each pollutant. Control technology requirements are generally based on the potential emissions from the new or modified source and the attainment status of the area in which the source is located. A detailed determination of applicable regulatory requirements under PSD and NNSR rules are provided in Section 3.0. The following sections discuss the applicability of BACT, LAER and additional NYSDEC requirements for emissions from the equipment associated with the project.

4.1.1 NNSR Pollutants Subject to LAER

Pollutants subject to NNSR are required to implement LAER. Dutchess County is designated as a Subpart 2/Moderate nonattainment area with respect to the 8-hour ozone NAAQS and NYAAQS. The major source thresholds for this nonattainment area are: 100 tpy of NO_x and 50 tpy of VOC. As indicated in Table 1-1, potential emissions of NO_x and VOC exceed these thresholds, and are therefore subject to NNSR and LAER requirements.

4.1.2 PSD Pollutants Subject to BACT

Pollutants subject to PSD review are subject to a BACT analysis. The proposed project is considered a major source for PSD purposes since potential emissions exceed major source thresholds. Therefore, individual pollutants are subject to BACT requirements if their potential emissions exceed the significant emission rates presented in Table 1-1. As shown in this table, the project is subject to PSD review for NO_x, CO, VOC, PM_{10}/$PM_{2.5}$, SO_2 and H_2SO_4 and, therefore, required to implement BACT for those pollutants. Since the area is designated as attainment for NO_2, NO_x emissions are subject to BACT as well as LAER. However, since LAER requirements are at least as stringent as BACT, the LAER analysis for NO_x will also satisfy the BACT requirements for NO_2. Similarly, VOC

emissions are subject to PSD review by exceeding the PSD significant emission rates. However, VOC is also subject to NNSR and, therefore, LAER will satisfy BACT requirements for VOC.

4.1.3 Emission Units Subject to LAER and BACT Analyses

For a facility subject to a BACT or LAER analysis, each pollutant emitted in amounts greater than the regulatory thresholds are subject to a prescribed level of control technology review for each emission unit that emits that pollutant. For the proposed project, the source responsible for the majority of the project's emissions will be the combined cycle combustion turbines with supplemental duct burning. Therefore, the primary focus of the BACT and LAER analyses presented in the following sections is on the combined cycle combustion turbines. Evaluation of the ancillary equipment is conducted consistent with their proposed small annual emission levels and with their limited hours of operation.

4.2 LAER and BACT Analysis Approach

The sections below outline the approach used to conduct the LAER and BACT analyses presented in this application.

4.2.1 Lowest Achievable Emission Rate

LAER is defined as the more stringent of:

1. The most stringent emission limitation which is achieved in practice by the class or category of source; or
2. The most stringent emission limitation contained in the applicable State Implementation Plan (SIP) (unless such emission rate is demonstrated not to be achievable).

In no event should application of LAER permit a new source or modification to emit any air contaminant in excess of the amount permitted under any applicable emission standard under 6 NYCRR or 40 CFR. Pursuant to 6 NYCCR 231-5 and 231-7, NYSDEC may consider any new information, including recent permit decisions, or public comments received.

To determine the most stringent emission limitation as defined above, several sources were utilized including preconstruction permits for other sources recently issued, USEPA's

RACT/BACT/LAER Clearinghouse (RBLC) database, and individual state agency databases.

LAER is expressed as an emission rate and may be achieved from one, or a combination of, the following:

- Change in raw material processes, which are typically considered for industrial processes that use chemicals such as solvents, where substitution to a lower emitting chemical may be technically feasible. For the project, the "raw material" would be the type of fuel combusted in the combustion turbines. The primary fuel for the project is natural gas, which results in the lowest uncontrolled NO_x and VOC emissions.
- Process modifications, which are typically considered for industrial processes that use chemicals, where a change in the process methods or conditions may result in lower emissions. For the project, the "process" is the combustion turbine. The proposed F-Class turbines will utilize efficient combustion technology to reduce the formation of NO_x and VOC emissions as combustion byproducts.
- Add-on controls, which capture and control air pollutant emissions using additional add-on equipment such as SCR or catalytic oxidation. Add-on control is a common option for combustion turbines. Both SCR and oxidation catalysts have been used for combined cycle turbine installations, and are proposed for the project.

The analyses presented below for NO_x and VOC follow the guidelines presented above.

4.2.2 Best Available Control Technology

BACT is defined as the optimum level of control applied to a pollutant emissions based upon consideration of energy, economic and environmental factors. In a BACT analysis, the energy, environmental, and economic factors associated with each alternate control technology are evaluated, as necessary, in addition to the benefit of reduced emissions that each technology would provide. The BACT analyses presented in the following sections consist of up to four steps as outlined below.

4.2.2.1 Identification of Technically Feasible Control Options

The first step in a BACT analysis is the identification of technically feasible and available control technology options, including consideration of transferable and innovative control measures that may not have been previously applied to the source type under analysis. The minimum requirement for a BACT proposal is an option that meets federal NSPS

limits or other minimum state or local requirements, such as RACT or NYSDEC emission standards. After elimination of technically infeasible control technologies, the remaining options are ranked by control effectiveness.

If there is only a single feasible option, or if the most stringent alternative is proposed, then no further analysis is required. Technical considerations and site-specific sensitive issues will often play a role in BACT determinations. Generally, if the most stringent technology is rejected as BACT, the next most stringent technology is evaluated and so on.

In order to identify options for each class of equipment, a search of the USEPA's RBLC database was performed. Individual searches were performed for each pollutant emitted from each emission unit. The most recently issued permits from New York State and other permits listed on the RBLC were also analyzed if available. Information was found for several hundred large combined cycle power plant projects permitted in the past decade. Appendix B provides a summary of recent similar energy projects from around the country. Less recent projects were also included due to regional proximity and/or very stringent emission limits. Using these criteria, lists for each pollutant for each equipment source were compiled and are presented in Appendix B.

If two or more technically feasible options are identified, the next three steps (as presented below) are applied to identify and compare the economic, energy and environmental impacts of the options.

4.2.2.2 Economic (Cost-Effectiveness) Analysis

This analysis consists of an estimation of cost and calculation of the cost-effectiveness of each control technology, on a dollar per ton of pollution removed basis. Annual emissions with a control option are subtracted from base case emissions to calculate tons of pollutant controlled per year. The base case may be uncontrolled emissions or the maximum emission rate allowed with BACT considerations (such as an NSPS or RACT limit). Annual costs are calculated by adding annual operation and maintenance costs to the annualized capital cost of a control option. Cost-effectiveness (dollars per ton) of a control option is the annual cost (dollars per year) divided by the annual reduction in emissions (tpy). If either the most effective control option is proposed, or if there are no technically feasible control options, an economic analysis is not required.

4.2.2.3 Energy Impact Analysis

Two types of energy impacts are normally considered quantifiable. First, when the installation of a particular option would result in a reduction in either the power output capacity or reliability of a unit, this reduction is a quantifiable energy impact. Second, the consumption of energy by the control option itself is a quantifiable energy impact. These impacts can be quantified by either an increase in fuel consumption due to reduced efficiency or fuel consumption to power the equipment.

4.2.2.4 Environmental Impact Analysis

The primary focus of the environmental impact analysis is the reduction in ambient concentrations of the pollutant being emitted. Increases or decreases in emissions of other criteria or non-criteria pollutants may occur with some technologies and should be identified. Non-air related impacts such as solid waste generation, increased water consumption or waste water generation may also be an issue associated with a control option. These additional impacts should be identified and qualitatively or quantitatively evaluated.

4.3 LAER/BACT Analysis for NO_x

NO_x is formed during the combustion of fuel and is generally classified as either thermal NO_x or fuel-related NO_x. Thermal NO_x results when atmospheric nitrogen is oxidized at high temperatures to produce nitrogen oxide (NO), NO_2, and other oxides of nitrogen. The major factors influencing the formation of thermal NO_x are temperature, concentrations of oxygen in the inlet air and residence time within the combustion zone. Fuel-related NO_x is formed from the oxidation of chemically bound nitrogen in the fuel. Fuel-related NO_x is generally minimal for natural gas combustion. As such, NO_x formation from combustion of natural gas is due mostly to thermal NO_x formation.

Reduction in NO_x formation can be achieved using combustion controls and/or flue gas treatment. Available combustion controls include water or steam injection and low emission combustors. Typical gas turbines are designed to operate at a nearly stoichiometric ratio of fuel in the combustion zone, with additional air introduced downstream. Fuel-to-air ratios below stoichiometric are referred to as fuel-lean mixtures. This type of fuel mixture limits the formation of NO_x because there is lower flame temperature with a lean fuel mixture. Using this concept, lean combustors are designed to operate below the stoichiometric ratio, thereby reducing the thermal NO_x formation within the combustion chamber.

The F-Class turbines proposed for the project utilize a lean fuel technology controlling NO_x to a concentration of 28 ppm_v at 15 percent O_2 in the turbine exhaust gas. In addition, exhaust gases from the turbine (and duct burner) will exhaust through an SCR system (discussed below) to further reduce NO_x emissions to 2.0 ppm_v at 15 percent O_2, with and without duct burning.

The project will also utilize an auxiliary boiler, diesel fire pump and emergency diesel black-start generators. The auxiliary boiler will utilize flue gas recirculation and low-NO_x burner technology, two combustion optimization techniques that also reduce the formation of NO_x. Using these enhanced combustion techniques, emissions from the auxiliary boiler will be limited to 0.036 lb/MMBtu. The diesel fire pump and the diesel black-start engines will meet the emission limitations for current model years under the NSPS for Stationary Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII). NO_x emissions from the fire pump and black-start generators will be limited to 0.95 lb/MMBtu and 0.70 lb/MMBtu, respectively.

The following discussion will demonstrate that the proposed NO_x emission rates for the combined cycle turbines, auxiliary boiler and diesel engines are considered LAER. As mentioned previously, since LAER requirements are at least as stringent as BACT, the LAER analysis for NO_x will also satisfy the BACT requirements for NO_2.

4.3.1 Identification of Control Options

SCR is an add-on NO_x control technology that is placed in the exhaust stream following the gas turbine/duct burner. SCR involves the injection of ammonia into the exhaust gas upstream of a catalyst bed. On the catalyst surface, NH_3 reacts with the NO_x contained within the flue gas to form nitrogen gas and water in accordance with the following chemical reactions:

$$4NH_3 + 4NO + O_2 \rightarrow 4N_2 + 6H_2O$$

$$8NH_3 + 6NO_2 \rightarrow 7N_2 + 12H_2O$$

The catalyst's active surface is usually a noble metal (platinum), base metal (titanium or vanadium) or a zeolite-based material. Metal-based catalysts are usually applied as a coating over a metal or ceramic substrate. Zeolite catalysts are typically a homogeneous material that forms both the active surface and the substrate. NH_3 is fed and mixed into the combustion gas upstream of the catalyst bed in greater than stoichiometric amounts to

achieve maximum conversion of NO_x. Excess NH_3 which is not reacted in the catalyst bed is subsequently emitted through the stack; this is called "ammonia slip."

An important factor that affects the performance of an SCR system is the operating temperature. The optimal temperature range for standard base metal catalysts is between 400°F and 800°F. Because the optimal temperature is below the CTG exhaust temperature but above the stack exhaust temperature, the catalyst needs to be located within the HRSG.

An undesirable side effect of the use of SCR systems is the potential for formation of ammonium bisulfate and ammonium sulfate, referred to as ammonium salts. These salts are reaction products of SO_3 and NH_3. Ammonium salts are corrosive and can stick to the heat exchanger surfaces, duct work or the stack at low temperatures. In addition, ammonia salts are considered $PM_{10}/PM_{2.5}$, and therefore increase the emissions of these criteria pollutants. Use of low sulfur fuels such as natural gas minimizes the formation of SO_3 and the subsequent formation of these ammonium salts.

USEPA's Alternative Control Techniques (ACT) document for reciprocating engines provides NO_x control technologies such as add-on techniques like SCR, as well as combustion control techniques such as ignition timing retard. However, the ACT concludes that add-on controls are not cost-effective for small emergency diesel engines that operate a limited number of hours per year. Project specific cost considerations cannot be taken into consideration in a LAER analysis. However, costs across an industry group or source type can be considered in the determination. For example, the use of add-on control technologies would be considered cost prohibitive for and technically infeasible for smaller sources that operate for short time durations, such as the emergency fire pump. Therefore, add-on controls would not represent LAER for limited duration emergency engines such as the fire pump.

4.3.2 Search of LAER/BACT Determinations

4.3.2.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified nearly 300 natural gas fired combined cycle combustion turbine projects. As described previously, representative projects were selected based upon recent decisions, local proximity, or stringent limits. Details for representative facilities are presented in Appendix B. The lowest permitted NO_x limit for a natural gas fired combined cycle turbine with duct burning was 2.0 ppm_v. Of the representative projects at least eight had NO_x LAER determinations greater than or equal

to 2.0 ppm_v. All of these projects use SCR systems in combination with combustion optimization technology such as low-NO_x burners. It is our understanding that several of these projects have demonstrated compliance with the 2.0 ppm_v emission limits under primary operating modes. Some of these projects have permit limits above 2.0 ppm_v to accommodate alternative operating modes such as duct burning.

In general, LAER determinations have focused on the level that can be achieved in the primary operating mode (typically gas-fired 100 percent load), with NO_x levels being set for alternative modes (duct burning, partial load, etc.) at the levels that result from application of the same degree of control used to achieve LAER in the primary mode.

4.3.2.2 Auxiliary Boiler

The RBLC and recent air permit search for natural gas-fired boilers between 10 and 100 MMBtu/hr in size identified close to 100 installations. NO_x emission limits for these boilers widely range from approximately 0.009 lb/MMBtu to 0.08 lb/MMBtu. Details on approximately 40 of the installations that were determined to be most representative for the proposed boiler are provided in Appendix B. The projects with emission limits less than 0.011 lb/MMBtu are generally industrial/commercial boilers less than 30 MMBtu/hr that are operated continuously to support industrial processes or other operations; these were not considered relevant to the project. There are a few auxiliary boilers with NO_x emission limits of 0.011 lb/MMBtu (~ 3 ppm_v at 15% O_2), although they are for smaller boilers (~ 30 MMBtu/hr). One of these projects, Caithness Bellport, is located in New York State and is believed to be currently operating using flue gas recirculation and ultra-low NO_x burners. Beyond these projects, other determinations generally proposed NO_x emission limits greater than 0.03 lb/MMBtu. The most recent determination for an auxiliary boiler proposed a NO_x emission limit of 0.049 lb/MMBtu.

4.3.2.3 Diesel Engines

The most stringent NO_x emission limit for an emergency fire pump found in the RBLC database is 3.0 g/hp-hr at CPV Saint Charles in Maryland. This limit was considered LAER for that project. The most recent determination in the RBLC for an emergency fire pump proposes a NO_x limit of 7.8 g/hp-hr at the Chouteau Power Plant in Oklahoma. These determinations are consistent with the NSPS limits under 40 CFR 60 Subpart IIII.

The most stringent NO_x emission limit in the RBLC for a large internal combustion engine is 1.01 g/hp-hr. However, this not an emergency generator, but rather a base load engine and would not be considered applicable for the project's black-start generators. The most

stringent NO_x emission limit for an emergency engine similar in size to the proposed generator is 4.5 g/hp-hr. The most recent NO_x emission limit determination for an emergency generator is 17.1 lb/hr which, based on information in the RBLC, equates to approximately 5.8 g/hp-hr at the Lake Charles Gasification Facility in Louisiana. Both of these installations are required to meet the NSPS limits under 40 CFR 60 Subpart IIII.

