Section 4 – Air Resources

Figures (provided following the text)

Tables

Appendices

List of Acronyms and Abbreviations – Section 4

%	percent
AAR	Authorized Account Representative
ACT	Alternative Control Techniques
ADR	Acid Deposition Reduction
AEGL	Acute Exposure Guideline Level
AERMOD	atmospheric dispersion modeling system
AGC	annual guideline concentrations
ALOHA	Areal Locations of Hazardous Atmospheres
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
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
Be	beryllium
BPIP	Building Profile Input Program
BPIPPRM	PRIME version of BPIP
Btu	British thermal units
Btu/kW-hr	British thermal units per kilowatt-hour
C	carbon
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CARB	California Air Resource Board
CATEF	California Air Toxics Emission Factor
CCS	carbon capture and sequestration
CEMS	Continuous Emissions Monitoring Systems
CFR	Code of Federal Regulations
CH_4	methane
CI	compression ignition

CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalents
CT	combustion turbine
CVE	Cricket Valley Energy Center, LLC
DB	duct burner
DLN	dry low NO_x
ERC	emission reduction credit
°F	degrees Fahrenheit
F^-	gaseous fluoride
FGD	flue gas desulfurization
FLM	Federal Land Manager
g/hp-hr	grams per horsepower-hour
g/kW-hr	grams per kilowatt-hour
GE	General Electric
GEP	Good Engineering Practice
GHG	Greenhouse Gas
$g/m^2/yr$	grams per square meter per year
g/s	grams per second
H_2S	hydrogen sulfide
H_2SO_4	sulfuric acid mist
HAP	hazardous air pollutant
HHV	higher heating value
hp	horsepower
HRSG	heat recovery steam generator
HVAC	Heating, Ventilating, and Air Conditioning
ISO	International Organization for Standards
kg/Ha/yr	kilogram per hectare per year
km	kilometer
KPOU	Poughkeepsie-Dutchess County Airport

kW	kilowatts
LAER	Lowest Achievable Emission Rate
Laydown Site	30-acre construction worker parking and laydown site
lb	pound
lb/hr	pounds per hour
lb/MMBtu	pounds per million british thermal units
lb/MW-hr	pounds per megawatt-hour
LEED	Leadership in Energy and Environmental Design
LHV	lower heating value
m	meters
m/s	meters per second
MAPS	Multi Area Production Simulation
MMBtu	million British thermal units
MMBtu/hr	million British thermal units per hour
msl	above mean sea level
MW	megawatts
n/a	not applicable
N_2	elemental nitrogen
N_2O	Nitrous oxide
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
NYISO	New York Independent System Operator
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
O_2	Oxygen
O_3	Ozone
Pb	Lead
PJM	Pennsylvania Jersey Maryland
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
ppb	parts per billion
ppm	parts per million
ppm_v	parts per million by volume
ppmvd	parts per million by volume dry
ppm_w	parts per million by weight
Poughkeepsie Airport	Poughkeepsie Dutchess County Airport
PRIME	Plume Rise Model Enhancement
Project Development Area	the 57-acre portion of the 131-acre Property proposed for development.
PSC	New York State Public Service Commission
PVMRM	Plume Volume Molar Ratio Method
RACT	Reasonably Available Control Technology
RBLC	RACT/BACT/LAER Clearinghouse
RGGI	Regional Greenhouse Gas Initiative
scf	standard cubic feet
SCR	selective catalytic reduction

SGC	short-term guideline concentrations
SIA	Significant Impact Area
SIL	Significant Impact Level
SIP	State Implementation Plan
SMC	Significant Monitoring Concentration
SMP	Stormwater Management Practices
SO_2	sulfur dioxide
SO_3	sulfur trioxide
SO_x	sulfur oxides
tpy	tons per year
TSP	total suspended particulates
$\mu g/m^3$	micrograms per cubic meter
U.S.	United States
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
UTM	Universal Transverse Mercator
VCAPCD	Ventura County Air Pollution Control District
VOC	volatile organic compounds
WQC	Water Quality Certification
Wy	Wayland silt loam
z_0	surface roughness

4. AIR RESOURCES

4.1 Applicable Laws, Regulations and Policies

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:

- Nonattainment New Source Review (NNSR)
- Prevention of Significant Deterioration (PSD) New Source Review
- Federal New Source Performance Standards (NSPS)
- Federal National Emission Standards for Hazardous Air Pollutants (NESHAP)
- Nitrogen oxide (NO_x) Budget Program and Clean Air Interstate Rule (CAIR)
- Federal Acid Rain Program
- Other New York State Department of Environmental Conservation (NYSDEC) Requirements
- Accidental Release Requirements

4.1.1 Nonattainment New Source Review

The United States Environmental Protection Agency (USEPA) has established primary and secondary National Ambient Air Quality Standards (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 such as those with chronic asthma or emphysema. The secondary NAAQS protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. USEPA has established both short-term and long-term NAAQS.

Under 6 New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York (NYCRR) Part 257, NYSDEC has adopted many of the federal NAAQS and standards for additional pollutants. Table 4-1 presents the federal NAAQS and the New York Ambient Air Quality Standards (NYAAQS).

Table 4-1: 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]
Sulfur dioxide (SO_2)	1-hour	196[c]	None[c]
	3-hour	1,300	1,300
	24-hour	365	365
	Annual	80	80
Particulate matter with a diameter equal to or less than10 microns (PM_{10})	24-hour	150	None
	Annual	revoked	None
Particulate matter with a diameter equal to or less than2.5 microns ($PM_{2.5}$)	24-hour	35	None
	Annual	15	None
Total Suspended Particulate (TSP)	24-hour	None	250
	Annual	None	45
Carbon monoxide (CO)	1-hour	40,000	40,000
	8-hour	10,000	10,000
Nitrogen dioxide (NO_2)	1-hour	188[d]	None[d]
	Annual	100	100
Lead (Pb)	3-month	1.5	None
Gaseous fluoride (F^-)[b]	12-hour	None	3.70
	24-hour	None	2.85
	1-week	None	1.65
	1-month	None	0.80
Beryllium (Be)	1-month	None	0.01
Hydrogen Sulfide (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 SO_2 took effect on June 2, 2010. The new standard has not yet been incorporated into NYSDEC air regulations.

d. The new 1-hour standard for NO_2 took effect on January 22, 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, these pollutants are subject to PSD New Source Review (see Section 4.1.2) and the project is required to demonstrate compliance with the NYAAQS and NAAQS shown in Table 4-1.

Dutchess County is designated as a Subpart 2/Moderate nonattainment area with respect to the 8-hour ozone NAAQS and NYAAQS. The following are the major source thresholds for this nonattainment area:

- 100 tons per year (tpy) of NO_x
- 50 tpy of volatile organic compounds (VOC)

Sources whose potential emissions exceed one of the thresholds presented above are defined as major sources and are subject to NNSR for these pollutants. As indicated in Table 4-2, the project's potential annual emissions exceed the thresholds for both NO_x and VOC and is, therefore, subject to the NNSR requirements, under 6 NYCRR Part 231, for permitting of major sources of nonattainment pollutants. As part of NNSR, the project is required to apply Lowest Achievable Emission Rate (LAER) technology for these pollutants and obtain emissions offsets.

The project will require a Air State Facility Permit (Part 201 permit) pursuant to 6 NYCRR Part 201 issued by the NYSDEC. NYSDEC has recently been delegated authority to administer the PSD program. Under the PSD regulations, since maximum annual emissions of at least one criteria pollutant (e.g., NO_x) will exceed 100 tpy, the project is considered major and will be subject to PSD review. Once a source exceeds the PSD major source threshold, those pollutants that exceed significant emission rates are subject to PSD review. 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. As presented in Table 4-2, PSD review will be required for NO_x, VOC, CO, SO_2, PM_{10}/$PM_{2.5}$, sulfuric acid (H_2SO_4), and greenhouse gases (GHGs).

Table 4-2: 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	279.4	100[a]	40[b]	Yes[a]
VOC	118.1	50[a]	40	Yes[a]
CO	569.9	n/a	100	Yes
PM_{10}	191.9	n/a	15	Yes
$PM_{2.5}$	191.9	n/a	10	Yes
SO_2	46.9	n/a	40	Yes
H_2SO_4	19.7	n/a	7	Yes
GHGs[c]	3,630,484	n/a	75,000	Yes
Pb	4.3×10^{-4}	n/a	0.6	No

a. Project is subject to NNSR for this pollutant.

b. PSD significant emission rate for NO_2.

c. GHGs are expressed as CO_2 equivalents (CO_2e)

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.

4.1.1.1 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 that can reasonably be expected to occur in practice for a category of emission sources. 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 4.3.

4.1.1.2 Emissions Offsets

A major source or major modification 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 must be obtained from existing sources that have implemented a permanent, enforceable, quantifiable and surplus emissions reduction, and 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 must obtain offsets at a ratio of 1.15 to 1. VOC and NO_x are considered precursors to ozone, therefore they are regulated under the NNSR program. As such, Cricket Valley Energy Center, LLC (CVE) will obtain offsets for these pollutants as described above.

4.1.1.3 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 and under the applicant's ownership or control are in compliance, or on a schedule for compliance, with all applicable emission limitations and standards under Chapter III (Air Resources). CVE and its parent company, Advanced Power AG, neither own nor manage any other facilities in New York State. The air permit application includes a certification from CVE in this regard.

4.1.1.4 Analysis of Alternatives

6 NYCRR Part 231-5.2(b) requires an analysis of alternative sites, sizes, production processes, and environmental control techniques to demonstrate 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 7. Alternative emission control technologies are identified and evaluated as part of the BACT/LAER analyses presented in Section 4.3.

The analyses demonstrate that the proposed emission control technologies are representative of BACT and LAER.

4.1.2 PSD New Source Review

As described previously, fossil fuel-fired steam electric plants with potential emissions greater than 100 tpy of one or more criteria pollutants are considered new major stationary sources under the PSD program. The proposed project's maximum annual emissions will exceed this threshold for at least one regulated criteria pollutant (e.g., NO_2). As such, the proposed project 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.

On April 2, 2007, the U.S. Supreme Court found that GHGs, including carbon dioxide (CO_2), are air pollutants covered by the Clean Air Act (CAA). On May 13, 2010, the USEPA issued a final rule (called the "Tailoring Rule") that establishes an approach to GHG emissions from stationary sources under the CAA. This final rule "tailors" the requirements of the CAA permitting program to limit which facilities will be required to obtain PSD permits. The CAA permitting program emissions thresholds for criteria pollutants are 100 tpy or 250 tpy, depending on the source category. While these thresholds are appropriate for criteria pollutants, they are not feasible for GHG emissions as they are emitted in much greater quantities. USEPA will phase in the CAA permitting requirements in two phases:

- Only sources already subject to the PSD program (i.e., new major sources such as CVE) are subject to permitting requirements for their GHG emissions under PSD, beginning on January 2, 2011. For these projects, those with GHG emission increases of 75,000 tpy or greater are required to determine BACT for their GHG emissions.
- In the second phase, PSD permitting requirements will cover new construction projects that exceed 100,000 tpy of GHG emissions, even if they do not exceed any other permitting thresholds. This phase is scheduled to begin on July 1, 2011.

NYSDEC adopted amendments to its regulations on December 29, 2010 to include the provisions of the Tailoring Rule as described above.

As presented in Table 4-2, CVE has triggered major source thresholds of pollutants other than GHGs. In addition, potential emissions of GHGs from the project exceed the 75,000 tpy threshold described above. As such, PSD review is required for NO_x, CO, VOC, SO_2, $PM_{10}/PM_{2.5}$, H_2SO_4 and GHG emissions.

NYSDEC has been recently delegated authority to administer the PSD program; however, the USEPA will maintain review authority for PSD permitting associated with this project.

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 elements of a PSD review are described in greater detail in the sections below.

4.1.2.1 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 under 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, H_2SO_4, and GHGs are presented in Section 4.3.

4.1.2.2 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 must demonstrate that they do not cause or significantly contribute to a violation of the NAAQS or NYAAQS and are in compliance with PSD increments. As part of this demonstration, the USEPA and NYSDEC have established final Significant Impact Levels (SILs) for all of the criteria pollutants except for 1-hour NO_2 and 1-hour SO_2. SILs represent concentrations of pollutants that are considered to be insignificant with respect to demonstration of NAAQS and PSD increment compliance. By definition, proposed new sources whose air quality impacts are less than SILs neither cause nor significantly contribute to NAAQS/NYAAQS and PSD increment violations. On September 29, 2010, the USEPA established final SILs for $PM_{2.5}$. The USEPA is in the process of establishing the SILs for 1-hour NO_2 and 1-hour SO_2 and, in the meantime, have provided interim SILs for these two pollutants to be used until final SILs are established.

Compliance with PSD increments prevents the air quality in attainment areas from deteriorating appreciably. While the NAAQS is a maximum allowable concentration or a ceiling, a PSD increment is the maximum increase in concentration for a pollutant above an established baseline concentration. A baseline concentration has been defined for each pollutant, which is, in general, the ambient concentration existing at the time that the first complete PSD permit application affecting the area is submitted. Significant deterioration is said to occur when the air quality impacts of a new or modified source exceed the applicable PSD increment. As such, proposed new sources whose air quality impacts are less than the PSD increment are not causing a significant deterioration of air quality. As described above, compliance with the SILs indicates that the project is in compliance with the PSD increment. Table 4-3 presents the promulgated SILs and PSD increments for criteria pollutants requiring PSD review.

If modeling of emissions from the project demonstrates that 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 source plus other major nearby background sources to demonstrate compliance with NAAQS and PSD increments. Section 4.5 presents an ambient air quality analysis demonstrating compliance with PSD requirements.

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 subject to PSD review. However, 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 4-3, or if representative quality-assured data already exist. The ambient air quality analysis presented in Section 4.5 demonstrates that maximum impacts are predicted to be less than the SMCs, including the recently promulgated SMC for $PM_{2.5}$. Prior to promulgation of this new standard, CVE 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. This waiver was granted by the USEPA in a letter dated March 24, 2010. A copy of this waiver is provided in Appendix 4-A.

Table 4-3: Summary of PSD Increment Value, Significant Impact Levels (SIL) and Significant Monitoring Concentrations (SMC)

Pollutant	Averaging Period	PSD Increment Class II ($\mu g/m^3$)	SIL ($\mu g/m^3$)	SMC ($\mu g/m^3$)
SO_2	1-hour	Not yet proposed	7.8[a] (interim)	Not yet proposed
	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	9[b]	1.2[b]	4[b]
	Annual	4[b]	0.3[b]	None
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	7.5[c] (interim)	Not yet proposed
	Annual	25	1	14
Pb	3-month	None	None	0.1

a. In guidance published August 23, 2010, USEPA recommends use of 3 parts per billion (ppb) (7.8 $\mu g/m^3$) as an Interim SIL for 1-hour SO_2.
b. On September 29, 2010, USEPA published final guidance on $PM_{2.5}$ increments, SILs, and SMCs.
c. In guidance published June 28, 2010, USEPA recommends use of 4 ppb (7.5 $\mu g/m^3$) as an Interim SIL for 1-hour NO_2.