4.3.3 LAER/BACT Determinations

4.3.3.1 Combustion Turbine Generators and Duct Burners

CVE is proposing a NO_x emission limit of 2.0 ppm_v at 15 percent O_2 (with and without duct burning) as LAER for the proposed project. This level of emissions will be achieved through the application of DLN burners in combination with SCR. This emission level is consistent with the most stringent level of control found during the RBLC search and has been demonstrated in practice.

4.3.3.2 Auxiliary Boiler

CVE is proposing a NO_x emission limit of 0.036 lb/MMBtu or approximately 9 ppm_v at 15 percent O_2. The auxiliary boiler will use flue gas recirculation in combination with low-NO_x burners. These technologies, used in combination, are capable of reducing NO_x emissions by 60 to 90 percent. This limit is consistent with the results from the RBLC database search.

4.3.3.3 Diesel Engines

CVE is proposing to utilize state-of-the-art combustion design to comply with the federal emission limitations for the current model years for the emergency fire pump. Thus, CVE proposes NO_x emission rates of 0.95 lb/MMBtu, or 2.6 g/hp-hr, for the emergency fire pump. As LAER for the black start generators, CVE is proposing to utilize state-of-the-art combustion design in conjunction with an integrated SCR to achieve NO_x emission rates of 0.703 lb/MMBtu, or 2.11 g/hp-hr.

4.4 LAER/BACT Analysis for VOC

Combustion turbines have inherently low VOC emission rates. Emissions of VOC from a combustion turbine occur as a result of 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 water. VOC emissions can be minimized by the use of good combustion controls and add-on controls as described below.

The F-Class turbines proposed for the project will utilize good combustion controls and exhaust through an oxidation catalyst to further reduce VOC emissions. Emissions of VOC from the exhaust stack will be limited to 1.0 ppm_v at 15 percent O_2 without duct burning and 2.0 ppm_v with duct burning.

The project will also utilize an auxiliary boiler, diesel fire pump and diesel black-start generators. The auxiliary boiler will utilize combustion optimization technologies to minimize incomplete combustion and subsequent emissions of VOC. Using good combustion controls, emissions from the auxiliary boiler will be limited to 0.005 lb/MMBtu. The diesel fire pump and the diesel black-start engines will meet the emission limitations for current model years under the NSPS for Stationary Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII). VOC emissions from the fire pump and black-start generators will be limited to 0.035 lb/MMBtu and 0.033 lb/MMBtu, respectively.

The following discussion demonstrates that the proposed VOC emission rates for the combined cycle turbines, auxiliary boiler and diesel engines are considered LAER. As mentioned previously, since LAER requirements are at least as stringent as BACT requirements, application of LAER technology for VOC will also satisfy the BACT requirements for VOC.

4.4.1 Identification of Control Options

There are only two practical methods for controlling VOC emissions from combustion processes: efficient combustion and add-on control equipment. The most stringent level of control is through the use of add-on control equipment. The only post-combustion control that can be practically implemented is catalytic oxidation. Oxidation catalyst systems consist of a passive reactor comprised of a grid of metal panels with a platinum catalyst. The optimal location for VOC control, in the 900°F to 1,100°F temperature range, would be upstream of the HRSG or in the front-end section of the HRSG. 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. As described previously, SO_3 may react with water and/or NH_3 to form H_2SO_4 and/or ammonium salt (PM_{10}/$PM_{2.5}$). Therefore, the placement of the oxidation catalyst in the “cooler” section of the HRSG, which is necessary for CO control, is the optimal design.

VOC emissions from the auxiliary boiler will also occur due to incomplete combustion. As such, VOC emissions are minimized by combustion practices that promote high combustion temperatures, long residence times, and turbulent mixing of fuel and combustion air. Post-combustion control methods are not considered technically feasible for the reduction of VOC emissions from auxiliary boilers, as supported by the search of the BACT/LAER determinations presented below.

Most unburned hydrocarbons from the diesel engines will occur due to fuel droplets that were transported into the quench layer during combustion. The quench layer is the region immediately adjacent to the combustion chamber surfaces, where temperatures are too low to support combustion. Incomplete combustion can also occur because of poor air/fuel mixing or air/fuel ratios. Add-on controls for VOC reduction are not considered technically feasible for the diesel engines, as supported by the search of BACT/LAER determinations presented below.

4.4.2 Search of LAER/BACT Determinations

4.4.2.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified close to 300 natural gas-fired combined cycle combustion turbine projects. Details for approximately 30 of these facilities have been included in Appendix B. Based on this search, use of an oxidation catalyst appears to be the most stringent level of VOC control for natural gas fired combined cycle turbines. VOC limits range from 0.7 ppm_v to 6 ppm_v, with most projects demonstrating LAER between 1 ppm_v and 2 ppm_v. The lowest VOC limit found in a permit for a natural gas fired combined cycle turbine was 0.7 ppm_v without duct burning, which was issued in to CPV Warren LLC in Virginia. While this facility has been permitted, it has not been constructed and has not demonstrated compliance with this limit. It is our understanding that an air permit application for CPV Valley Energy Center in Wawayanda, New York has also been submitted that proposes a VOC limit of 0.7 ppm_v without duct burning and 1.8 ppm_v with duct burning. Similar to the CPV Warren facility, this project has not been constructed and has not demonstrated compliance with these limits. The lowest permitted VOC emission limit for a combined cycle facility located in New York State is 1.0 ppm_v (without duct burning) for Empire Generating Project in Rensselaer, New York. The most recent VOC LAER determination in the RBLC was a draft permit for West Deptford Energy in New Jersey issued in May 2009. The VOC limit proposed in this draft permit was 1.9 ppm_v. An oxidation catalyst and good combustion control were proposed as LAER for both the Empire Generating Project and the West Deptford Energy Project. This is consistent with other recent projects in the RBLC which have VOC limits ranging

from 1.0 ppm_v to 5.0 ppm_v and propose an oxidation catalyst as LAER. The variation in VOC concentrations between different projects is not unexpected due to differences in turbine and HRSG manufacturers and overall engineering design. Based on the review of the RBLC, LAER for VOC is utilization of an oxidation catalyst system to achieve an outlet VOC concentration in the 1-2 ppm_v range.

In general, LAER determinations have focused on the level that can be achieved in the primary operating mode (typically gas fired 100 percent load), with VOC levels being set for alternative modes (duct burning, partial load, etc.) at the levels that result from application of the same degree of control used to achieve LAER in the primary mode.

4.4.2.2 Auxiliary Boiler

The RBLC and recent air permit search for natural gas fired boilers between 10 and 100 MMBtu/hr in size identified close to 100 installations. VOC emission limits for these installations range from approximately 0.002 lb/MMBtu to 0.08 lb/MMBtu. Details on approximately 30 of the installations that were determined to be most applicable to the proposed boiler are provided in Appendix B.

The most recent determination in the database is for a commercial boiler with a VOC BACT limit of 0.0054 lb/MMBtu. Most of the boilers that operate in a similar manner to the proposed boiler also have operational restrictions on hours. There are several determinations for auxiliary boilers at energy generating facilities in the database. The most recent LAER limit for an auxiliary boiler is 0.002 lb/MMBtu for CPV Warren. However, this project has not been constructed and this limit has not been demonstrated in practice. The most stringent emission limit for an operating auxiliary boiler is 0.004 lb/MMBtu. There are only two facilities currently operating with this limit. The remainder of the installations have emission limits of 0.005 lb/MMBtu or greater. Based on the review of the RBLC, LAER for VOC is good combustion practices to achieve a VOC emission limit in the 0.004 to 0.005 lb/MMBtu range.

4.4.2.3 Diesel Engines

The most stringent VOC emission limit for an emergency fire pump found in the RBLC database is 0.05 g/hp-hr at Crescent City Power in Louisiana, although this facility was never constructed. The most recent determination in the RBLC for an emergency fire pump proposes a VOC limit of 1.12 g/hp-hr at the Chouteau Power Plant in Oklahoma.

The most stringent VOC emission limit in the RBLC for a large internal combustion engine is 0.015 g/hp-hr for a diesel generator at AEP Waterford Energy in Ohio. The most recent VOC emission limit determination for an emergency generator at an energy facility is 0.32 g/hp-hr at the Chouteau Power Plant in Oklahoma.

4.4.3 LAER/BACT Determinations

4.4.3.1 Combustion Turbine Generators and Duct Burners

CVE is proposing a VOC emission limit of 1.0 ppm_v at 15 percent O_2 without duct burning and 2.0 ppm_v at 15 percent O_2 while duct burning as LAER for the proposed project. This level of emissions will be achieved via good combustion control and an oxidation catalyst. This emission level is consistent with the limits and control technologies found in the RBLC for recent LAER determinations in New York State and in other states.

4.4.3.2 Auxiliary Boiler

CVE is proposing a VOC emission limit of 0.005 lb/MMBtu from the auxiliary boiler using good combustion practices in combination with reduced annual operating hours. This is consistent other LAER determinations for this type of equipment.

4.4.3.3 Diesel Engines

The proposed engines for the project will utilize state-of-the-art combustion design to limit emissions of VOC and comply with the federal emission limitations for the current model years. Thus, CVE proposes VOC emission rates of 0.035 lb/MMBtu (0.097 g/hp-hr) for the emergency fire pump and 0.033 lb/MMBtu (0.10 g/hp-hr) for the black-start generators as LAER.

4.5 BACT Analysis for CO

Emissions of CO from combustion occur as a result of incomplete combustion of fuel. CO emissions are minimized by the use of proper combustor design, good combustion practices and add-on controls. The combined cycle turbines, the auxiliary boiler and the diesel engines will all be sources of CO emissions. Since the potential emissions from the project exceed PSD significance thresholds, BACT is required for CO emissions.

The F-Class turbines proposed for the project will utilize good combustion controls and exhaust through an oxidation catalyst to reduce CO emissions. Emissions of CO from the exhaust stack will be limited to 2.0 ppm_v at 15 percent O_2 with and without duct burning.

The auxiliary boiler will utilize good combustion practices to minimize incomplete combustion and subsequent emissions of CO. Using good combustion controls, emissions from the auxiliary boiler will be limited to 0.037 lb/MMBtu. The diesel fire pump and the diesel black-start engines will meet the emission limitations for current model years under the NSPS for Stationary Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII). CO emissions from the fire pump and black-start generators will be limited to 0.19 lb/MMBtu and 0.89 lb/MMBtu, respectively.

The following discussion demonstrates that the proposed CO emission rates for the combined cycle turbines, auxiliary boiler and diesel engines are considered BACT.

4.5.1 Identification of Control Options

There are only two practical methods for controlling CO emissions from combustion processes: efficient combustion and add-on control equipment. The most stringent level of control is the use of add-on equipment. The only post-combustion control that can be practically implemented is catalytic oxidation. Oxidation catalyst systems consist of a passive reactor comprised of a grid of metal panels with a platinum catalyst. CO reduction efficiencies in the range of 80 to 90 percent can be expected, although CO reduction may at times be less than these values due to the low inlet concentrations expected from the F-Class turbines.

CO emissions from the auxiliary boiler will also occur due to incomplete combustion. As such, combustion design that promotes high combustion temperatures, long residence times, and turbulent mixing of fuel and combustion air is the common practice used to minimize CO emissions. Although it is technologically feasible to control CO emissions from a boiler in the 10 to 100 MMBtu/hr size range using an oxidation catalyst, current combustion technology results in very low emissions of CO such that add-on control would not be considered cost-effective.

Based on a review of issued permits, oxidation catalysts are not considered technically feasible for control of diesel engines, especially those with limited annual operation hours. As such, add-on controls for CO reduction are not considered technically feasible for the diesel engines, as supported by the search of BACT/LAER determinations presented below.

4.5.2 Search of LAER/BACT Determinations

4.5.2.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC other available permits identified close to 300 natural gas fired combined cycle combustion turbine projects. Based on this search, use of an oxidation catalyst appears to be the most stringent level of control for natural gas fired combined cycle turbines.

CO emission limits from recently permitted projects generally ranged from 0.9 ppm_v to 15 ppm_v (or greater). The lowest CO limit found in a permit for a natural gas fired combined cycle turbine was 0.9 ppm_v without duct burning and 1.8 ppm_v with duct burning, issued to Kleen Energy Systems in Connecticut. While the duct burning limit is consistent with other determinations, the 0.9 ppm_v limit is an outlier. This is the only facility that proposed this limit, and while this facility has been permitted, it has not yet been constructed and thus has not demonstrated compliance with this limit. As such, 0.9 ppm_v is not considered to represent BACT. A search of the RBLC indicates that the CPV Warren facility in Virginia also proposed a CO emission limit less than 2.0 ppm_v. The CPV Warren facility has not been constructed. There are many facilities in the RBLC with recently permitted BACT CO emission limits of 2.0 ppm_v (or greater). For example, the Empire Generating and Caithness Long Island Energy projects in New York State have permit limits of 2.0 ppm_v for CO, which is considered representative of BACT. It is our understanding that several of these facilities are operating in compliance with their 2.0 ppm_v limit.

4.5.2.2 Auxiliary Boiler

The RBLC and recent air permit search for natural gas-fired boilers between 10 and 100 MMBtu/hr in size identified close to 100 installations. CO emission limits for these installations range from approximately 0.0073 lb/MMBtu to 0.08 lb/MMBtu. Details on approximately 30 of the installations that were determined to be most applicable to the proposed boiler are provided in Appendix B.

The most stringent limit for an auxiliary boiler at an energy generating facility is 0.0164 lb/MMBtu at Emery Generating Station in Iowa, which was permitted in 2002. This installation is operational and it utilizes a catalytic oxidizer with an estimated control efficiency of 80 percent to achieve this emission rate. Since this installation, there have been many projects permitted without add-on controls that utilize good combustion practices to achieve CO control. The most recent auxiliary boiler installation listed in the RBLC has a CO limit of 0.15 lb/MMBtu. However, there are several other recent

determinations with CO limits between 0.02 and 0.04 lb/MMBtu. These installations also utilize good combustion practices to control CO emissions.

4.5.2.3 Diesel Engines

A search of the RBLC and other existing permits indicates that add-on controls are generally not feasible for diesel emergency engines. Several recently issued BACT determinations for large emergency generators (i.e., Lake Charles Generation and Southeast Idaho Energy) propose good combustion controls and certification of the NSPS Subpart IIII standards as BACT for CO.

For engines the size of the fire pump, the CO emission limit in the RBLC widely ranged from 0.25 g/hp-hr to 3 g/hp-hr depending on the engine size and its application, with most limits greater than 1 g/hp-hr. The most recent determination in the RBLC for an emergency fire pump proposes a CO limit of 2.6 g/hp-hr at the Chouteau Power Plant in Oklahoma.

For larger diesel engines, CO limits ranged from 0.21 g/hp-hr to 10 g/hp-hr with most limits greater than 1 g/hp-hr. The lower limits appear to be for non-emergency engines that have a much larger capacity factor. The most recent CO emission limit determination for an emergency generator at an energy facility is 2.61 g/hp-hr at the Chouteau Power Plant in Oklahoma.

4.5.3 LAER/BACT Determinations

4.5.3.1 Combustion Turbine Generators and Duct Burners

CVE is proposing a CO emission limit of 2.0 ppm_v at 15 percent O_2 with and without duct burning as BACT for the proposed project. This level of emissions will be achieved via good combustion control and an oxidation catalyst. This proposal is consistent with the limits and control technologies found in the RBLC for recent BACT determinations in New York State and in other states.