4.1.2.3 PSD Class I Area Review

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), United States Fish and Wildlife Service (USFWS), or the U.S. Forest Service (USFS). 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 Development Area (the 57-acre portion of the 131-acre CVE property proposed for development). The closest designated PSD Class I area is the Lye Brook Wilderness Area, located 167 km north-northeast of the Project Development Area 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 confirming this consultation is provided in Appendix 4-A. However, in response to comments from USEPA Region 2 and NYSDEC, a visibility impact analysis was conducted for two state parks. This analysis is presented in Section 4.5.6.

4.1.2.4 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 and an assessment of impacts to soils and vegetation. These additional analyses are presented in Section 4.5.7.

NYSDEC also requires an assessment of the potential for 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 4.5.7.1.

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 on this requirement. A copy of correspondence to date is included in Appendix 4-A. CVE is continuing to work with the USFWS to confirm that the project will have no adverse impacts on protected species.

4.1.2.5 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, which applies to major projects as defined in 6 NYCRR Part 621.2 and Part 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 6.7.5.

4.1.3 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.

4.1.3.1 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.

4.1.3.2 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 million British thermal units per hour (MMBtu/hr), such as the project turbines, NO_x emissions are limited to:

- 15 parts per million volume (ppm_v) at 15 percent oxygen (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).

The proposed project will use a selective catalytic reduction (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 pounds per million British thermal units (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 continuous emissions monitoring system (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.

4.1.3.3 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 60.0 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. While there are recordkeeping requirements, there are no specific reporting requirements to the USEPA under Subpart Dc for sources that combust only natural gas

4.1.3.4 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 requires 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 kilowatt (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.

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

40 CFR Part 61 provides pollutant specific standards for Hazardous Air Pollutants (HAPs). There are no 40 CFR Part 61 standards applicable to the proposed facility operations. 40 CFR Part 63 provides standards applicable to types of sources that have the potential to emit HAPs in excess of major source thresholds. Current emission factors from the USEPA's *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition Volume I: Stationary Point and Area Sources* (AP-42) (USEPA, 2000a), emission factors from other regulatory sources, and vendor information were reviewed in determining if the proposed project would be 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.

4.1.5 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.

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 that section. The project will be required to submit an acid rain permit application at least 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.

4.1.6 NO_x Budget Programs and Clean Air Interstate Rule

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 electric 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.

On March 10, 2005, USEPA issued CAIR, which requires reductions in emissions of NO_x and SO_2 from large fossil fuel-fired 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.

6 NYCRR Parts 243, 244 and 245 establish New York's CAIR programs. 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 and obtain a CAIR permit from the NYSDEC. The NYSDEC CAIR program operates similarly to the NO_x Budget Program requirements that were set forth in 6 NYCRR Part 204 (The NO_x Budget Program regulations have been repealed, effective May 6, 2010). Annual and ozone season NO_x allowances for calendar year 2009 were implemented through the provisions of the CAIR program. 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.

4.1.7 Acid Deposition Reduction SO_2 Budget Program

6 NYCRR Part 238 establishes the ADR SO_2 Budget Trading Program which is a cap-and-trade program 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 an 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.

4.1.8 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.

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 ultra low sulfur diesel (ULSD) with a sulfur content of 15 parts per million by weight (ppm_W) in the fire pump and black-start generators.
- 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 GHG emissions as part of the Regional Greenhouse Gas Initiative (RGGI). RGGI is a cooperative effort between ten Northeast and Mid-Atlantic States to limit GHG 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 one allowance for every ton of CO_2 that they emit. The proposed project will acquire CO_2 allowances in compliance with this regulation.
- 6 NYCRR Part 212 outlines the regulatory requirements for emissions of air toxics (non-criteria pollutants) from process sources. This regulation specifies the degree of control required for air toxic emissions. Generally, ambient impact of air toxics must be demonstrated to be less than applicable health-based standards. An air quality modeling analysis demonstrating compliance with the applicable standards is provided in Section 4.6.2.

4.1.9 Accidental Release Requirements

Aqueous ammonia (NH_3) will be used as the reducing agent in the project's SCR system for controlling NO_x emissions. An aqueous solution of 19 percent NH_3 by weight will be stored on-site 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 4.6.3.

4.2 Baseline Air Quality, Meteorology and Climatology

The Project Development Area is located in the Town of Dover, Dutchess County, New York, in the Taconic Mountains, a minor highland region in southeastern New York along the New York-Connecticut border. The following excerpts were taken from an overview of state climatology prepared by the New York State Climatologist (New York State Climate Office, 2010):

> *The climate of New York State is broadly representative of the humid continental type, which prevails in the northeastern United States, but its diversity is not usually encountered within an area of comparable size. The geographical position of the state and the usual course of air masses, governed by the large-scale patterns of atmospheric circulation, provide general climatic controls. Differences in latitude, character of the topography, and proximity to large bodies of water have pronounced effects on the climate.*

Regional air mass circulation generally falls into three categories: cold, dry northern continental air; warm, humid air from the south and southwest, originating over the Gulf of Mexico and adjacent subtropical waters; and cool, cloudy and damp air flowing inland from the North Atlantic. The North Atlantic influence is important in the lower Hudson Valley, but secondary to the first two categories. Storms and frontal systems generally move eastward across the continent or northward along the Atlantic coast. Lengthy periods of fair (cold or warm) weather can result from the passage of large-scale high-pressure systems into and through the eastern U.S.

4.2.1 Precipitation

Monthly precipitation and temperature statistics are summarized in Table 4-4 for two locations. The Cary Institute, in Millbrook, New York, elevation 420 feet msl, provides 21 years of data for a site within 11 miles of the project, while Poughkeepsie Dutchess County Airport (Poughkeepsie Airport), located about 16 miles west-southwest of the Project Development Area, at elevation 166 feet msl, provides a 60-year observation record (80 years for temperature). The Project Development Area has a base elevation of 436 feet above mean sea level (msl). Observed annual precipitation is 44.4 inches at Millbrook and 41.5 inches at the Poughkeepsie Airport. Monthly average precipitation is fairly uniform throughout the year at both sites. February has the lowest monthly average precipitation at both sites; the highest months at Millbrook are September and October, while May through August are highest at the Poughkeepsie Airport.

Table 4-4: Average Temperature and Precipitation for Project Region

	Annual	January	February	March	April	May	June	July	August	September	October	November	December
Temperature (°F)		**Poughkeepsie Dutchess County Airport (1929-2009)**											
Average	50.2	26.5	28.3	37.5	48.8	59.5	68.5	73.3	71.5	63.7	52.4	42.1	30.8
Average high	61.1	35.7	38.1	47.5	60.6	71.8	80.5	85.0	83.1	75.4	64.2	51.9	39.8
Average low	39.1	17.0	18.2	27.0	36.7	46.9	56.3	61.4	59.9	52.0	40.4	32.2	21.7
		Cary Institute - Millbrook, New York (1988-2009)											
Average	49.3	26.6	28.6	36.7	48.2	58.1	67.1	71.2	69.8	61.9	50.4	41.4	30.4
Average high	60.8	35.6	38.7	48.2	61.0	71.1	79.9	84.0	82.4	74.3	62.8	51.3	39.0
Average low	37.6	16.2	17.4	25.0	35.1	44.6	54.5	59.0	58.1	49.5	38.1	30.6	20.5
Precipitation (inches)		**Poughkeepsie Dutchess County Airport (1950-2009)**											
	41.5	2.9	2.5	3.2	3.6	3.9	3.8	3.9	3.9	3.5	3.5	3.5	3.3
		Cary Institute - Millbrook, New York (1988-2009)											
	44.4	3.2	2.7	3.6	3.2	4.1	3.8	4.1	3.9	4.3	4.3	3.5	3.6

4.2.2 Temperature

The annual average temperature is 49.3 degrees Fahrenheit (°F) at Millbrook, with monthly averages ranging from a low of 26.6°F in January to a high of 71.2°F in July. The average temperature range (high versus low) ranges from 18.5°F in December to 25.5°F in May. The annual average temperature is about 1°F higher at the Poughkeepsie Airport, compared to Millbrook, while the average low temperature is 1.5°F warmer. The temperatures at Millbrook are considered more representative of the Project Development Area, which is at a similar elevation.

4.2.3 Winds

The Project Development Area is located along New York State Route 22 south of Dover Furnace Road, Dover, New York, in the Ten Mile River Valley. 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 Project Development Area, 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 Project Development Area, 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 Airport is situated in the Hudson River Valley, about 16 miles west of the Project Development Area (as shown in Figure 4-1). The Hudson River Valley is somewhat broader than the Ten Mile River Valley, but has a very similar north-south orientation. Base elevation at the Poughkeepsie Airport is 165 feet msl. A north-south ridge about 6 miles to the west of the Poughkeepsie Airport is approximately 800 feet msl, with a similar ridge 8 miles to the east of the Poughkeepsie Airport.

Regionally representative wind measurements were obtained from the Poughkeepsie Airport. Figure 4-2-*Wind Rose Plot* provides a five-year wind rose depicting the frequency distribution of wind speed and direction at the Poughkeepsie Airport. The average wind speed is 5.1 knots (2.6 meters per second [m/s]); the peak wind direction frequencies are from the north (11 percent) and southwest (8 percent). 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.

4.2.4 Background Air Quality Data and Trends

The project consulted with USEPA and NYSDEC regarding the most appropriate air quality monitoring stations to utilize in the air quality impact analyses. Both NYSDEC and the Connecticut Department of Environmental Protection collect air quality data at numerous monitoring stations throughout each state.

Based on review of available data, ambient monitors located in Dutchess County and adjacent counties were selected for the determination of background ambient air quality concentrations to be used in the air quality impact assessment. The only NYSDEC monitoring station in Dutchess County, at the Cary Institute of Ecosystems Studies in Millbrook, 11 miles northwest of the Project Development Area, measures ground-level ozone (O_3). The nearest monitor for SO_2 and PM_{10} is the Mt. Ninham site, located in Carmel (Putnam County), 17 miles south of the Project Development Area. For $PM_{2.5}$, monitors are located in Newburgh (Orange County), 25 miles southwest of the Project Development Area; Cornwall, Connecticut (Litchfield County), 18 miles northeast of the Project Development Area; and Thomaston, Connecticut (Litchfield County), 26 miles east of the Project Development Area. For NO_2 and for CO, the nearest monitor is located in Thomaston, Connecticut. Three of these sites are rural, consistent with the project surroundings; the Newburgh site is located in a more heavily developed area. Figure 4-3 shows the locations of these monitoring sites. Table 4-5 summarizes identification and location information for the monitoring sites.

Table 4-5: Background Air Quality Monitoring Sites

Monitor	USEPA ID	Address	Pollutants
Mt. Ninham	36-079-0005	Gypsy Trail Rd, Carmel, New York	SO_2, PM_{10}
Newburgh	36-071-0002	55 Broadway, Newburgh, New York	$PM_{2.5}$
Mohawk Mt.	09-005-0005	Cornwall, Connecticut	$PM_{2.5}$
Millbrook	36-027-0007	Millbrook, New York	O_3
Thomaston	09-005-0004	Old Waterbury Rd, Thomaston, Connecticut	$PM_{2.5}$, CO, NO_2, SO_2

Table 4-6 summarizes the most recent available ambient air quality monitoring data for SO_2, PM_{10}, $PM_{2.5}$, CO, and NO_2 from these monitoring stations. As shown in that table, all measured concentrations for these pollutants are less than their respective NAAQS. In accordance with agency regulations, the listed short-term concentrations represent the highest or second-highest measurement recorded by the monitor during each year, except for $PM_{2.5}$. For $PM_{2.5}$, consistent with USEPA guidance, the 98^{th} percentile or 8^{th} high value is given. As such, these data provide a conservative representation of background air quality in the region. Hourly observed ozone concentrations from Millbrook for 2005 – 2010 were used for NO_2 modeling, as discussed in Section 4.5.

Table 4-6: Regional Ambient Air Quality Data

Monitor Location	Pollutant	Averaging Period	Concentration ($\mu g/m^3$) Year 2008	Year 2007	Year 2006	3-yr average ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Mt. Ninham	SO_2	1-hour (highest)	46.8	67.6	57.2	57.2	195
		3-hour (2nd highest)	33.8	44.2	48.1	42.0	1,300
		24-hour (2nd highest)	18.2	23.4	28.0	23.2	365
		Annual	5.2	3.9	4.4	4.5	80
			1998	**1997**	**1996**		
Mt. Ninham	PM_{10}	Annual	14	14	14	-	50[a]
		24-hour (2nd highest)	39	-	-	-	150
			2009	**2008**	**2007**		
Thomaston	NO_2	1-hour (highest)	97.8	176.7	94.0	122.8	188
		Annual	12.7	14.2	17.0	14.7	100
			2008	**2007**	**2006**		
Thomaston	CO	1-hour (2nd highest)	1200	1100	1650	-	40,000
		8-hour (2nd highest)	1000	900	1200	-	10,000
			2009	**2008**	**2007**		
Thomaston	$PM_{2.5}$	24-hour (98th percentile)	18.0	24.8	31.0	24.6	35
		Annual	7.3	9.0	10.2	8.8	15
			2008	**2007**	**2006**		
Millbrook	Ozone	8-hour (2nd highest)	0.081 ppm[b]	0.078 ppm	0.064 ppm	0.074 ppm	0.075 ppm

a. Revoked.

b. parts per million.

A summary of selected background air quality concentrations is provided in Table 4-7. For PM_{10}, annual NO_2, 1-hour SO_2 and CO, the highest value from Table 4-6 was selected for each averaging time. For $PM_{2.5}$, 1-hour NO_2 and 3-hour, 24-hour and annual SO_2, the 3-year average observed values were selected. These selections are based on USEPA guidance concerning how to combine background air quality and model-predicted impacts to estimate concentrations for comparison with NAAQS; this guidance varies by pollutant and averaging time. The Thomaston site was judged to be more representative of $PM_{2.5}$ air quality at the Project Development Area than either the Newburgh monitor, which is in a more densely populated location, or the Cornwall monitor, which is at a remote, elevated site. The Thomaston site was approved by USEPA for use in cumulative modeling for $PM_{2.5}$ and for NO_2. Recent USEPA guidance for cumulative modeling for 1-hour NO_2 recommends use of the highest observed concentration over a 3-year period as a conservative background value. However, that value is an extreme outlier in the 3-year data set from Thomaston, so, after consulting with USEPA, the average of the highest observed maximum daily concentrations from all 3 years was used. This value is still more than double the observed 98th percentile 1-hour concentration from any year.

Table 4-7: Background Air Quality Levels for the Cricket Valley Energy Project

Pollutant	Averaging Period	Background Air Quality (µg/m^3)
SO_2	1-hour	67.6
	3-hour	42.0
	24-hour	23.2
	Annual	4.5
PM_{10}	24-hour	39
	Annual	14
$PM_{2.5}$	24-hour	24.6
	Annual	8.8
CO	1-hour	1,650
	8-hour	1,200
NO_2	1-hour	122.8
	Annual	14.7

As shown in Table 4-6, ambient concentrations of SO_2 measured at Mt. Ninham have shown a steady decline over the last three years of reported data. This trend is consistent with monitoring results from this station over the last ten years. $PM_{2.5}$, as a relatively newly regulated pollutant, does not have long-term monitoring data from which to observe meaningful trends. Ozone levels have been monitored in Millbrook since 1988. The last ten years of monitoring data do not show any improvement or degradation in Ozone levels. Annual average NO_2 levels measured at Thomaston, Connecticut show improvement in air quality over the last three years for this pollutant.