4.5.3.2 Auxiliary Boiler

CVE is proposing a CO emission limit of 0.037 lb/MMBtu from the auxiliary boiler using good combustion practices in combination with reduced annual operating hours. This is consistent with other BACT determinations for this type of equipment.

4.5.3.3 Diesel Engines

The proposed diesel engines for the project will utilize state-of-the-art combustion design to comply with the federal emission limitations for the current model years. Thus, CVE proposes CO emission rates of 0.19 lb/MMBtu (0.53 g/hp-hr) for the emergency fire pump and 0.86 lb/MMBtu (2.6 g/hp-hr) for the black-start generators as BACT, with limited annual hours of operation.

4.6 BACT Analysis for Particulate Matter (PM_{10}/$PM_{2.5}$)

Emissions of particulate matter from combustion occur as a result of inert solids contained in the fuel, unburned fuel hydrocarbons which agglomerate to form particles, and mineral matter in water that may be injected for NO_x control during diesel firing. Particulate emissions can also result from the formation of ammonium sulfates due to the conversion of SO_2 to SO_3, which is then available to react with ammonia to form ammonium sulfate. All of the particulate matter emitted from the turbines is conservatively assumed to be less than 2.5 microns in diameter. Therefore, PM_{10} and $PM_{2.5}$ emission rates are assumed to be the same.

The combustion of clean burning fuels is the most effective means for controlling particulate emissions from combustion equipment. The project is proposing to use natural gas as the only fuel for the turbines. Natural gas is a very clean burning fuel with very low associated particulate emissions. CVE is not aware of any combustion turbine projects in existence that have add-on particulate control.

The F-Class turbines proposed for the project will utilize natural gas as their only fuel to minimize particulate emissions. Emissions of PM_{10}/$PM_{2.5}$ from the exhaust stack will be limited to 0.006 lb/MMBtu without duct burning and 0.007 lb/MMBtu with duct burning.

The project will also utilize an auxiliary boiler, diesel fire pump and diesel black-start generators. The auxiliary boiler will combust only natural gas, resulting in a PM_{10}/$PM_{2.5}$ emission limit of 0.005 lb/MMBtu. The diesel fire pump and the diesel black-start engines will meet the emission limitations for current model years under the NSPS for Stationary Compression Ignition Internal Combustion Engines (40 CFR 60 Subpart IIII). PM_{10}/$PM_{2.5}$ emissions from the fire pump and black-start generators will be limited to 0.032 lb/MMBtu and 0.05 lb/MMBtu, respectively.

The following discussion will demonstrate that the proposed PM_{10}/$PM_{2.5}$ emission rates for the combined cycle turbines, auxiliary boiler and diesel engines are considered BACT.

4.6.1 Search of LAER/BACT Determinations

4.6.1.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified over 300 natural gas fired combined cycle combustion turbine projects. Based on this search, use of clean burning fuels is the primary control for particulate emissions. Particulate matter emission limits in the RBLC database generally ranged from approximately 0.003 lb/MMBtu to 0.3 lb/MMBtu (or greater). The lowest $PM_{10}/PM_{2.5}$ limit found in a permit for an F-series natural gas fired combined cycle turbine was 0.0051 lb/MMBtu, which was issued to Kleen Energy Systems in Connecticut. While this facility has been permitted, it has not been constructed and has not demonstrated compliance with this limit. Similarly, Caithness Long Island Energy has a limit of 0.0055 lb/MMBtu. Beyond these examples, there are many facilities in the RBLC with permitted BACT $PM_{10}/PM_{2.5}$ emission limits in the range of 0.006 lb/MMBtu to 0.01 lb/MMBtu. Generally, all of these projects utilize clean burning fuel as their primary control technology and their emission limits are based upon the overall quality of their commercial natural gas source.

4.6.1.2 Auxiliary Boiler

A review of the RBLC indicates that good combustion practices and clean burning fuels have typically been determined to be BACT for boilers. $PM_{10}/PM_{2.5}$ emission limits for natural gas fired boilers vary widely, ranging from 0.002 lb/MMBtu through 0.6 lb/MMBtu. $PM_{10}/PM_{2.5}$ emission limits for gas-fired auxiliary boilers of similar size are as low as 0.003 lb/MMBtu. The most recent listing in the RBLC for an auxiliary boiler proposed a $PM_{10}/PM_{2.5}$ limit of 0.005 lb/MMBtu.

4.6.1.3 Diesel Engines

For engines the size of the fire pump, $PM_{10}/PM_{2.5}$ emission limits in the RBLC generally ranged from 0.07 g/hp-hr to greater than 1 g/hp-hr. The most recent determination in the RBLC for an emergency fire pump proposes a $PM_{10}/PM_{2.5}$ limit of 0.40 g/hp-hr at the Chouteau Power Plant in Oklahoma.

For larger diesel engines, $PM_{10}/PM_{2.5}$ limits ranged from 0.02 g/hp-hr to greater than 1 g/hp-hr. The most recent $PM_{10}/PM_{2.5}$ emission limit determination for an emergency generator at an energy facility is 0.15 g/hp-hr at the Chouteau Power Plant in Oklahoma.

4.6.2 LAER/BACT Determinations

4.6.2.1 Combustion Turbine Generators and Duct Burners

CVE is proposing a $PM_{10}/PM_{2.5}$ emission limit of 0.006 lb/MMBtu without duct burning and 0.007 lb/MMBtu with duct burning as BACT for the proposed project. This level of emissions will be achieved by combusting only commercially available, pipeline quality natural gas in the turbines. This emission level is consistent with the limits and control technologies found in the RBLC for recent BACT determinations in New York State and in other states.

4.6.2.2 Auxiliary Boiler

CVE is proposing the exclusive use of clean-burning pipeline quality natural gas in conjunction with good combustion practices as BACT for the auxiliary boiler. The project proposes a $PM_{10}/PM_{2.5}$ emission limit of 0.005 lb/MMBtu boiler using natural gas as the only fuel in conjunction with reduced annual operating hours. This is consistent with other BACT determinations for this type of equipment.

4.6.2.3 Diesel Engines

The proposed engines for the project will utilize state-of-the-art combustion design to comply with the federal emission limitations for the current model years. Thus, CVE proposes $PM_{10}/PM_{2.5}$ emission rates of 0.032 lb/MMBtu (0.087 g/hp-hr) for the emergency fire pump and 0.05 lb/MMBtu (0.15 g/hp-hr) for the black-start generators as BACT, with limited annual hours of operation. These limits are consistent with recent BACT determinations as found in the RBLC.

4.7 BACT Analysis for Sulfur Dioxide and Sulfuric Acid

Emissions of SO_2 are formed from the oxidation of sulfur in the fuel. H_2SO_4 emissions, in addition to being a function of sulfur content, are also related to the amount of sulfur oxidized to SO_3. Sulfuric acid is produced when SO_2 is converted to SO_3, and is then combined with water to form an acid. As such, minimizing SO_2 emissions will effectively control sulfuric acid emissions. SO_2 emissions can be controlled using pre- and post-combustion controls. Pre-combustion controls involve the use of low sulfur fuels such as natural gas or ULSD. Post-combustion controls involve the use of add-on control technology such as wet and dry flue gas desulfurization (FGD) processes. Installation of such systems is an established technology principally on coal-fired and high sulfur oil-fired

steam electric generation stations. However, FGD systems are not practical for combustion turbines due to several factors including the large exhaust flow (and corresponding pressure drop) and the low inlet concentration in the flue gas. The use of natural gas and ULSD are the most common methods for controlling SO_2 emissions from combustion turbines.

The F-Class turbines proposed for the project will utilize natural gas as their only fuel to minimize SO_2 and H_2SO_4 emissions. Emissions of SO_2 from the exhaust stack will be limited to 0.002 lb/MMBtu with and without duct burning. Emissions of H_2SO_4 from the combined-cycle turbines will be limited to 0.00014 lb/MMBtu without duct burning and 0.0005 lb/MMBtu with duct burning.

The project will also utilize an auxiliary boiler, diesel fire pump and diesel black-start generators. The auxiliary boiler will combust only natural gas, resulting in SO_2 and H_2SO_4 emission limits of 0.0016 lb/MMBtu and 0.0001 lb/MMBtu, respectively. The diesel fire pump and the diesel black-start engines will utilize ULSD. SO_2 emissions from the fire pump and black-start generators will be limited to 0.002 lb/MMBtu for both pieces of equipment. Emissions of H_2SO_4 from both engines will be limited to 0.0003 lb/MMBtu.

The following discussion will demonstrate that the proposed SO_2 and H_2SO_4 emission rates for the combined cycle turbines, auxiliary boiler and diesel engines are considered BACT.

4.7.1 Search of LAER/BACT Determinations

4.7.1.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified close to 300 natural gas fired combined cycle combustion turbine projects. Based on this search, use of low sulfur fuels is the primary control for SO_2 emissions, with emission limits being dependent upon the sulfur content of the fuel and engine design. SO_2 emission limits in the RBLC generally ranged from 0.0003 lb/MMBtu to 0.01 lb/MMBtu (or greater). Most projects proposed limits in the range of 0.002 to 0.005 lb/MMBtu and utilized commercially available pipeline quality natural gas.

Similarly, a search of permits for natural gas-fired combined cycle turbines indicated H_2SO_4 emissions ranging from 0.0001 lb/MMBtu to 0.002 lb/MMBtu (or greater). Similar to SO_2, BACT for these sources was the use of low sulfur fuels and emission limits are dependent upon the sulfur content of the fuel and engine design.

4.7.1.2 Auxiliary Boiler

A review of the RBLC indicates that combustion of clean burning low-sulfur fuels has typically been determined to be BACT for SO_2 and H_2SO_4. The most stringent SO_2 emission limit for an auxiliary boiler found the RBLC was 0.0006 lb/MMBtu. The most recent project listed in the RBLC proposes an SO_2 emission limit of 0.0009 lb/MMBtu. Both limits are based upon the sulfur content of the natural gas supply.

A search of the RBLC for H_2SO_4 emissions only identified two boilers of similar size to the proposed auxiliary boiler. Of these listings, only one was for an auxiliary boiler at an energy facility. This project, CPV Saint Charles, proposed an H_2SO_4 limit of 0.0001 lb/MMBtu.

4.7.1.3 Diesel Engines

A search of the RBLC for diesel fired emergency engines (large and small) indicated widely varying emission limits for SO_2 (in widely varying units). However, in general, SO_2 limits were based upon the sulfur content of the diesel fuel. The lowest sulfur content diesel fuel identified in the RBLC was 15 parts per million by weight (ppm_w) for ULSD.

A search of the RBLC for diesel fired emergency engines identified no H_2SO_4 limits for small engines and two entries for large engines. The H_2SO_4 limits in the RBLC ranged from 0.007 g/hp-hr (calculated from lb/hr) to 0.049 g/hp-hr. In general, H_2SO_4 limits are based upon the sulfur content of the fuel. One of the determinations indicated the use of ULSD.

4.7.2 LAER/BACT Determinations

4.7.2.1 Combustion Turbine Generators and Duct Burners

CVE is proposing a SO_2 emission limit of 0.0017 lb/MMBtu (with and without duct burning) and an H_2SO_4 emission limit of 0.00014 lb/MMBtu without duct burning and 0.0005 lb/MMBtu with duct burning as BACT for the proposed project. This level of emissions will be achieved by combusting commercially available, pipeline quality natural gas with a maximum sulfur content of 0.5 grains/100 SCF in the combustion turbines. This emission level is consistent with the limits and control technologies found in the RBLC.

4.7.2.2 Auxiliary Boiler

CVE is proposing a SO_2 emission limit of 0.0016 lb/MMBtu and an H_2SO_4 emission limit of 0.0001 lb/MMBtu as BACT for the proposed project. The proposed auxiliary boiler will combust natural gas with a maximum sulfur content of 0.5 grains/100 SCF. This is consistent with other BACT determinations for this type of equipment.

4.7.2.3 Diesel Engines

The proposed engines for the project will use ULSD with a maximum sulfur content of 15 ppm_w as a fuel. Thus, CVE proposes SO_2 emission rates of 0.002 lb/MMBtu (0.005 g/hp-hr) and H_2SO_4 emissions of 0.000031 lb/MMBtu (0.0001 g/hp-hr) for the engines as BACT, with limited annual hours of operation.

4.8 Emission Limit and Control Technology Summaries

Tables 4-1 through 4-4 summarize the proposed emission limits and associated control technology for the project.

Table 4-1: Summary of Proposed BACT/LAER Emission Limits and Associated Control Technologies for the Combustion Turbines

Pollutant	Emission Rate (lb/MMBtu)	Emission Rate (ppm_v)	Control Technology	Represents
NO_x CT only CT w/ DB	 0.008 0.008	 2.0 2.0	DLN and SCR	LAER
VOC CT only CT w/ DB	 0.001 0.003	 1.0 2.0	Good combustion controls and oxidation catalyst	LAER
CO CT only CT w/ DB	 0.005 0.005	 2.0 2.0	Good combustion controls and oxidation catalyst	BACT
$PM_{10}/PM_{2.5}$ CT only CT w/ DB	 0.006 0.007	 n/a n/a	Low sulfur fuel	BACT
SO_2 CT only CT w/ DB	 0.0017 0.0017	 n/a n/a	Low sulfur fuel	BACT
H_2SO_4 CT only CT w/ DB	 0.00014 0.0005	 n/a n/a	Low sulfur fuel	BACT

Table 4-2: Summary of Proposed BACT/LAER Emission Limits and Associated Control Technologies for the Auxiliary Boiler

Pollutant	Emission Rate (lb/MMBtu)	Control Technology	Represents
NO_x	0.036	LNG and FGR	LAER
VOC	0.005	Good combustion controls	LAER
CO	0.037	Good combustion controls	BACT
$PM_{10}/PM_{2.5}$	0.005	Low sulfur fuel	BACT
SO_2	0.0016	Low sulfur fuel	BACT
H_2SO_4	0.0001	Low sulfur fuel	BACT

Table 4-3: Summary of Proposed BACT/LAER Emission Limits and Associated Control Technologies for the Emergency Fire Pump

Pollutant	Emission Rate (lb/MMBtu)	Control Technology	Represents
NO_x	0.95	Good combustion controls	LAER
VOC	0.035	Good combustion controls	LAER
CO	0.19	Good combustion controls	BACT
$PM_{10}/PM_{2.5}$	0.032	Low sulfur fuel	BACT
SO_2	0.002	Low sulfur fuel	BACT
H_2SO_4	0.00003	Low sulfur fuel	BACT

Table 4-4: Summary of Proposed BACT/LAER Emission Limits and Associated Control Technologies for the Black-Start Generators

Pollutant	Emission Rate (lb/MMBtu)	Control Technology	Represents
NO_x	0.70	Good combustion controls	LAER
VOC	0.033	Good combustion controls	LAER
CO	0.86	Good combustion controls	BACT
$PM_{10}/PM_{2.5}$	0.05	Low sulfur fuel	BACT
SO_2	0.002	Low sulfur fuel	BACT
H_2SO_4	0.00003	Low sulfur fuel	BACT

5. AIR QUALITY MODELING ANALYSIS

This section presents the air quality modeling analyses performed to satisfy the regulatory requirements outlined in Section 3.0. As described previously, PSD regulations require that an ambient air quality analysis be performed to demonstrate compliance with NAAQS, NYAAQS and PSD increments, in addition to other impact analyses. The NAAQS, NYAAQS, PSD increments, SILs and SMCs are shown in Table 5-1.

Table 5-1: National and New York Ambient Air Quality Standards, PSD Increments, Significant Impact Levels, and Significant Monitoring Concentrations

Pollutant	Averaging Period	Ambient Air Quality Standards		PSD Increment Class II ($\mu g/m^3$)	SIL ($\mu g/m^3$)	SMC ($\mu g/m^3$)
		NAAQS ($\mu g/m^3$)	NYAAQS ($\mu g/m^3$)			
SO_2	3-hour	1,300	1,300	512	25	none
	24-hour	365	365	91	5	13
	Annual	80	80	20	1	none
PM_{10}	24-hour	150	none	30	5	10
	Annual	revoked	none	17	1	none
$PM_{2.5}$	24-hour	35	none	9[b]	1.2 to 5[b]	2.3 to 10[b]
	Annual	15	none	4 to 5[b]	0.3 to 1.0[b]	none
TSP	24-hour	none	250	none	none	none
	Annual	none	45	none	none	none
CO	1-hour	40,000	40,000	none	2,000	none
	8-hour	10,000	10,000	none	500	575
NO_2	1-hour	189[a]	–[a]	not yet proposed	not yet proposed	not yet proposed
	Annual	100	100	25	1	14
Pb	3-month	1.5	none	none	none	0.1

a. The new 1-hour standard for NO_2 was published in the Federal Register on February 9, 2010. The new standard has not yet been incorporated into NYSDEC air regulations.
b. PSD increments, SILs and SMC for $PM_{2.5}$ proposed by USEPA on September 17, 2007.

As shown in Table 5-1, generally New York has adopted the NAAQS as NYAAQS. In addition, NYAAQS have been established for TSP, F^-, Be, and H_2S. The pollutants Pb, F^-, Be and H_2S are also listed in *Policy DAR-1: Guidelines for the Control of Toxic Ambient Air*

Contaminants (NYSDEC, 1997), DAR-1, and are addressed in the air toxics impact analysis (Section 5.2.4).

A modeling protocol was submitted to the NYSDEC and the USEPA in September 2009. This modeling protocol provides details concerning the modeling methodology used in this air quality analysis. The modeling protocol was reviewed by both NYSDEC and USEPA, who issued comment letters dated November 19, 2009 and December 15, 2009, respectively. USEPA issued additional clarification regarding processing of the meteorological data to be used in the modeling analysis on January 26, 2010. Responses to these comments were addressed in a letter dated January 27, 2010. The proposed modeling approach was approved by the NYSDEC on February 11, 2010. The protocol and related agency correspondence are provided in Appendix C.

The methodology used for the modeling presented below is consistent with the approved modeling approach; with the guidance provided by the USEPA in the "Guideline on Air Quality Models" (USEPA, 2005); and by the NYSDEC in "NYSDEC Guidelines on Dispersion Modeling Procedures for Air Quality Impact Analysis" (NYSDEC, 2006). The air quality analysis presented in the sections below also incorporate and address comments raised by the agencies during their review of the protocol.

5.1 Modeling Methodology

5.1.1 Source Data

The modeling analyses include the following project sources:

- Three combined cycle combustion turbines with HRSG duct burners (combusting only natural gas);
- An auxiliary boiler (combusting only natural gas);
- An emergency fire pump; and
- Three black-start emergency generators.

These sources are discussed in Section 2.0, and detailed emission calculations are provided in Appendix B. The emission rates and stack exit parameters used in the modeling analyses are provided in the following tables: combined cycle units (Table 5-2), ancillary equipment (Table 5-3), and turbine startup and shutdown events (Table 5-4).

Table 5-2: Stack Parameters and Emission Rates for a Single Combustion Turbine

		Design Cases											
	Units	**Case 1**	**Case 3**	**Case 6**	**Case 7**	**Case 9**	**Case 12**	**Case 19**	**Case 21**	**Case 24**	**Case 36**	**Case 37**	**Case 39**
Fuel Type	--	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas
Ambient Temperature	°F	105	59	-8	105	59	-8	105	59	-8	-8	105	59
Percent Load Rate	%	100	100	100	100	100	100	75	75	75	50	50	50
Duct Burner Operation	--	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No
Stack Diameter (feet)	19	19	19	19	19	19	19	19	19	19	19	19	19
Stack Height (feet)	282.5	282.5	282.5	282.5	282.5	282.5	282.5	282.5	282.5	282.5	282.5	282.5	282.5
Stack Temperature	°K[a]	385.9	377.6	379.8	382.6	378.2	379.8	379.8	375.4	377.6	378.7	378.7	378.7
Stack Exit Velocity	m/s[b]	19.4	21.0	23.3	19.0	20.9	23.1	15.8	17.1	18.6	15.6	14.4	15.0
NO_x Emission Rate	g/s[c]	2.21	2.29	2.47	1.63	1.82	2.04	1.31	1.45	1.61	1.25	1.01	1.12
CO Emission Rate	g/s	1.34	1.39	1.50	0.99	1.11	1.24	0.80	0.88	0.98	0.76	0.62	0.68
VOC Emission Rate	g/s	0.78	0.69	0.69	0.28	0.32	0.35	0.23	0.25	0.28	0.22	0.18	0.19
SO_2 Emission Rate	g/s	0.46	0.47	0.50	0.34	0.38	0.42	0.28	0.31	0.33	0.26	0.20	0.22
Total $PM_{10}/PM_{2.5}$	g/s	2.01	1.87	1.94	1.26	1.26	1.39	1.26	1.26	1.26	1.01	1.01	1.01

a. degrees Kelvin
b. meters per second
c. grams per second

Table 5-3: Stack Parameters and Emission Rates for Ancillary Equipment

	Units	Auxiliary Boiler	Emergency Fire Pump	Black-Start Generators
Fuel Type	--	Natural Gas	Diesel ULSD	Diesel ULSD
Stack Temperature	^{o}K	422[a]	692.6	–[b]
Stack Height	feet	282.5	50	282.5
Stack Diameter	feet	19	0.67	19
Stack Exit Velocity	m/s	0.26[a]	36.7	–[b]
NO_x	g/s	0.22	0.33	2.59[c]
CO	g/s	0.23	0.07	3.16[c]
VOC	g/s	0.03	0.01	0.12[c]
SO_2	g/s	0.01	0.0006	0.01[c]
$PM_{10}/PM_{2.5}$	g/s	0.03	0.01	0.18[c]

a. The auxiliary boiler will exhaust through a HRSG stack. The stack parameters presented in this table are representative of the auxiliary boiler operating alone.
b. The black start generators will exhaust through a HRSG stack. The stack parameters presented in this table are representative of one generator operating together with the three CTGs, as only one generator would be readiness-tested at a time.
c. These represent emissions from each black start generator.

Table 5-4: Modeling Inputs for CTG Startup and Shutdown Events

Pollutant	Units	Cold Startup	Warm Startup
NO_x	g/s	6.3	5.8
CO	g/s	78.8	58.1
SO_2	g/s	0.087	0.082
$PM_{10}/PM_{2.5}$	g/s	1.5	1.5
Exit Temperature	^{o}K	357.8	369.5
Exit Velocity	m/s	12.3	7.4

Figure 2-2 provides a detailed plot plan which clearly identifies the building locations, building footprints, stack locations and property fence line; a geo-referenced AutoCAD file

is provided on the compact disc in Appendix E. Each HRSG has a dedicated stack. The UTM coordinates for the three HRSG stacks and the emergency fire pump are provided in Table 5-5. As indicated on the site plan, the three HRSG stacks will be co-located. This proximity ensures that the plumes will merge upon stack exit, and allows the units to be modeled as a single source when multiple units are operating simultaneously.

The auxiliary boiler and the black start generators will exhaust through the one of the combustion turbine HRSG stacks (Stack No. 1). The emergency fire pump will have its own exhaust stack.

Table 5-5: Stack Coordinates

Emission Point	UTM N[a]	UTM E[a]
Stack 1	4614800	618142
Stack 2	4614797	618150
Stack 3	4614792	618144
Combined[b]	**4614796**	**618145**
Fire Pump	4614954	618216

a. UTM Zone 18, NAD83
b. Center point coordinates of combined stack used for modeling.

Modeling scenarios were based on the combustion turbine operating performance data at 100, 75 and 50 percent loads at cold, average, and hot ambient temperatures (-8°F, 59°F and 105°F). Duct burner operation was modeled only under 100 percent load, since duct burning will only occur when a turbine is at or near full load.

Impacts from startup and shutdown operations were predicted by modeling the cold start and warm start cases. The hot start and shutdown cases have shorter duration and lower emission rates compared to the cold start and warm start cases, and would, therefore, have lesser impacts. Stack parameters for startups are based on operating information provided by turbine vendors (reflected in Table 5-4). NO_x emission rates for modeling of annual NO_2 impacts reflect the contribution from startups and shutdowns.

Typically, the black start generators will only operate periodically for load testing. In this case, they could operate concurrently with the combustion turbines for short periods of time. However, only one black start generator would be load tested at a time. This scenario was modeled for the compliance demonstration.

Similarly, for the fire pump, load testing could occur while the CTGs are operating. The auxiliary boiler, under normal conditions, would only be used if the CTGs are not operating.

The following operational scenarios were evaluated in the modeling analysis to determine maximum predicated impacts:

- Steady-state operation of the three combustion turbines;
- Steady state operation of a single combustion turbine;
- Steady-state operation of the three combustion turbines with the emergency fire pump (35-minute test firing);
- Steady-state operation of the three combustion turbines plus one black start generator at full load (2-hour test firing);
- Warm startup of one combustion turbine plus the auxiliary boiler at full load;
- Cold startup of one combustion turbine plus the auxiliary boiler at full load; and
- Auxiliary boiler operating at full load (nothing else operating).

5.1.2 Good Engineering Practice Stack Height

A Good Engineering Practice (GEP) stack height analysis was conducted to evaluate whether the plumes emitted from the turbine stacks would be subject to building wake effects. If a stack is sufficiently close to a large building or other structure, the plume can be entrained in the building's wake. The resulting "downwash" reduces the effective release height and leads to increased ground-level ambient concentrations. Building downwash effects must be evaluated when a stack is less than "formula" GEP stack height. Formula GEP stack height is defined as:

$H_{GEP} = H_B + 1.5L_B$ where:

- H_{GEP} = formula GEP stack height;
- H_B = the building's height above stack base; and
- L_B = the lesser of the building's height or maximum projected width.

A second definition of GEP stack height is "regulatory" GEP stack height. Regulatory GEP stack height is either 65 meters (m) or formula GEP stack height, whichever is greater. Sources are not allowed to take credit for ambient air concentrations that result from stacks that are higher than regulatory GEP stack height.

The USEPA Building Profile Input Program (BPIP) (USEPA, 1995) produces the model input information necessary to account for building wake effects, based on the dimensions of buildings in the vicinity of the stacks. The "PRIME" version of BPIP (BPIPPRM) (Schulman, et al., 1997) is used with AERMOD. BPIP requires a digitized blueprint of the facility's buildings and stacks as well as other nearby structures. The position and height of buildings relative to the stack positions must be evaluated in the GEP analysis. The CAD file of the site plan is provided in Appendix E. Tier heights for the various project elements are shown on Figure 5-1. The base elevation of the proposed stack is 436 feet above mean sea level (msl).

The results of the analysis for the combustion turbine stacks indicate that the HRSG enclosures and structures on the top of the ACCs, with a tier height of 113 feet, are the "controlling" structures for the turbine stacks. The projected width of the controlling structures exceeds the height, so the GEP formula height is 282.5 feet (83 m), which translates to a stack-top elevation of 718.5 feet msl. The design calls for the turbine stacks to be built to GEP height. The fire pump will have a 50-foot stack (for a stack-top elevation of 486 feet msl) and will be modeled with inputs to account for building wake downwash. BPIPPRM input and output files are provided on the compact disk provided in Appendix E.

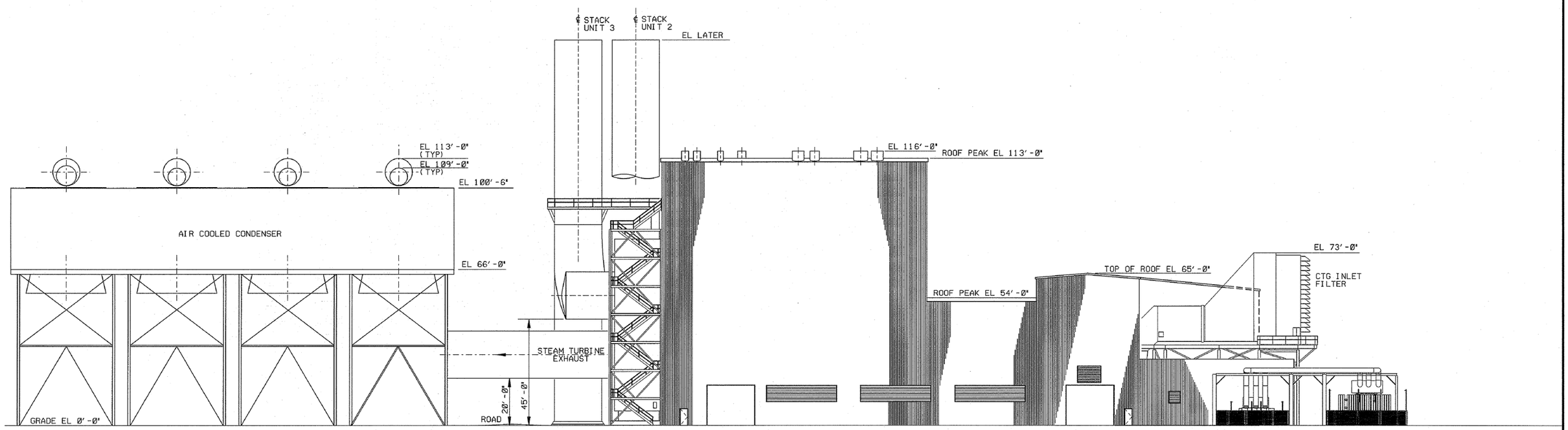
5.1.3 Model Selection

AERMOD (version 09292; USEPA, 2004a) was selected to predict ambient concentrations in simple (below stack height), complex (above plume height) and intermediate (between stack height and plume height) terrain. The AERMOD Modeling System includes preprocessor programs (AERMET, AERSURFACE, and AERMAP) to create the required input files for meteorology and receptor terrain elevations. AERMOD is the recommended model in USEPA's *Guideline on Air Quality Models* (40 CFR Part 51, Appendix W) (USEPA, 2005). The regulatory default option will be used. This option commands AERMOD to use:

- The elevated terrain algorithms requiring input of terrain height data for receptors and emission sources;
- Stack tip downwash (building downwash automatically overrides);
- The calms processing routines;
- Buoyancy-induced dispersion; and
- The missing meteorological data processing routines.

NOTES

1. CURRENT LAND/RECORD OWNER: HOWLANDS LAKE PARTNERS, LLC PO BOX 285, MOUNT KISCO, NY 10549.
2. PARCELS' GRID NUMBERS: 7060-00-493989; 7061-00-465190; 7061-00-580190; 7061-00-585063.
3. ALL ELEVATIONS ARE PRELIMINARY.