4.3 Control Technology Analysis

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), as described in the following sections.

4.3.1 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.

4.3.1.1 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 4-2, potential emissions of NO_x and VOC exceed these thresholds, and are, therefore, subject to NNSR and LAER requirements.

4.3.1.2 PSD Pollutants Subject to BACT

Pollutants subject to PSD review are required to implement BACT. 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 4-2. As shown in this table, the project is subject to PSD review for NO_x, CO, VOC, PM_{10}/$PM_{2.5}$, SO_2, H_2SO_4, and GHG 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. 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, LAER will satisfy BACT requirements for VOC emissions, which are subject to PSD review by exceeding the PSD significant emission rates.

4.3.1.3 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 combustion turbines with heat recovery steam generators' (HRSGs') supplemental duct burning. Therefore, the primary focus of the BACT and LAER analyses presented in the following sections is on the combustion turbines with HRSGs' supplemental duct burning. Evaluation of the ancillary equipment is conducted consistent with their proposed small annual emission levels and with their limited hours of operation.

4.3.2 LAER and BACT Analysis Approach

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

4.3.2.1 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 allow 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 General Electric (GE) 7FA.05 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 combustion turbines in combined cycle installations, and are proposed for the project.

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

4.3.2.2 Best Available Control Technology

BACT is defined as the optimum level of control applied to a pollutant’s 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.

4.3.2.2.1 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 4-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 4-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.

4.3.2.2.2 Economic (Cost-Effectiveness) Analysis

This analysis consists of an estimation of cost and calculation of the cost-effectiveness of each control technology, on a dollars 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.

4.3.2.2.3 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.

4.3.2.2.4 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.

4.3.3 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 GE 7FA.05 combustion turbines proposed for the project utilize a lean fuel technology controlling NO_x to a concentration of 9 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 0.011 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 demonstrates that the proposed NO_x emission rates for the combined cycle units, 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.

4.3.3.1 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 NH_3 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:

$$4NH_3 + 4NO + O_2 \bullet \quad 4N_2 + 6H_2O$$

$$8NH_3 + 6NO_2 \bullet \quad 7N_2 + 12H_2O$$

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.

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 combustion turbine exhaust temperature but above the stack exhaust temperature, the catalyst needs to be located within the HRSG.

Use of SCR systems has the potential for formation of ammonium bisulfate and ammonium sulfate, referred to as ammonium salts. These salts are reaction products of sulfur trioxide (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.

4.3.3.2 Search of LAER/BACT Determinations

4.3.3.2.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified nearly 300 natural gas-fired combined cycle 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 4-B. The lowest permitted NO_x limit for a natural gas-fired combined cycle unit with duct burning was 2.0 ppm_v. Of the representative projects, at least eight had NO_x LAER determinations 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.

4.3.3.2.2 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 0.080 lb/MMBtu. Details on approximately 40 of the installations that were determined to be most representative for the proposed boiler are provided in Appendix 4-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 Long Island Energy, 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 0.030 lb/MMBtu. The most recent determination for an auxiliary boiler proposed a NO_x emission limit of 0.049 lb/MMBtu.

4.3.3.2.3 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 (Dutch Harbor Power Plant). 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 (ADM Corn Processing). The most recent NO_x emission limit determination for an emergency generator is 17.1 pounds per hour (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.

4.3.3.3 LAER/BACT Determinations

4.3.3.3.1 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 dry low NO_x 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.

4.3.3.3.2 Auxiliary Boiler

CVE is proposing a NO_x emission limit of 0.011 lb/MMBtu 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.

4.3.3.3.3 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.

4.3.4 LAER/BACT Analysis for VOC

Generally, combustion turbines have 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 GE 7FA.05 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 0.0015 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 units, 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.

4.3.4.1 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.

4.3.4.2 Search of LAER/BACT Determinations

4.3.4.2.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified close to 300 natural gas-fired combined cycle projects. Details for approximately 30 of these facilities have been included in Appendix 4-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 units. 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 unit 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.

4.3.4.2.2 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 4-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, which, as discussed above, 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 (Virginia Power Possum Point in Virginia and AEP Waterford Energy in Ohio). The remainder of the installations have emission limits of 0.005 lb/MMBtu or greater.

4.3.4.2.3 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.

4.3.4.3 LAER/BACT Determinations

4.3.4.3.1 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.

4.3.4.3.2 Auxiliary Boiler

CVE is proposing a VOC emission limit of 0.0015 lb/MMBtu from the auxiliary boiler using good combustion practices in combination with reduced annual operating hours. This is consistent with other LAER determinations for this type of equipment.

4.3.4.3.3 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.

4.3.5 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 units, 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 GE 7FA.05 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 units, auxiliary boiler and diesel engines are considered BACT.

4.3.5.1 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 GE 7FA.05 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.

4.3.5.2 Search of LAER/BACT Determinations

4.3.5.2.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC other available permits identified more than 300 natural gas-fired combined cycle 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 units.

CO emission limits from recently permitted projects generally range 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 unit 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 finished construction 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, but again, this 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.

4.3.5.2.2 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 4-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.

4.3.5.2.3 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.

4.3.5.3 LAER/BACT Determinations

4.3.5.3.1 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.

4.3.5.3.2 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.

4.3.5.3.3 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.

4.3.6 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 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 GE 7FA.05 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 0.005 lb/MMBtu without duct burning and 0.006 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 units, auxiliary boiler and diesel engines are considered BACT.

4.3.6.1 Search of LAER/BACT Determinations

4.3.6.1.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified more than 300 natural gas-fired combined cycle 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 0.300 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 unit 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, which has been in operation since 2009, 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.

4.3.6.1.2 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 (CPV Saint Charles in Maryland).

4.3.6.1.3 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.

4.3.6.2 LAER/BACT Determinations

4.3.6.2.1 Combustion Turbine Generators and Duct Burners

CVE is proposing a $PM_{10}/PM_{2.5}$ emission limit of 0.005 lb/MMBtu without duct burning and 0.006 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.

4.3.6.2.2 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.

4.3.6.2.3 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.

4.3.7 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 GE 7FA.05 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 0.0015 lb/MMBtu with and without duct burning. Emissions of H_2SO_4 from the combined cycle turbines will be limited to 0.0004 lb/MMBtu without duct burning and 0.0006 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 0.0015 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 units, auxiliary boiler and diesel engines are considered BACT.

4.3.7.1 Search of LAER/BACT Determinations

4.3.7.1.1 Combustion Turbine Generators and Duct Burners

The search of the RBLC and other available permits identified more than 300 natural gas-fired combined cycle 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 units 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.

4.3.7.1.2 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.

4.3.7.2 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, the Cornell Combined Heat and Power project in New York State, indicated the use of ULSD.

4.3.8 LAER/BACT Determinations

4.3.8.1 Combustion Turbine Generators and Duct Burners

CVE is proposing a SO_2 emission limit of 0.0015 lb/MMBtu (with and without duct burning) and an H_2SO_4 emission limit of 0.0004 lb/MMBtu without duct burning and 0.0006 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 standard cubic feet (scf) in the combustion turbines. This emission level is consistent with the limits and control technologies found in the RBLC.