UNIT 3
ELEVATION LOOKING NORTH

GRAPHIC SCALE

0 10' 20' 40' 60'

1" = 20.0'

PRELIMINARY

ARCADIS

CRICKET VALLEY ENERGY

FIGURE 5-1
Site Elevations

Dutchess County, New York

Rev No	Revision	Date	Dwn	Chkd	Approved Chief Engr
E	ISSUED FOR PERMITTING	10/6/09	JGF		
F	REVISED TO INCLUDE HRSG AND GENERATOR ENCLOSURES	10/29/09	JFH		

Drawing Control				
Purpose	Approved By	Date	Released By	Date
For Information		10/23/09		10/30/09
For Comment				
For Bid				
For Fabrication				
For Construction				

JORGE E. FERRERO
Oct 29, 2009
STATE OF NEW YORK · JORGE E. FERRERO · LICENSED PROFESSIONAL ENGINEER · No. 082862-1
NEW YORK PROFESSIONAL ENGINEER NO. 082862-1

Engineering Review		
Disc	Engr	Date
Mech		
Elec		
Civil		
Arch		
Instr		

Drawn	Designed	Checked
JGF	JGF	

Lead Engineer | Date | Scale 1"=20'-0"

advanced power

CRICKET VALLEY ENERGY
TOWN OF DOVER
DUTCHESS COUNTY, NEW YORK

GENERAL ARRANGEMENT
UNIT 3 ELEVATION LOOKING NORTH

BURNS AND ROE ENTERPRISES, INC.
Engineers and Constructors - Oradell, NJ
New York Certificate of Authorization No. 0004677

Approved for Construction | Chief MECHANICAL Engineer | Work Order 3000 | Drawing No M207 | Sh | Rev F

M207.DGN 13:35 29-OCT-2009

5.1.4 Meteorological Data

NYSDEC and USEPA recommend using a five-year data set in order to capture typical and atypical meteorological characteristics (e.g., inversions, high wind scenarios) that could impact dispersion. Careful consideration was given to selecting a location from which to obtain meteorological data that are representative of site conditions and were appropriately collected. The following information was reviewed in support of NYSDEC and USEPA's approval of appropriate the meteorological data location, years, and processing requirements.

The CVE site is located along Route 22 south of Dover Plains, New York, in the Ten Mile River Valley. The stack base elevation is at 436 feet msl. The valley is about 5 km (3 miles) wide and oriented north-south, with a ridge of elevated terrain rising steeply within 1.5 km west of the site, including Bald Mountain (1,266 feet msl), West Mountain (1,286 feet msl), and Dobar Mountain (1,086 feet msl) and a parallel ridge beginning almost 4 km east-northeast of the site, including Schaghticoke Mountain (1,325 feet msl) and continuing to the north. Compared to the surrounding area, near surface winds in this terrain setting would be channeled along the valley, toward north-south transport directions.

The Poughkeepsie-Dutchess County Airport (KPOU) is situated in the Hudson River Valley, about 16 miles west of the CVE site. The Hudson River Valley is somewhat broader than the Ten Mile River Valley, but has a very similar north-south orientation. Base elevation at KPOU is 165 feet msl. A north-south ridge about 6 miles to the west of KPOU is approximately 800 feet msl, with a similar ridge 8 miles to the east of KPOU.

The influence of local topography on channeling of the winds diminishes with height above the surface, as well as with the width of the valley. With stack height and plume rise, CVE emissions will be transported 500 feet or more above the ground, based on a stack height of 282.5 feet. The channeling influence of local topography on winds 300-500 feet above the surface is considerably less than the influence on winds closer to the surface. Both the near-surface wind directions in the broader valley at KPOU (wind measurement height on the meteorological tower is 26 feet above ground level) and the winds at 500 feet above the narrower Ten Mile River Valley at the CVE site will be dominated by the synoptic (regional-scale) wind flow. The secondary influence of channeling due to local topography is oriented north-south at both locations.

Based upon a review of the most recent data available and consultation with NYSDEC and USEPA, it was determined that processing of the raw meteorological data, using methods approved by NYSDEC and USEPA and consistent with methods currently under

development by USEPA, would be preferable to use of available hourly average data. An analysis of the National Climatic Data Center (NCDC) hourly surface data for the KPOU location for 2004-2008 showed a high number of "calm" observations and lower than expected average wind speed. These findings are consistent with trends seen at other Automated Surface Observing Systems (ASOS) stations. After discussing this matter with NYSDEC and with USEPA, software was developed for calculating hourly average winds based on one-minute ASOS data collected at the KPOU site. This approach greatly reduced the frequency of calms, but did not increase the average wind speed. The approach for processing of the meteorological data was approved by both USEPA and NYSDEC.

Given the above factors, the meteorological data selected for the sequential modeling consist of hourly surface observations calculated for one-minute ASOS data collected at KPOU from March 10, 2005 through December 31, 2009. (The NCDC archive of one-minute ASOS data from KPOU starts in March of 2005; only the less-refined hourly data are available prior to that time.) Upper air radiosonde data concurrent with the surface meteorological data were obtained from NCDC for Albany, New York. A wind rose for each year of meteorological data is provided in Appendix D. The prevailing wind directions are southwest and north. Lighter winds (below 4 knots) are most frequently from the southeast quadrant, while higher wind speeds (above 11 knots) are most often associated with west winds. By averaging the one-minute wind observations, calms were reduced from about 40 percent of hours to less than 10 percent.

Following the averaging procedure to compute hourly-average winds, as presented in the modeling protocol and subsequent correspondence, surface and upper air input files for AERMOD were prepared using the AERMET processor programs. The inputs to AERMET for surface characteristics (surface roughness, Albedo, and Bowen ratio) were determined using the AERSURFACE preprocessor. The following seasonal assignments for calendar months were made:

- Late autumn after frost and harvest, or winter with no snow: December, January, February, March
- Transitional spring (partial green coverage, short annuals): April, May
- Midsummer with lush vegetation: June, July, August, September
- Autumn with unharvested cropland: October, November

Long-term snow cover records for Poughkeepsie indicate that no winter months are characterized by continuous snow cover. The assignment for March was adjusted from spring (AERSURFACE default) to winter, because deciduous trees in this area remain

bare for most of March, and "short annuals" generally appear in late March to early April; similarly, September was assigned to summer, since in this area trees remain in leaf and "lush vegetation" persists through most of September.

To assess the representativeness of the airport data for the proposed model application, the land use distribution and estimated values of surface roughness (z_0), Albedo and Bowen ratio for the area surrounding the project site were compared to surface parameters for the area surrounding the airport. The predominant land use around the project site is forest and woody wetlands, while the predominant land uses around the airport are Low Intensity Residential, Commercial/Industrial/Transport, and Urban/Recreational Grasses. Surface roughness is consistently higher for the project site, while the two sites have comparable Albedo and Bowen ratio. To ensure that model predictions are based on meteorological inputs representative of the project site, AERMOD was applied with two sets of input meteorology, created using AERSURFACE parameters from both the airport and the project site. The modeling results show that maximum impacts were predicted using the surface parameters for the area surrounding the airport.

The effect of inversions (which can result as colder air settles in the valley, typically during the night under conditions with few clouds and light winds) can strongly influence near-surface (within 100-200 feet of the ground surface) conditions at the project site. Under these conditions, the combustion turbine stacks will be above the inversion layer, and the inversion will prevent the plumes from mixing down to ground level. KPOU data provide regionally representative wind speed and cloud cover observations. Dispersion conditions at plume height, 500 feet above the ground surface, are characterized well by observed conditions at KPOU.

5.1.5 Land Use

The potential effect of the project on air quality is dependent on the existing air quality characteristics of both land and air resources. Although the project is located on industrially zoned land that was formerly used for industrial purposes, the land use in the vicinity of the site is primarily rural.

Selection of the appropriate dispersion coefficients for air quality modeling is determined using the USEPA-preferred land use classification technique in 40 CFR 51, Appendix W (also known as the "Auer" technique). This classification technique involves assessing land use for Auer's categories within a 3-km radius of the site (Auer, 1978). Based on an evaluation of land use in the vicinity of the site, less than 10 percent of the area within a 3-km radius is urban, less than 10 percent is water, and more than 80 percent is rural.

Therefore, rural dispersion coefficients and mixing heights were confirmed to be appropriate for use in the modeling analysis.

5.1.6 Receptors

A receptor grid consisting of 1,507 receptors contained within five nested Cartesian grids was used for the analysis. The grid has a total coverage of 8 km by 8 km. Receptor spacing is as follows:

- Fence line receptors = 10 m spacing around the perimeter of the site, delineating the area to which the public will not have access;
- Inner grid = 25 m spacing out to a distance of 200 m;
- Second grid = 50 m spacing out to a distance of 400 m;
- Third grid = 100 m spacing from X = -2,400 to +800 m, and from Y = -800 to +1,600 m;
- Fourth grid = 500 m spacing out to a distance of 4 km; and
- Outer grid = 1,000 m spacing out to a distance of 8 km.

The 100 m receptor spacing was extended to provide higher resolution for the ridge of elevated terrain west of the project site.

Receptor elevations were assigned using the USEPA's AERMAP software tool (version 06341; USEPA, 2004b), which is designed to extract elevations from United States Geological Survey (USGS) National Elevation Dataset (NED) data at 1/3 arc second resolution in GeoTIFF format (USGS, 2002). This represents the highest resolution digital terrain data available from the USGS.

AERMAP, the terrain preprocessor for AERMOD, uses interpolation procedures to assign elevations to a receptor:

- For each receptor, the program searches through the NED data index files to determine the two profiles (longitudes or eastings) that straddle the receptor.
- For each of these two profiles, the program then searches through the nodes in the index file to determine which two rows (latitudes or northings) straddle the receptor.

- The program then reads the elevations for these four points. A two-dimensional distance-weighted interpolation is then used to determine the elevation at the receptor location based on the elevations at the four nodes determined above.

A summary of AERMAP files is provided on the compact disc in Appendix E. Using Lakes AERMOD View® software, a topographic map of the model region was generated from AERMAP elevations.

Surveyed topographic information was available for the site. The developed base elevation of the stack will be 436 feet msl, which includes consideration of site grading to 435 feet msl as provided by the design engineers. The nearest terrain at or above stack height is about 1.4 km (4,600 feet) to the west of the project site.

5.2 AERMOD Modeling Results

The following sections describe the results of modeling for the project to demonstrate compliance with regulatory requirements.

5.2.1 Modeling to Determine Worst-Case Operating Conditions

As described previously, modeling of the combined cycle units was conducted for a matrix of representative normal operating conditions covering a range of turbine loads and ambient temperatures. Cold and warm start scenarios were also modeled to assess potential peak short-term impacts. Operation of ancillary equipment was modeled consistent with anticipated usage; the black start generator, for example, will never operate at the same time as other emission sources, aside from periodic testing. The operating scenarios that were modeled to determine worst-case impacts are presented in Section 5.1. (As noted previously, modeling was separately performed using two sets of meteorological data, reflecting surface characteristics around the KPOU airport anemometer and around the project site, respectively. The airport data set consistently gave higher predictions, except for the fire pump. The results discussed below are for the airport data set, except as noted.)

5.2.2 Comparison with SILs

The scenarios that yielded the highest predicted impacts for each pollutant and averaging time were identified. The maximum predicted impacts from these scenarios were evaluated relative to SILs (shown on Table 5-1), to determine whether cumulative interactive modeling is warranted for any pollutant. The maximum predicted impacts for the project (including ancillary sources) are provided in Table 5-6. Table 5-6 also presents

the turbine operating scenario and year of meteorological data that resulted in the worst-case predicted impact.

Table 5-6: Maximum Predicted Impacts – Cricket Valley Energy

Pollutant	Averaging Time	Impact (µg/m^3)	Turbine Scenario[a]	Year	SIL	SMC
NO_2	Annual	0.41	100%, 59°F, DB plus black start generator	2009	1	14
	1-hr	93.8[b]	Warm start plus auxiliary boiler	2007	n/a	n/a
CO	1-hr	1,035	Cold start plus auxiliary boiler	2005	2,000	n/a
	8-hr	355.6	Cold start plus auxiliary boiler	2009	500	575
SO_2	3-hr	3.58	100%, 59°F, DB	2006	25	n/a
	24-hr	0.91	100%, 59°F, DB	2008	5	13
	Annual	0.08	100%, 59°F, DB plus black start generator	2009	1	n/a
PM_{10}	24-hr	3.90	100%, 105°F, DB	2008	5	10
	Annual	0.35	100%, 105°F, DB plus black start generator	2009	1	n/a
$PM_{2.5}$	24-hr	3.90	100%, 105°F, DB	2008	–[c]	–[d]
	Annual	0.35	100%, 105°F, DB plus black start generator	2009	–[e]	n/a

a. Turbine scenarios are defined by percent load, ambient temperature (°F) and duct burner operation. Annual average emissions for the black start generators assume 500 hours per year. Average 1-hour emissions from the fire pump assume a maximum of 35 minutes of operation in any hour.
b. Highest predicted 98th percentile maximum daily 1-hour average.
c. Pending (1.2 to 5 µg/m^3).
d. Pending (2.3 to 10 µg/m^3).
e. Pending (0.3 to 1 µg/m^3).

The results indicate that the maximum predicted project impacts are below the SILs for NO_2, CO and SO_2 and PM_{10}. A demonstration that maximum impacts are less than SILs for a given pollutant establishes that the project will not cause or contribute significantly to any violation of the corresponding NAAQS or PSD increment. If a major source or major modification is predicted to have maximum impacts that are below the SILs, then a cumulative impact modeling analysis that included other facilities is not required. By

showing that the maximum predicted project impacts are below the corresponding SILs for a given pollutant, the project is exempt from the requirements to conduct any additional modeling analyses to demonstrate compliance with NAAQS and/or Class II PSD increments for that pollutant.

The USEPA and NYSDEC have not established a SIL for $PM_{2.5}$. However, in the USEPA's comments on the modeling protocol, they recommended that the project use the strictest of the three SILs that were proposed for consideration for $PM_{2.5}$ (Federal Register p. 54112, September 21, 2007) in order to define the Significant Impact Area (SIA) and determine if interactive source modeling is required. Table 5-6 provides the range of the three proposed SILs currently under consideration. As indicated in Table 5-6, the maximum project impacts exceed the most stringent of the proposed SILs for 24-hour and annual average $PM_{2.5}$. Therefore, additional cumulative impact modeling to demonstrate compliance with NAAQS and PSD increments was required. This additional modeling is described in Section 5.2.4.

For the scenario with maximum predicted 24-hour impacts, 108 receptors have predicted $PM_{2.5}$ impacts above 1.2 $\mu g/m^3$; the largest source-receptor distance is 6.08 km. This distance, therefore, defines the SIA. Only three receptors have predicted maximum annual average impacts above 0.3 $\mu g/m^3$, and all are less than 3 km from the project. The spatial pattern of predicted maximum 24-hour $PM_{2.5}$ impacts in 2008 (the worst case year) is shown in Figure 5-2.

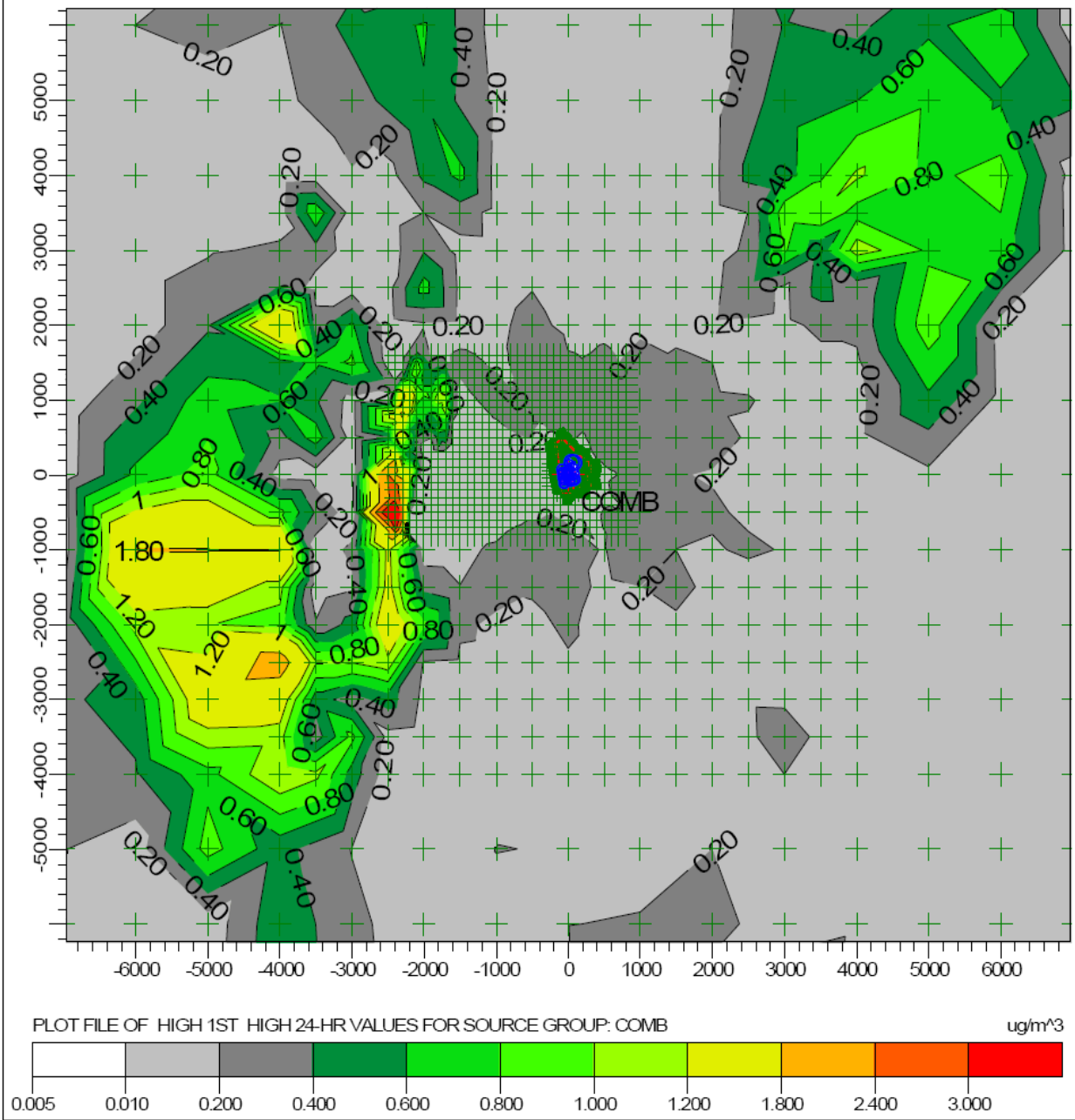
5.2.3 Comparison with Significant Monitoring Concentrations

Modeling to determine project impacts for comparison to SMCs was conducted as described above and in the modeling protocol. If a new major source or major modification can demonstrate that impacts from a project are less than the SMCs (presented in Table 5-1) then a source can be exempted from preconstruction monitoring requirements that might otherwise apply under the PSD program.

Table 5-6 provides a summary of maximum predicted project impacts relative to the SMCs. The USEPA and NYSDEC have not established an SMC for $PM_{2.5}$. However, in the USEPA's comments on the modeling protocol, they requested that the project compare project impacts to the most stringent of the three SMC values that were proposed

PROJECT TITLE:

Maximum PM2.5 24-Hour Average Impact
Year: 2008



COMMENTS:	SOURCES:	COMPANY NAME:
100 percent load, 105 degrees F, with Duct Burning. Proposed SIL = 1.2 ug/m3	1	Cricket Valley Energy Center, LLC
	RECEPTORS: 1507	MODELER: ARCADIS
	OUTPUT TYPE: Concentration	SCALE: 1:85,000 (0 – 3 km)
	MAX: 3.89274 ug/m^3	DATE: 3/17/2010

ARCADIS

CRICKET VALLEY ENERGY

FIGURE 5-2
$PM_{2.5}$ 24-Hour Impacts

Dutchess County, New York

(Federal Register p.54112, September 21, 2007) for $PM_{2.5}$. Table 5-1 presents the range of SMC values proposed by the USEPA for $PM_{2.5}$.

As indicated above, maximum predicted project impacts are less than the SMCs for NO_2, CO, SO_2 and PM_{10}. The maximum predicted project impact exceeds the most stringent SMC proposed for $PM_{2.5}$. Since peak predicted impacts exceed the lowest candidate SMC value for $PM_{2.5}$, a waiver from preconstruction monitoring was requested from USEPA Region 2 on February 26, 2010. The waiver request indicates that measured $PM_{2.5}$ concentrations from the existing monitoring stations at Mohawk Mountain (090050005) and Thomaston, Connecticut (090050004) are representative of conditions in the project vicinity, based on geographic proximity and comparable population density. Although a monitoring location in Newburgh, New York at a comparable distance was also identified, the significantly higher population density of the Newburgh location was determined to be less characteristic of the project area than the two Connecticut locations. All three monitors provide at least three years of $PM_{2.5}$ data collected using the Federal Reference Method. The modest impacts predicted from the project, and the availability of representative data from existing monitors, provide a sound technical basis for a waiver from preconstruction monitoring. A copy of the waiver request and USEPA's approval of the Thomaston, Connecticut monitoring site as representative are provided in Appendix C.

Based on the most current three years of air quality data from the approved monitor, the estimated $PM_{2.5}$ background concentrations are 9.5 $\mu g/m^3$ (3-year average of annual average concentrations) and 26 $\mu g/m^3$ (3-year average of 98th percentile 24-hour average concentrations).

5.2.4 Cumulative Impact Modeling for $PM_{2.5}$

Cumulative impact modeling was performed to assess the impacts of the project plus other sources of $PM_{2.5}$ in the surrounding region, including all permitted sources of $PM_{2.5}$ within the SIA and all identified major sources of $PM_{2.5}$ to a distance of 50 km beyond the SIA. Cumulative impacts were predicted using the worst-case operating scenario for the project (Case 1: turbines at 100% load, 105°F with duct burning), with all other sources at maximum permitted emission rates.

The search distance was 56 km from the project origin, since the farthest receptor with predicted 24-hour average project impact is 6.1 km from the project. The SIA is located entirely within Dutchess County; the 56-km search area extends into Connecticut and Massachusetts. Both Connecticut Department of Environmental Protection and the Massachusetts Department of Environmental Protection confirmed that there are no major sources of PM emissions within 56 km of the project located in Connecticut or

Massachusetts (correspondence is provided in Appendix C). The NYSDEC provided an inventory of all permitted sources of particulate matter within 60 km of the project. From the data provided, three permitted facilities were identified within the SIA, plus six major sources of $PM_{2.5}$ located within 56 km of the project. No PSD increment-consuming sources of $PM_{2.5}$ within 56 km of the project were identified.

The NYSDEC provided information for each identified facility which included location coordinates, emission points/sources, stack parameters and, for some sources, emission rates. However, not all of the required data was provided in this NYSDEC information. CVE worked with NYSDEC to fill the remaining data gaps, which involved developing estimates of potential $PM_{2.5}$ emission rates from the identified sources and developing estimates for missing stack parameters. The emissions inventory information is documented in Appendix D.

Impacts were predicted for all receptors located within the SIA. The highest impacts predicted across this region are dominated by other facilities, and occur at receptor locations where the project has no significant impact (project impacts less than SILs). The predicted impacts for all of the receptors in the SIA are documented in the model output files provided in Appendix E.

The peak impacts predicted at receptors where the project has a predicted significant impact are summarized in Table 5-7. Predicted cumulative impacts demonstrate compliance with applicable increments and ambient standards. Predicted PSD increment consumption (from the project alone) is below the range of annual and 24-hour Class II increments proposed by USEPA. The predicted highest annual concentration from all sources combined, plus ambient background, is below the annual NAAQS of 15 $\mu g/m^3$. The predicted highest 98th percentile (8th highest) concentration from all sources combined, plus ambient background, is below the 24-hour NAAQS of 35 $\mu g/m^3$. As outlined in the modeling protocol (Appendix C), comparisons are based on the highest value for any one year, rather than the 3-year average, because the modeling period does not cover five full years.

The results of the cumulative modeling demonstrate that the project will not significantly contribute to a violation of the $PM_{2.5}$ NAAQS.

Table 5-7. Peak Predicted $PM_{2.5}$ Cumulative Impacts

		2005	2006	2007	2008	2009	Maximum ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Annual											
CVE	Highest	0.228	0.206	0.313	0.332	0.345	0.345	4 to 5[a]			
All	Highest	0.602	0.652	0.845	0.855	0.867	0.867		9.5	10.4	15.0[b]
24-Hour											
CVE	Highest	3.53	2.56	2.97	3.89	2.55					
CVE	High 2nd high	2.51	2.47	2.85	2.60	2.28					
CVE	High 8th high	1.40	1.45	1.54	1.90	1.61	1.90	9[c]			
All	Highest	3.98	4.85	8.56	4.78	7.55					
All	High 2nd high	3.25	3.56	6.59	4.63	5.88					
All	High 8th high	2.14	2.42	3.67	3.10	3.89	3.89		26	29.9	35.0[d]

a. Range of annual PSD increment values for $PM_{2.5}$ for Class II Areas, proposed by EPA September 21, 2007.

b. Annual standard based on 3-year average of annual concentrations.

c. 24-hour average PSD increment value for $PM_{2.5}$ for Class II Areas, proposed by EPA September 21, 2007

d. 24-hour standard based on 3-year average of 98th percentile concentration values.

5.2.5 Air Toxic Impacts

An air quality modeling analysis was conducted for potential emissions of non-criteria pollutants from the turbines, auxiliary boiler, emergency fire pump and black-start generators. Each source was modeled individually using a unit emission rate, and impacts for particular pollutants were obtained by scaling with the appropriate emission rate. Maximum impacts from each source were then added together to provide estimates of total impacts for each pollutant. These estimates of total project impacts are conservative since the maximum predicted impacts from individual sources will not necessarily occur at the same time or location.

The predicted project impacts were then compared to the health-effect based annual guideline concentrations (AGCs) and short-term guideline concentrations (SGCs) as defined in NYSDEC Policy DAR-1 (NYSDEC, 1997). The AGCs and SGCs used in the analysis are those most recently revised in September 2007.

Potential non-criteria pollutant emissions from the operation of the combustion turbines and ancillary equipment were estimated using AP-42 emission factors with the following exceptions. Emissions of formaldehyde from the CTGs were estimated using an emission factor from a California Air Resource Board (CARB) database. The California Air Toxics Emission Factor (CATEF) database contains air toxics emission factors calculated from source test data collected for California's Air Toxics Hot Spots Program (CARB, 1996). Emissions of hexane from the duct burner and the auxiliary boiler were estimated using an emission factor from the Ventura County Air Pollution Control District (VCAPCD, 2001). In both cases, the AP-42 emission factors had a very low emission factor rating and were not considered representative of the proposed equipment. The CARB and VCAPCD emission factors are considered more appropriate for the advanced technology of the F-Class combined cycle turbines. Tables 5-8 and 5-9 present a summary of the maximum predicted non-criteria pollutant impacts relative to the associated AGC and SGC values. Predicted impacts of non-criteria pollutants are all below the guideline concentrations.

5.3 Additional Impact Analyses

Additional impacts analyses consist of: an accidental release assessment of impacts from a hypothetical spill of the ammonia storage tank; an assessment of potential acidic deposition on sensitive receptors; an assessment of impacts resulting from the project on community growth; an Environmental Justice Analysis; an assessment of visibility impairment; and impacts to soils and vegetation. These analyses are presented in the sections below.

Table 5-8: Maximum Predicted Non-Criteria Pollutant Annual Impacts – Cricket Valley Energy

Air Toxic Compound	Maximum Projected Impacts (µg/m^3)					AGC (µg/m^3)
	CTGs and DB	Auxiliary Boiler	Fire Pump	Black Start Generators	Total	
1,3-Butadiene	2.09E-05	0.00E+00	1.66E-05	0.00E+00	3.75E-05	3.30E-02
2-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.10E+00
Acetaldehyde	1.94E-03	0.00E+00	3.26E-04	1.03E-05	2.28E-03	4.50E-01
Acrolein	3.11E-04	0.00E+00	3.94E-05	3.23E-06	3.53E-04	2.00E-02
Anthracene	3.18E-08	1.51E-08	7.96E-07	5.05E-06	5.89E-06	2.00E-02
Ammonia	3.88E-01	0.00E+00	0.00E+00	0.00E+00	3.88E-01	1.00E+02
Benzene	6.10E-04	1.32E-05	3.97E-04	3.18E-04	1.34E-03	1.30E-01
Benzo(a)anthracene	2.38E-08	1.13E-08	7.15E-07	2.55E-07	1.01E-06	2.00E-02
Benzo(a)pyrene	1.59E-08	7.55E-09	0.00E+00	1.05E-07	1.29E-07	9.10E-04
Butane	2.78E-02	1.32E-02	0.00E+00	0.00E+00	4.10E-02	5.70E+04
Chrysene	2.38E-08	1.13E-08	1.50E-07	6.28E-07	8.13E-07	2.00E-02
Dibenz(a,h)anthracene	1.59E-08	7.55E-09	2.48E-07	1.42E-07	4.13E-07	2.00E-02
Ethane	4.11E-02	1.95E-02	0.00E+00	0.00E+00	6.06E-02	2.90E+03
Ethylbenzene	1.55E-03	0.00E+00	0.00E+00	0.00E+00	1.55E-03	1.00E+03
Formaldehyde	6.33E-03	4.72E-04	5.02E-04	3.24E-05	7.34E-03	6.00E-02
Hexane	6.09E-05	2.90E-05	0.00E+00	0.00E+00	8.99E-05	7.00E+02
Naphthalene	7.12E-05	3.84E-06	3.61E-05	5.33E-05	1.64E-04	3.00E+00
Pentane	3.44E-02	1.64E-02	0.00E+00	0.00E+00	5.08E-02	4.20E+03
Phenanthrene	2.25E-07	1.07E-07	1.25E-05	1.67E-05	2.96E-05	2.00E-02
Polycyclic aromatic hydrocarbons	1.08E-04	4.93E-07	7.15E-05	8.70E-05	2.67E-04	2.00E-02
Propane	2.12E-02	1.01E-02	0.00E+00	0.00E+00	3.13E-02	4.30E+04
Propylene	0.00E+00	0.00E+00	1.10E-04	1.14E-03	1.25E-03	3.00E+03
Propylene Oxide	1.41E-03	0.00E+00	0.00E+00	0.00E+00	1.41E-03	2.70E-01
Pyrene	6.62E-08	3.15E-08	2.03E-06	1.52E-06	3.65E-06	2.00E-02
Sulfuric Acid	1.84E-02	7.50E-04	1.32E-05	1.27E-05	1.92E-02	1.00E+00
Toluene	6.35E-03	2.14E-05	1.74E-04	1.15E-04	6.66E-03	5.00E+03
Xylene (Total)	3.11E-03	0.00E+00	1.21E-04	7.92E-05	3.31E-03	1.00E+02
Arsenic	2.65E-06	1.26E-06	0.00E+00	0.00E+00	3.91E-06	2.30E-04
Barium	5.83E-05	2.77E-05	0.00E+00	0.00E+00	8.60E-05	1.20E+00
Beryllium	1.59E-07	7.55E-08	0.00E+00	0.00E+00	2.34E-07	4.20E-04
Cadmium	1.46E-05	6.92E-06	0.00E+00	0.00E+00	2.15E-05	2.40E-04
Chromium	1.85E-05	8.81E-06	0.00E+00	0.00E+00	2.74E-05	1.20E+00
Cobalt	1.11E-06	5.29E-07	0.00E+00	0.00E+00	1.64E-06	1.00E-03
Copper	1.13E-05	5.35E-06	0.00E+00	0.00E+00	1.66E-05	2.00E-02
Manganese	5.03E-06	2.39E-06	0.00E+00	0.00E+00	7.43E-06	5.00E-02
Mercury	3.44E-06	1.64E-06	0.00E+00	0.00E+00	5.08E-06	3.00E-01
Molybdenum	1.46E-05	6.92E-06	0.00E+00	0.00E+00	2.15E-05	1.20E+00
Nickel	2.78E-05	1.32E-05	0.00E+00	0.00E+00	4.10E-05	4.20E-03
Selenium	3.18E-07	1.51E-07	0.00E+00	0.00E+00	4.69E-07	2.00E+01
Vanadium	3.05E-05	1.45E-05	0.00E+00	0.00E+00	4.49E-05	2.00E-01
Zinc	3.84E-04	1.83E-04	0.00E+00	0.00E+00	5.67E-04	4.50E+01