4.3.8.2 Auxiliary Boiler

CVE is proposing a SO_2 emission limit of 0.0015 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.

4.3.8.3 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.

4.3.9 BACT Analysis for Greenhouse Gases

The principal GHGs are CO_2, methane (CH_4), and nitrous oxide (N_2O). Because these gases differ in their ability to trap heat, one ton of CO_2 in the atmosphere has a different effect on warming than one ton of CH_4 or one ton of N_2O. For example, CH_4 and N_2O have 21 times and 298 times the global warming potential of CO_2, respectively. GHG emissions from the proposed project are primarily attributable to combustion of fuels. The project will not have any other industrial processes releasing GHGs. By far the greatest proportion of potential GHGs emissions are from CO_2. Trace amounts of CH_4 and N_2O, would be emitted in varying quantities depending on operating conditions. However, emissions of CH_4 and N_2O are negligible when compared to total CO_2 emissions, and would not be considered significant to climate change issues. In addition, as presented previously, the project is proposing to implement LAER for both VOC (expressed as CH_4)

and NO_x, such that these pollutants are being effectively controlled. As such, the remainder of this section will focus on BACT for CO_2.

CO_2 is a product of combusting any carbon (C) containing fuel, including natural gas. All fossil fuel contains significant amounts of carbon. During complete combustion, the fuel carbon is oxidized into CO_2 via the following reaction:

$$C + O_2 \bullet \quad CO_2$$

Full oxidation of carbon in fuel is desirable because CO, a product of partial combustion, has long been a regulated pollutant and because full combustion results in more useful energy. In fact, emission control technologies required for CO emissions (oxidation catalysts) increase CO_2 emission by oxidizing CO to CO_2.

There are limited alternatives available for controlling CO_2. The USEPA has indicated (USEPA, 2010f) that carbon capture and sequestration (CCS) should be considered in BACT analyses as a technically feasible add-on control option for CO_2. Currently, there are no combined cycle power plants utilizing CCS, and although theoretically feasible, this technology is not commercially available.

CCS requires three distinct processes:

1. Isolation of CO_2 from the waste gas stream;
2. Transportation of the captured CO_2 to a suitable storage location; and
3. Safe and secure storage of the captured and delivered CO_2.

The first step in the CCS process is capture of the CO_2 from the process in a form that is suitable for transport. There are several methods that may be used for capturing CO_2 from gas streams including chemical and physical absorption, cryogenic separation, and membrane separation. Only physical and chemical absorption would be considered technically implementable for a high volume, low concentration gas stream. Currently, there are no combined cycle power plants utilizing CO_2 absorption systems. As such, this technology, while theoretically feasible, has not been demonstrated in practice for combined cycle facilities. Even if it were commercially available, the cost for designing, installing and operating this type of capture system would be prohibitive. In addition, the costs of compressing the captured CO_2 to pressures needed for transportation would result in a large parasitic load to the facility, reducing its efficiency and increasing overall emissions of CO_2 and all other regulated pollutants on a per megawatt-hour basis.

The next step in the CCS process is transportation of the captured CO_2 to a suitable storage location. Currently CO_2 storage is available at only a very limited number of sites. Geologic conditions at the proposed Project Development Area, underlain with Stockbridge Marble with a significant degree of fracturing, are not suitable for carbon sequestration. CVE does not own or control any other sites that would be appropriate for CO_2 sequestration. The closest commercially available CO_2 sequestration site is in Saskatchewan, Canada, over 2,000 miles from the Project Development Area. Accordingly, to remain a viable control technology, captured CO_2 would have to be transported to the storage site in order to achieve any environmental benefit. Pipelines are the most common method for transporting large quantities of CO_2 over long distances. There are currently approximately 3,600 miles of existing CO_2 pipeline located in the United States. However, there is no existing CO_2 pipeline located near the Project Development Area, the nearest pipeline being over 1,000 miles away. As such, a CO_2 transportation pipeline would need to be constructed to tie into the existing pipeline structure. The cost for permitting and constructing this pressurized CO_2 pipeline would be economically prohibitive.

Based upon the large costs associated with the capture, transportation and storage of CO_2, in addition to the large parasitic load, CCS is considered cost prohibitive and economically infeasible for the project.

Apart from CCS, the only other technology with the potential to reduce GHG from the proposed facility is pollution prevention or the use of inherently lower-emitting processes, practices and designs. Because emissions of CO_2 are directly related to the amount of fuel combusted, an effective means of reducing GHG emissions is through highly efficient combustion technologies. By utilizing more efficient technology, less fuel is required to produce the same amount of output electricity.

The project is designed for baseload electricity generation and will utilize state-of-the-art combustion turbine technology in combined cycle mode. Combined cycle generation takes advantage of the waste heat from the combustion turbines, capturing that heat in the HRSG and generating steam which then powers a conventional steam turbine. Use of waste heat in this manner makes combined cycle projects considerably more efficient than conventional boiler technology.

The project is proposing to use GE 7FA.05 combustion turbines, which utilize highly efficient combustion technology. In addition, the combustion turbines will combust natural gas as their only fuel source. Other fossil fuels generate a greater amount of CO_2 per megawatt-hour of power produced or million British thermal units (MMBtu) of fuel consumed. As such, using natural gas as the only fuel source effectively minimizes the production of CO_2 from combustion. The proposed project has a "Design Base Heat Rate" of approximately 6,740 British thermal units per kilowatt-hour (Btu/kW-hr) (higher heating value [HHV]) at International Standards Organization (ISO) conditions (59°F, 60 percent relative humidity) with no duct firing.

4.3.9.1 Search of LAER/BACT Determinations

The search of the RBLC identified more than 300 natural gas-fired combined cycle projects. However, the RBLC did not provide a CO_2 BACT limit for any of these projects. However, the Bay Area Air Quality Management District (BAAQMD) in California issued a permit in February 2010 for the Russell City Energy Center that included a BACT limit. The Russell City Energy Center is the only available permit for a combined cycle facility that has included a BACT limit for CO_2. It is a proposed combined cycle generating facility with a nominal capacity of 600 megawatts (MW) utilizing two Siemens F-class combustion turbines. In the Statement of Basis, the BAAQMD indicated that its BACT determination is based upon a design thermal efficiency of 56.4 percent (lower heating value [LHV]), which was considered the highest efficiency available for the F-class turbine family at that time. The BAAQMD based this determination on a comparison with other similar facilities in California that had recently been permitted, or were currently undergoing review. They found the 56.4 percent efficiency to be higher than any other comparable facility. For this reason, the BAAQMD determined that "the 56.4% (LHV) thermal efficiency proposed for the Russell City Energy Center is the best efficiency performance achievable from commercially available systems for a 600 MW combined cycle power plant."

The Russell City Energy Center PSD Permit established a BACT limit of 7,730 Btu/kW-hr for this facility. This BACT limit is based upon a design base heat rate of 6,852 Btu/kw-hr based on net power output at ISO conditions without duct firing, and includes a reasonable margin of compliance. In its analysis, the BAAQMD evaluated factors that could be reasonably expected to degrade the theoretical design efficiency of the turbines and increase the heat rate. They considered a number of factors including:

- A design margin to reflect that the equipment as constructed and installed may not fully achieve the assumptions that went into the design calculations;
- A reasonable performance degradation margin to reflect normal wear and tear; and
- A reasonable degradation margin based on normal wear and tear caused by variability in the operation of the auxiliary plant equipment.

Based on their analysis, BAAMD concluded that 12.8 percent was a reasonable compliance margin to add to the design base heat rate to develop a numerical BACT limit.