Table 5-9: Maximum Predicted Non-Criteria Pollutant Short-Term Impacts – Cricket Valley Energy

Air Toxic Compound	Maximum Projected Impacts (µg/m^3)					SGC (µg/m^3)
	CTGs and DB	Auxiliary Boiler	Fire Pump	Black Start Generators	Total	
1,3-Butadiene	1.61E-03	0.00E+00	1.25E-02	0.00E+00	1.42E-02	
2-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Acetaldehyde	1.50E-01	0.00E+00	2.46E-01	1.01E-02	4.06E-01	4.50E+03
Acrolein	2.40E-02	0.00E+00	2.97E-02	3.16E-03	5.69E-02	1.90E-01
Anthracene	2.46E-06	1.37E-06	6.00E-04	4.94E-03	5.54E-03	
Ammonia	3.00E+01	0.00E+00	0.00E+00	0.00E+00	3.00E+01	2.40E+03
Benzene	4.72E-02	1.20E-03	2.99E-01	3.12E-01	6.59E-01	1.30E+03
Benzo(a)anthracene	1.84E-06	1.03E-06	5.39E-04	2.50E-04	7.92E-04	
Benzo(a)pyrene	1.23E-06	6.86E-07	0.00E+00	1.03E-04	1.05E-04	
Butane	2.15E+00	1.20E+00	0.00E+00	0.00E+00	3.35E+00	
Chrysene	1.84E-06	1.03E-06	1.13E-04	6.14E-04	7.31E-04	
Dibenz(a,h)anthracene	1.23E-06	6.86E-07	1.87E-04	1.39E-04	3.28E-04	
Ethane	3.17E+00	1.77E+00	0.00E+00	0.00E+00	4.95E+00	
Ethylbenzene	1.20E-01	0.00E+00	0.00E+00	0.00E+00	1.20E-01	5.40E+04
Formaldehyde	4.89E-01	4.29E-02	3.79E-01	3.17E-02	9.43E-01	3.00E+01
Hexane	4.71E-03	2.63E-03	0.00E+00	0.00E+00	7.34E-03	
Naphthalene	5.50E-03	3.49E-04	2.72E-02	5.22E-02	8.53E-02	7.90E+03
Pentane	2.66E+00	1.49E+00	0.00E+00	0.00E+00	4.15E+00	
Phenanthrene	1.74E-05	9.72E-06	9.43E-03	1.64E-02	2.58E-02	
Polycyclic aromatic hydrocarbons	8.33E-03	4.48E-05	5.39E-02	8.51E-02	1.47E-01	
Propane	1.64E+00	9.15E-01	0.00E+00	0.00E+00	2.55E+00	
Propylene	0.00E+00	0.00E+00	8.28E-02	1.12E+00	1.20E+00	
Propylene Oxide	1.09E-01	0.00E+00	0.00E+00	0.00E+00	1.09E-01	3.10E+03
Pyrene	5.12E-06	2.86E-06	1.53E-03	1.49E-03	3.03E-03	
Sulfuric Acid	1.42E+00	6.81E-02	9.95E-03	1.25E-02	1.51E+00	1.20E+02
Toluene	4.91E-01	1.94E-03	1.31E-01	1.13E-01	7.37E-01	3.70E+04
Xylene (Total)	2.40E-01	0.00E+00	9.15E-02	7.75E-02	4.09E-01	4.30E+03
Arsenic	2.05E-04	1.14E-04	0.00E+00	0.00E+00	3.19E-04	
Barium	4.50E-03	2.52E-03	0.00E+00	0.00E+00	7.02E-03	
Beryllium	1.23E-05	6.86E-06	0.00E+00	0.00E+00	1.91E-05	1.00E+00
Cadmium	1.13E-03	6.29E-04	0.00E+00	0.00E+00	1.76E-03	
Chromium	1.43E-03	8.00E-04	0.00E+00	0.00E+00	2.23E-03	
Cobalt	8.60E-05	4.80E-05	0.00E+00	0.00E+00	1.34E-04	
Copper	8.70E-04	4.86E-04	0.00E+00	0.00E+00	1.36E-03	1.00E+02
Manganese	3.89E-04	2.17E-04	0.00E+00	0.00E+00	6.06E-04	
Mercury	2.66E-04	1.49E-04	0.00E+00	0.00E+00	4.15E-04	1.80E+00
Molybdenum	1.13E-03	6.29E-04	0.00E+00	0.00E+00	1.76E-03	
Nickel	2.15E-03	1.20E-03	0.00E+00	0.00E+00	3.35E-03	6.00E+00
Selenium	2.46E-05	1.37E-05	0.00E+00	0.00E+00	3.83E-05	
Vanadium	2.35E-03	1.31E-03	0.00E+00	0.00E+00	3.67E-03	
Zinc	2.97E-02	1.66E-02	0.00E+00	0.00E+00	4.63E-02	

5.3.1 Hypothetical Aqueous Ammonia Release

Ammonia is regulated as a toxic air pollutant. The NH_3 for the SCR system will be stored as an aqueous solution (19%). A dispersion modeling analysis was performed to assess the potential hazards of air emissions from an accidental spill from an ammonia storage tank. The storage tanks will be surrounded by a reinforced concrete containment dike, filled with plastic balls to reduce evaporation. The USEPA model ALOHA (Areal Locations of Hazardous Atmospheres) is designed especially for simulating chemical releases, as a tool for emergency planning and training. A hypothetical worst-case spill scenario was modeled, assuming the entire contents of one storage tank released into the 50 foot by 25 foot diked containment area.

Two sets of dispersion conditions were modeled: a “worst case” scenario with peak temperature (90°F) and light winds (1 m/s), and a “typical daytime” scenario (70°F, 3 m/s). For both scenarios, the plastic balls were assumed to reduce the evaporation rate from the ammonia “puddle” by 90 percent. The ammonia emission rates predicted by ALOHA are 108 lb/hr, for the “worst case” scenario, and 172 lb/hr, for the “typical” scenario. (Estimated emissions increase with wind speed, but impacts decrease due to greater dilution.)

For each scenario, ALOHA provides predicted distances for three Acute Exposure Guideline Levels (AEGLs). The AEGLs represent benchmark 60-minute concentrations determined by the National Research Council that reflect different levels of potential hazard. AEGL-3 represents the airborne concentration at which the general population, including susceptible individuals, could experience life-threatening health effects or death. For ammonia, the 60-minute AEGL-3 is 1,100 parts per million (ppm). The distance to AEGL-3 for both scenarios is less than 10 m (ALOHA predictions are unreliable at this distance).

AEGL-2 represents the airborne concentration at which the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape. For ammonia, the 60-min AEGL-2 is 160 ppm. The predicted distance to AEGL-2 is 38-39 yards, outside the containment area, but about half the distance to the nearest fence line. These results indicate that emergency response measures should be considered to protect anyone working within this potential hazard zone, but no off-site individuals would be at risk in the event of the worst-case release.

AEGL-1 represents the concentration above which the general population, including susceptible individuals, could experience discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and

reversible upon cessation of exposure. The predicted distance range for AEGL-1 is 99-109 yards; this impact area extends offsite by 20 to 30 yards.

In summary, the ALOHA predictions indicate that potential impacts would remain well below AEGL-2 at all offsite locations; the AEGL-1 results indicate that a worst-case release scenario could produce temporary discomfort or irritation for a distance of about 20 to 30 yards from the site.

5.3.2 Acidic Deposition

In accordance with the New York State Acid Deposition Control Act, a "Source Specific Acidic Deposition Impacts" analysis was conducted to provide quantification of the project's contribution to the New York State total deposition of sulfates and nitrates at 18 defined receptors in New York State, New England, and Canada.

The analysis followed the methodology presented in the March 4, 1993 memorandum from Leon Sedefian of NYSDEC to Impact Assessment and Meteorology Staff (NYSDEC, 1993). The basic elements of the analysis are as follows:

1. Select a representative source that best represents the proposed (new) source. If a representative source cannot be found, then select the New York county in which the project is located.

2. Reference the tables contained in the memorandum, determine the proposed source NO_x and SO_2 impacts by scaling the reference source or county NO_x and SO_2 impacts at each of the 18 receptors by the ratio of the new source NO_x and SO_2 emissions over the reference source or county NO_x and SO_2 emissions.

3. Calculate the percentage contribution of new source NO_x and SO_2 impacts to the total impacts determined for each of the eighteen receptors from all sources.

The results of the analysis are presented in Table 5-10. The reference source used in the analysis was Dutchess County, with 4,374 tpy of SO_2 emissions and 6,482 tpy of NO_x emissions. New source emissions of 50.1 tpy of SO_2 and 276.1 tpy of NO_x were scaled as described above, and percent contributions of total values were determined. Given the firing of natural gas and the use of LAER NO_x control, the new facility's contribution to the New York State total deposition of sulfates and nitrates at each of the 18 receptors are all below 0.032 percent.

Table 5-10: Acid Deposition Impacts

Receptor	Receptor SO_2 Impact ($g/m^2/yr$)[a]				Receptor NO_x Impact (kg/Ha/yr)[b]			
	Reference Source	All NY Sources	Proposed Source	% of All NY	Reference Source	All NY Sources	Proposed Source	% of All NY
Whiteface	0.000323	0.143425	0.00000370	0.0026%	0.000323	4.136114	0.00001376	0.0003%
W. Adirondacks	0.000332	0.201734	0.00000380	0.0019%	0.000332	5.179167	0.00001414	0.0003%
Catskills	0.001961	0.263758	0.00002246	0.0085%	0.001961	7.107259	0.00008353	0.0012%
West Point	0.003102	0.332539	0.00003553	0.0107%	0.003102	11.260204	0.00013213	0.0012%
Chautauqua	0.000145	0.178049	0.00000166	0.0009%	0.000145	1.581787	0.00000618	0.0004%
Brookhaven	0.001895	0.671944	0.00002171	0.0032%	0.001895	18.500769	0.00008072	0.0004%
Bennett's Bridge	0.000310	0.409691	0.00000355	0.0009%	0.000310	7.170561	0.00001320	0.0002%
Green Mountains	0.000359	0.121215	0.00000411	0.0034%	0.000359	3.440833	0.00001529	0.0004%
Berkshires	0.002530	0.329630	0.00002898	0.0088%	0.002530	8.233134	0.00010777	0.0013%
Connecticut	0.007858	0.291966	0.00009001	0.0308%	0.007858	9.387031	0.00033471	0.0036%
Muskoka	0.000084	0.033580	0.00000096	0.0029%	0.000084	0.589719	0.00000358	0.0006%
S. New Hampshire	0.000454	0.065597	0.00000520	0.0079%	0.000454	1.366437	0.00001934	0.0014%
New Hampshire	0.000360	0.090665	0.00000412	0.0046%	0.000360	2.380087	0.00001533	0.0006%
SW Quebec	0.000061	0.016791	0.00000070	0.0041%	0.000061	0.499722	0.00000260	0.0005%
S Quebec	0.000109	0.024986	0.00000125	0.0050%	0.000109	1.015349	0.00000464	0.0005%
NE Quebec	0.000046	0.008503	0.00000053	0.0062%	0.000046	0.368393	0.00000196	0.0005%
Newfoundland	0.000076	0.012184	0.00000087	0.0071%	0.000076	0.243350	0.00000324	0.0013%
Hubbard Brook	0.000588	0.138607	0.00000673	0.0049%	0.000588	3.273920	0.00002505	0.0008%

a. grams per square meter per year.
b. kilograms per hectare per year.

Local impacts from acid precipitation formed due to the proposed project are highly unlikely because the processes that convert SO_2 and NO_x gases into their acid counterparts can take several days. During this time, the pollutants would have traveled hundreds of miles from the original source. Thus, the emissions from the proposed project would have little or no contribution to the acidity of the precipitation that falls on the surrounding area. Furthermore, impacts at greater distances would be negligible due to the wide dispersion of these gases.

5.3.3 Impact on Industrial, Commercial and Residential Growth

The project is proposed to be located at a previously developed parcel that is industrially zoned and has been used for industrial purposes for many years. Natural gas and electrical interconnections will occur adjacent to the parcel, and all elements of the proposed facility will be located on the site, minimizing potential off-site impacts to other residential, commercial and industrial uses.

CVE anticipates that 25-30 new employees will be hired to operate the proposed facility, working in shifts, which will increase long-term jobs within the community. There will be additional short-term local employment during the construction phase of the proposed project. Short-term employment is expected to reach 750 workers over a five month period in the middle of the 36-month construction effort.

5.3.3.1 Work Force

During the anticipated construction period associated with the proposed project, the majority of construction jobs will be filled by local area workers. Due to the large available labor pool in the region, supplemental short-term labor is not likely to require a significant influx of temporary workers relocating to the Dutchess County area during the construction phase. CVE anticipates that the additional temporary workers during the construction phase will have minimal effect on the environment, but will have a positive effect on the local economy.

For daily operation and maintenance of the project, CVE anticipates that the required full time staff will be mostly comprised of nearby Dutchess County residents, and the project will not result in a significant increase in residential housing demand.

During the construction phase of the project, there will be a temporary increase in truck traffic. The project's location on a major route (State Route 22) provides good access. Appropriate measures (e.g., manual police control) will be implemented to prevent significant impacts to existing traffic during the construction period. Once in operation, it is

anticipated that less than 25 trucks per week will be needed to provide the facility with supplies. The potential for traffic impact would be insignificant.

A significant impact on local municipal services is also not anticipated. Safety and hazard protection will be addressed with on-site systems and services. During both the temporary construction period and facility operation, CVE will work closely with the local community to ensure that significant impact to services does not occur.

The resulting increase in employment is not anticipated to significantly impact the air quality of the area because the increase represents a small fraction of the regional population. Thus, construction and operation of the proposed project will have a positive impact on the work force in Dutchess County and the surrounding areas, but its net impact on the environment and to residential resource consumption is anticipated to be insignificant.

5.3.3.2 Industry

The project will add a new industry to the area that will provide for substantial economic benefit through primary and secondary effects. However, because much of the growth from the project will be filled by local labor and resources, no new influx of commercial or industrial development that would increase air emissions is anticipated. In addition, the project is intended to support existing energy needs throughout the regional electricity grid area; CVE does not anticipate any significant corresponding commercial or industrial growth as a result of the additional energy contribution of the project. Because the commercial and industrial growth resulting from the project is anticipated to be minimal, air quality impacts resulting from such commercial and industrial growth are also expected to be minimal.

5.3.4 Environmental Justice

The intent of this environmental justice (EJ) analysis is to determine whether the construction and operation of the proposed project would have a significant adverse and disproportionate affect on an “environmental justice community.” The concept of performing an EJ analysis for the project is related to the issuance of Executive Order 12898, entitled “Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations” (February 11, 1994). The order requires federal agencies to consider disproportionate adverse human health and environmental impacts on minority and low-income populations. The methodology used in preparing this analysis is based upon the NYSDEC EJ Policy (CP-29, Environmental Justice and Permitting, March 19, 2003) and federal guidance documents and online tools available from USEPA Region 2.

The NYSDEC EJ Policy was issued on March 19, 2003. This report identified guidelines for incorporating consideration of environmental justice into permit review, State Environmental Quality Review Act (SEQRA) procedures, and some components of the NYSDEC's enforcement and public participation programs. Applications for a new permit for a project classified as a major project (as defined by 6 NYCRR §621.2 and §621.4), including a Part 201 permit, are required to conduct screening to determine the applicability of further EJ impact review.

The NYSDEC EJ Policy prescribes a two-step methodology for conducting the preliminary screening analysis:

- Determine whether the proposed action is in or near a minority or low-income community and identify potential environmental impacts

- Determine whether impacts are likely to adversely affect a potential EJ community

The focus of an EJ analysis is the determination of whether the construction and operation of a proposed project would have both adverse and disproportionate impacts on an EJ community. This screening procedure was followed to evaluate the project's consistency with state and federal EJ policies.

5.3.4.1 Identification of Environmental Justice Communities

NYSDEC has identified potential EJAs of concern relating to impacts on communities or facilities housing disadvantaged population groups. The NYSDEC EJ Policy establishes the New York State urban EJ threshold for minority population at 51.1 percent and the New York State EJ threshold for low-income population at 23.59 percent. The NYSDEC map of potential EJA areas in Dutchess County was reviewed; the only potential EJA in the eastern portion of Dutchess County is the location of a former state hospital and detention center (Harlem Valley). That property has been sold for private development, and, as described in more detail below, no longer houses the disadvantaged population that resulted in the EJA classification.

The USEPA Region 2 Environmental Justice Geographic Assessment Tool located one Community of Concern within 10 miles of the project site. According to the assessment tool, Census Tract 6200 showed a 58.82 percent minority population. The tract is located approximately 2.5 miles south of the proposed site, also reflecting the former state facility, as discussed below.

A map of potential EJ areas considered for the project, based upon both NYSDEC and USEPA data, is provided in Figure 5-3.

The 2000 Census data for Census Tract 6200 indicated that of a total population of 213 people, 76 were identified as white alone, 131 as black or African-American alone, 1 as Asian alone, 2 as some other race alone, and 3 as two or more races. Of the total population in the tract, about 81 percent (172 people) were housed in an institutionalized population, with a breakdown of 17 in mental/psychiatric wards and 155 in training schools for juvenile delinquents. The institutionalized population consisted of 39 people identified as white alone, 127 as black or African-American alone, 1 as Asian alone, 2 as some other race alone, and 3 as two or more races. Accordingly, the institutionalized population comprised 133 of the 137-person non-white population, or 97 percent.

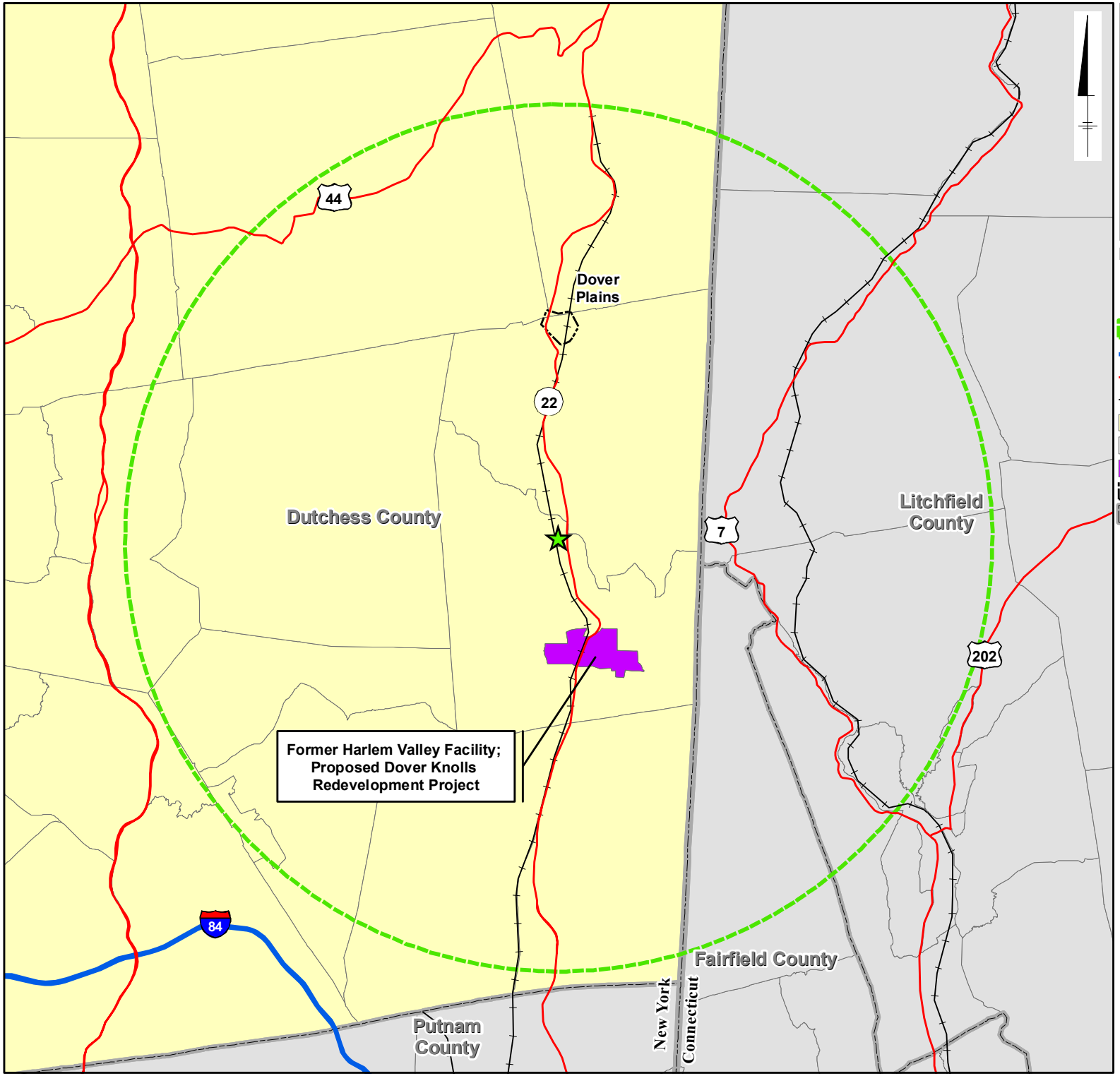
The only institutionalized population in the census tract resided at the Harlem Valley Secure Center for Juveniles and Department of Correction Housing. On March 28, 2004, the Office of Children and Family Services closed the juvenile detention center, although the March 2009 Environmental Impact Statement for the Dover Knolls project described temporary housing for New York State Department of Correction officers in three of the buildings in the southern portion of the site. Without the large minority population once housed at the facility, this census tract would no longer meet the criteria to be considered a Community of Concern under USEPA Region 2 Guidelines for Conducting Environmental Justice Analyses.

As such, there are no EJAs of concern that will be impacted by the proposed project.

5.3.4.2 Outreach and Impact

CVE has a strong commitment to community outreach and information sharing about the project. Irrespective of the characteristics of the surrounding community, CVE has provided information locally to allow for the greatest possible number of citizens to participate in project review. In addition to the formal regulatory requirements, CVE has held two public information sessions, and is hosting a series of community working group meetings that focus on particular topics of general interest, including air quality. Initial meetings have focused on general project background and information about each topic. As the permitting process progresses, additional information will be shared and participants will have the opportunity for focused attention to any concerns.

As outlined in this application, project impacts are consistent with ambient air quality standards, and with the exception of $PM_{2.5}$, are below SILs. This indicates that the air quality impact of the project is protective of human health and the environment.



Legend

- Cricket Valley Energy Center N41.676168/W73.580618
- Cricket Valley Energy Center - 10 mile Radius
- Primary Limited Access or Interstate
- Primary US or State Highway
- Railroads
- Dutchess County, NY - Census 2000 Tracts
- Census 2000 Tracts
- Potential Environmental Justice Area
- Municipal Boundary
- County Boundary

0 2.5 5
Miles

Source:
- U. S. Census Bureau, Census 2000
- Base data courtesy of ESRI Street Map Pro

ARCADIS

CRICKET VALLEY ENERGY CENTER

FIGURE 5-3

POTENTIAL ENVIRONMENTAL JUSTICE AREAS

Dutchess County, New York

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5.3.5 Visibility Impairment Analysis

There are no PSD Class I areas within 100 km of the proposed project site. The closest designated PSD Class I area is the Lye Brook Wilderness Area, located 167 km north-northeast of the site in southern Vermont.

Based on the level of proposed emissions from the project and the distances to the nearest PSD Class I area, the project is not required to complete PSD Class I impact modeling. CVE has consulted with the FLM from the nearest PSD Class I area who confirmed that the project would be too distant to warrant a Class I impact analysis. Correspondence from the FLM is provided in Appendix C.

In response to comments from NYSDEC and USEPA Region 2, a visibility impact analysis was conducted for James Baird State Park and for Catskill State Park. Class II areas are not subject to the stringent protection that is provided to Class I areas.

James Baird State Park, located 17 km west of the project site, is the State Park nearest to the project. This park is primarily used for golfing, with a picnic area, camping and hiking; there is no nearby elevated terrain. Potential impacts on visibility due to project emissions were assessed, based on viewsheds within the park, with a “sky” background. A Level-1 screening analysis for impacts on local visibility was performed using the USEPA VISCREEN (Version 1.01) model for the maximum emissions operating scenario (Case 3 – 100% load at 59°F, with duct burning). Predicted impacts were assessed for delta E (brightness) and Contrast (color shift). Predicted impacts are below the Level 1 Screening thresholds, as summarized in Table 5-11.

A Level-1 screening analysis for impacts on local visibility was also performed for Catskill State Park using VISCREEN. This park, located 50 km west of the project, has elevated terrain and scenic vistas, both within and outside of the park. Predicted impacts for Catskill State Park are below the Level I screening thresholds, with both “sky” and “terrain” background, for views both within and outside the park boundaries.

Table 5-11. Predicted Visual Impacts for James Baird and Catskill State Parks

Location	Background	Delta E (Brightness)		Contrast (Color Shift)	
James Baird State Park – Visual Impacts Inside Park		**Criteria**	**Plume**	**Criteria**	**Plume**
	Sky	2.00	1.94	0.05	0.024
	Terrain	n/a	n/a	n/a	n/a
Catskill State Park – Visual Impacts Inside Park		**Criteria**	**Plume**	**Criteria**	**Plume**
	Sky	2.00	0.682	0.05	0.008
	Terrain	2.00	0.499	0.05	0.006
Catskill State Park – Visual Impacts Outside Park		**Criteria**	**Plume**	**Criteria**	**Plume**
	Sky	2.00	0.829	0.05	0.009
	Terrain	2.00	0.644	0.05	0.008

5.3.6 Soils and Vegetation Analysis

PSD review requirements include an analysis to determine the potential air quality impacts on sensitive vegetation types that may be present in the vicinity of a proposed project. Ambient air quality screening levels are provided for soils and vegetation in USEPA guidance (USEPA, 1980). USEPA has not published screening values for PM_{10} (or $PM_{2.5}$). Table 5-12 summarizes the maximum predicted project impacts compared to the relevant screening levels.

Maximum predicted concentrations for SO_2 and NO_2 are below the SILs established by USEPA, and are less than 1 percent of the USEPA soil and vegetation screening levels. USEPA has not established screening levels for impacts on vegetation for other criteria pollutants. The project impacts are below SILs for all criteria pollutants except $PM_{2.5}$. Cumulative modeling has indicated that maximum projected impacts of $PM_{2.5}$ are less than the health-based NAAQS. Therefore, impacts to soil and vegetation are expected to be negligible.

The screening analysis and USEPA guidance support the conclusion that the proposed project will not adversely impact vegetation or soils in the site area.

Table 5-12: Soils and Vegetation Screening Modeling

Parameter	Maximum Predicted Project Impact ($\mu g/m^3$)	Averaging Period	USEPA Screening Level ($\mu g/m^3$)
SO_2	6.3	1-hour	917
	3.6	3-hour	786
	0.08	Annual	18
NO_2	<88[a]	4-hour	3,760
	<88[a]	8-hour	3,760
	<88[a]	1-month	564
	0.4	Annual	94
CO	<371[b]	1-week	1,800,000

a. Maximum 1-hour NO_2 impacts conservatively assumed.
b. Maximum 8-hour CO impact conservatively assumed.

6. REFERENCES

Auer, 1978. Auer, August H. Jr., "Correlation of Land Use and Cover with Meteorological Anomalies," Journal of Applied Meteorology, p 636-643, 1978.

CARB, 1996. California Air Toxics Emission Factor Database (CATEF) 1996.

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" President William J. Clinton. February 11, 1994.

Federal Register 72:183. "Prevention of Significant Deterioration (PSD) for Particulate Matter Less Than 2.5 Micrometers (PM2.5)—Increments, Significant Impact Levels (SILs) and Significant Monitoring Concentration (SMC)" Proposed Rule. p. 54112. September 21, 2007.

NYSDEC, 1993. "Source Specific Acidic Deposition. Impacts for Permit Applications," L. Sedefian. March 4, 1993.

NYSDEC, 1997. Policy DAR-1: Guidelines for the Control of Toxic Ambient Air Contaminants. November 1997.

NYSDEC, 2006. NYSDEC DAR-10: Guidelines on Dispersion Modeling Procedures for Air Quality Impact Analyses. May 2006.

Schulman, et al., 1997. "The PRIME Plume Rise and Building Downwash Model," Addendum to ISC3 User's Guide. November 1997.

USEPA, 1980. "*A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils and Animals."* EPA 450/2-81-078. December 12, 1980.

USEPA, 1990. *New Source Review Workshop Manual (Draft)*. October 1990.

USEPA, 1993. Alternative Control Techniques Document – NOx Emissions from Stationary Reciprocating Internal Combustion Engines. Office of Air and Radiation. EPA-453/R-93-032. July 1993.

USEPA, 1995. *User's Guide To The Building Profile Input Program,* EPA-454/R-93-038. Revised February 8, 1995.

USEPA, 2000. *Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*.

USEPA. 2000. Interim Environmental Justice Policy, "Guidelines for Conduction Environmental Justice Analyses." USEPA Region 2. December 2000.

USEPA, 2004a. *User's Guide for the AMS/EPA Regulatory Model – AERMOD,* EPA-454/B-03-001. September 2004.

USEPA, 2004b. *User's Guide For The AERMOD Terrain Preprocessor (AERMAP),*EPA-454/B-03-003. October 2004.

USEPA, 2005. Guideline on Air Quality Models. November 2005.

USGS, 2002. The National Map – Elevation, Fact Sheet 106-02. http://egsc.usgs.gov/isb/pubs/factsheets/fs10602.html, U.S. Department of the Interior. November 2002.

VCAPCD, 2001. AB2588 Combustion Emission Factors 2001.