4.3.9.2 LAER/BACT Determination

The GE 7FA.05 turbines operating in combined cycle mode proposed for the CVE project have a design thermal efficiency of 57.4 percent (LHV) at ISO conditions with no duct firing. In addition, they have a design base heat rate of 6,742 Btu/kW-hr at ISO conditions with no duct firing (based on net output). Both of these values are superior to the efficiencies proposed in the Russell City Energy Center BACT analysis. Based upon these design efficiencies, and adding a reasonable margin of compliance consistent with the BAAQMD analysis for Russell City Energy Center, CVE is proposing a limit of 7,605 Btu/kW-hr (ISO conditions without duct firing) as BACT for the proposed project. This limit represents the lowest heat input rate that can reasonably be assured under all operating scenarios. This level of emissions will be achieved through utilization of high efficiency, state-of-the-art combustion turbine technology and combusting only commercially available, pipeline quality natural gas in the turbines. This emission level is consistent with the limit provided in the BACT determination for the Russell City Energy Center, and represents the lowest level of CO_2 emissions for combined cycle power plants demonstrated in practice.

4.3.10 Emission Limit and Control Technology Summaries

Tables 4-8 through 4-11 summarize the proposed emission limits and associated control technologies for the project.

Table 4-8: Summary of Proposed BACT/LAER Emission Limits and Associated Control Technologies for the Combined Cycle Units

Pollutant	Emission Rate (lb/MMBtu)	Emission Rate (ppm_v)	Control Technology	Represents
NO_x			DLN[c] and SCR	LAER
CT[a] only	0.008	2.0		
CT with DB[b]	0.008	2.0		
VOC			Good combustion controls and oxidation catalyst	LAER
CT only	0.001	1.0		
CT with DB	0.003	2.0		
CO			Good combustion controls and oxidation catalyst	BACT
CT only	0.005	2.0		
CT with DB	0.005	2.0		
$PM_{10}/PM_{2.5}$			Low sulfur fuel	BACT
CT only	0.005	n/a		
CT with DB	0.006	n/a		
SO_2			Low sulfur fuel	BACT
CT only	0.0015	n/a		
CT with DB	0.0015	n/a		
H_2SO_4			Low sulfur fuel	BACT
CT only	0.0004	n/a		
CT with DB	0.0006	n/a		

a. Combustion turbine.
b. Duct burner.
c. Dry-low NO_X.

Table 4-9: 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	0.011	Low NO_X burner and flue gas recirculation	LAER
VOC	0.0015	Good combustion controls	LAER
CO	0.0375	Good combustion controls	BACT
$PM_{10}/PM_{2.5}$	0.005	Low sulfur fuel	BACT
SO_2	0.0015	Low sulfur fuel	BACT
H_2SO_4	0.0001	Low sulfur fuel	BACT

Table 4-10: 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 4-11: 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

4.4 Sources and Source Emission Parameters

The project includes the following emission sources:

- Three combined cycle units, each consisting of one combustion turbine with a HRSG supplemental duct firing (both combusting only natural gas);
- An auxiliary boiler (combusting only natural gas);
- An emergency fire pump (combusting ULSD); and
- Four black-start emergency generators (combusting ULSD).

4.4.1 Combined Cycle Units

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 36 percent combustion turbine load without supplemental duct firing to 100 percent combustion turbine load with supplemental duct firing (full capacity).

Because of the different emission rates and exhaust characteristics, a matrix of operation modes is employed in the various analyses completed. Exhaust parameters and emission rates for three different ambient temperatures (105°F, 59°F and -8°F), four turbine loads (100 percent, 75 percent, 50 percent, and 36 percent), and with and without duct firing are incorporated into the analyses.

Combined cycle startup and shutdown scenarios are also included in the emissions estimates. Startup and shutdown conditions refer to times which may, for some pollutants, result in an increase in short term (lb/hr) emission rates because the systems have not reached their optimal operating efficiency or temperatures for the control equipment. 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 following sections present estimated emissions from the combined cycle units 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. Detailed emissions calculations are provided in Appendix 4-B.

As described above, exhaust and emission parameters for the proposed combustion turbines have been developed for three ambient temperatures, four load conditions and duct burner operation. Table 4-12 presents short term (lb/hr) emissions estimates from each combined cycle unit under ISO conditions (59°F) 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 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 4-B.

Potential emissions of HAPs and NYSDEC air toxics (e.g., non-criteria pollutants) from operation of the combustion turbines and duct burners were estimated using emission factors presented in AP-42 and other regulatory sources. Appendix 4-B provides emission estimates for these non-criteria pollutants.

Table 4-12: Summary of Short Term Emission Rates for a Single Combined Cycle Unit[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)	36% Load without Duct Burning[b] (lb/hr)
NO_x	18.7	15.8	12.6	10.0	8.6
VOC	6.5	2.8	2.2	1.7	1.5
CO	11.4	9.6	7.7	6.1	5.3
$PM_{10}/PM_{2.5}$	14.4	10.1	9.9	9.7	9.6
SO_2	3.6	3.0	2.4	1.9	1.6
H_2SO_4	1.5	0.82	0.66	0.53	0.45
NH_3	17.3	14.6	11.6	9.3	8.0

a. Emissions presented in table are for ISO conditions. These may not represent worst-case conditions for purposes of air quality dispersion modeling. Appropriate worst-case conditions were used for these analyses, as discussed in Section 4.5.2.

b. The duct burner will only operate while the combustion turbine is running at 100% load.

Potential emissions associated with startup and shutdown of the combined cycle units were developed using vendor-supplied information. Table 4-13 presents the emissions and downtimes (minimum number of hours the units would be off before a re-start) associated with startup and shutdown events for the combined cycle unit. 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. Potential annual emissions for the project incorporate the emissions from startup and shutdown. The shutdown case has shorter duration and lower emission rates, compared to the cold start and warm/hot start cases. The shutdown case would, therefore, have lesser impacts, and was not included in modeling.

Table 4-13: 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	2.4	1.0	1.0	0.34
	Emissions Per Event (lb)[a]			
$PM_{10}/PM_{2.5}$	30.7	14.4	14.4	4.1
SO_2	3.18	2.03	2.03	0.54
NO_x	104.4	43	43	18.4
CO	1693	236	236	322
VOC	244.4	16	16	38.5

a. pounds.

4.4.2 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 four 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 60 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 4-14 and 4-15 summarize estimated short-term (lb/hr) and annual emissions of criteria pollutants from the ancillary equipment. Supporting calculations are provided in Appendix 4-B.

Table 4-14: Short-Term Potential Emissions from Ancillary Equipment

Pollutant	Auxiliary Boiler (lb/hr)	Emergency Fire Pump[a] (lb/hr)	Each Black-Start Generator (lb/hr)
$PM_{10}/PM_{2.5}$	0.30	0.051	1.45
SO_2	0.09	0.003	0.04
NO_x	0.66	1.54	20.55
CO	2.25	0.31	25.08
VOC	0.09	0.057	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 4-15: Potential Annual Emissions from Ancillary Equipment

Pollutant	Auxiliary Boiler (tpy)	Emergency Fire Pump (tpy)	Four Black-Start Generators (tpy)	Total (tpy)
$PM_{10}/PM_{2.5}$	0.68	0.02	1.45	2.15
SO_2	0.20	0.001	0.04	0.25
NO_x	1.49	0.66	20.55	22.69
CO	5.06	0.13	25.08	30.28
VOC	0.20	0.02	0.95	1.18
Pb	–-	1.01×10^{-5}	4.24×10^{-4}	4.34×10^{-4}

4.4.3 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 firing during steady-state operation of each combustion turbine;
- Incorporation of startup/shutdown events (a total of 260 combined startup events per year and 260 shutdown events per year were assumed); and
- Incorporation of emissions from ancillary equipment.

Potential annual emissions for the proposed project are summarized in Table 4-16.

Table 4-16: Summary of Annual Potential Emissions

Pollutant	Combined Cycle Units (tpy)	Ancillary Equipment (tpy)	Total (tpy)
$PM_{10}/PM_{2.5}$	189.7	2.1	191.9
SO_2	46.6	0.2	46.9
NO_x	256.7	22.7	279.4
CO	539.6	30.3	569.9
VOC	116.9	1.2	118.1
H_2SO_4	19.7	0.016	19.7
NH_3	227.3	0	227.3
Pb	–-	4.34×10^{-4}	4.34×10^{-4}

The emission rates and stack exit parameters used in the modeling analyses are provided in the following tables: combined cycle units (Table 4-17), ancillary equipment (Table 4-18), and combined cycle startup and shutdown events (Table 4-19).

Table 4-17: Stack Parameters and Emission Rates for a Single Combined Cycle Unit

		Design Cases						
	Units	**Case 1**	**Case 2**	**Case 3**	**Case 4**	**Case A**	**Case 5**	**Case 6**
Fuel Type	--	Gas	Gas	Gas	Gas	Gas	Gas	Gas
Ambient Temperature	°F	105	105	105	105	105	59	59
Percent Load Rate	%	100	100	75	52	36	100	100
Duct Burner Operation	--	Yes	No	No	No	No	Yes	No
Stack Diameter	feet	19	19	19	19	19	19	19
Stack Height	feet	282.5	282.5	282.5	282.5	282.5	282.5	282.5
Stack Temperature	°K[a]	371.5	373.7	364.8	363.2	364	354.8	363.7
Stack Exit Velocity	m/s	21.7	21.7	16.2	14.7	12.54	21.4	21.8
NO_x Emission Rate	g/s[b]	2.09	1.89	1.45	1.21	1.00	2.36	1.99
CO Emission Rate	g/s	1.27	1.15	0.88	0.74	0.60	1.44	1.21
VOC Emission Rate	g/s	0.73	0.33	0.25	0.21	0.18	0.82	0.35
SO_2 Emission Rate	g/s	0.40	0.36	0.28	0.23	0.19	0.45	0.38
Total $PM_{10}/PM_{2.5}$	g/s	1.59	1.27	1.24	1.22	1.20	1.82	1.27

a. degrees Kelvin
b. grams per second

Table 4-17: Stack Parameters and Emission Rates for a Single Combined Cycle Unit (Cont.)

		Design Cases							
	Units	**Case 7**	**Case 8**	**Case B**	**Case 9**	**Case 10**	**Case 11**	**Case 12**	**Case C**
Fuel Type	--	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas
Ambient Temperature	°F	59	59	59	-8	-8	-8	-8	-8
Percent Load Rate	%	75	49	36	100	100	75	52	36
Duct Burner Operation	--	No	No	No	Yes	No	No	No	No
Stack Diameter	ft	19	19	19	19	19	19	19	19
Stack Height	ft	282.5	282.5	282.5	282.5	282.5	282.5	282.5	282.5
Stack Temperature	°K	355.9	352.6	364	358.2	365.9	361.5	352.6	364
Stack Exit Velocity	m/s	16.7	14.1	12.9	23.4	23.7	18.7	14.6	13.09
NO_x Emission Rate	g/s	1.59	1.26	1.08	2.56	2.19	1.73	1.39	1.17
CO Emission Rate	g/s	0.97	0.77	0.67	1.56	1.34	1.06	0.84	0.72
VOC Emission Rate	g/s	0.28	0.21	0.19	0.89	0.38	0.30	0.24	0.20
SO_2 Emission Rate	g/s	0.30	0.24	0.21	0.49	0.41	0.33	0.27	0.22
Total PM_{10}/$PM_{2.5}$	g/s	1.25	1.22	1.21	1.85	1.29	1.26	1.23	1.22

Table 4-18: 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	^oK	423.7[a]	692.6	745.9[b]
Stack Height	feet	282.5	50	282.5
Stack Diameter	feet	19	0.67	19
Stack Exit Velocity	m/s	0.31[a]	36.7	0.44[b]
NO_x	g/s	0.083	0.33	2.59[c]
CO	g/s	0.28	0.07	3.16[c]
VOC	g/s	0.011	0.01	0.12[c]
SO_2	g/s	0.016	0.0006	0.01[c]
$PM_{10}/PM_{2.5}$	g/s	0.038	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 alone.

c. These represent emissions from each black-start generator.

Table 4-19: Modeling Inputs for Combined Cycle Startup Events

Pollutant	Units	Cold Startup	Warm/Hot Startup
NO_x	g/s	5.5	5.4
CO	g/s	43.7	29.7
SO_2	g/s	0.16	0.26
$PM_{10}/PM_{2.5}$	g/s	1.6	1.8
Exit Temperature	^oK	368.2[a]	373.7
Exit Velocity	m/s	8.4[a]	11.8

[a]Cold start was modeled with auxiliary boiler operating (combined flow).

Figure 4-4 provides a detailed plot plan which clearly identifies the building locations, building footprints, stack locations and property fence line. Each HRSG has a dedicated stack. The Universal Transverse Mercator (UTM) coordinates for the three HRSG stacks and the emergency fire pump are provided in Table 4-20. 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 combined cycle unit's HRSG stacks (Stack No. 1). The emergency fire pump will have its own exhaust stack.

Table 4-20: 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. Universal Transverse Mercator (UTM) Zone 18, North American Datum of 1983 (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, 50 and 36 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/hot start cases. The shutdown cases have shorter duration and lower emission rates compared to the cold start and warm/hot start cases, and would, therefore, have lesser impacts. Stack parameters for startups are based on operating information provided by turbine vendors (reflected in Table 4-18). 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 combined cycle units for short periods of time. However, only one black-start generator would be readiness tested at a time. This scenario was modeled for the compliance demonstration.

Similarly, for the fire pump, readiness testing could occur while the combined cycle units are operating.

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

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

4.5 Air Quality Impact Assessment

This section presents the air quality modeling analyses performed to satisfy the PSD requirements. 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 requiring other impact analyses. The NAAQS and NYAAQS were previously presented in Table 4-1; PSD increments, SILs and SMCs were previously presented in Table 4-3.

As shown in Table 4-1, 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), Division of Air Resources (DAR)-1, and are addressed in the air toxics impact analysis (Section 4.6.2).

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. USEPA guidance issued during 2010 prompted additional correspondence concerning modeling procedures for $PM_{2.5}$, 1-hour SO_2 and 1-hour NO_2. The protocol and agency correspondence related to modeling procedures are provided in Appendix 4-A.

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 in *"Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS*" (March 26, 2010), *"Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS*" and *"Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program*" (June 28, 2010), and *"Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 NAAQS*" and *"Guidance Concerning the Implementation of the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program*" (August 23, 2010).; 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 incorporates and addresses comments raised by the agencies during their review of the protocol.

4.5.1 Stack Height Optimization

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 reduced 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 Plume Rise Model Enhancement (PRIME) version of BPIP (BPIPPRM) (Schulman, et al., 1997) is used with the atmospheric dispersion modeling system, AERMOD. BPIP uses 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. Tier heights for the various project elements are shown on Figure 4-5. The base elevation of the proposed stack is 436 feet above msl.

The results of the BPIP analysis for the combustion turbine stacks indicate that the HRSG enclosures and structures on the top of the air cooled condensers, 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) [113 feet + 1.5 x 113 feet = 282.5 feet], which translates to a stack-top elevation of 718.5 feet above 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 above msl) and was modeled with inputs to account for building wake downwash.

4.5.2 Air Quality Modeling

4.5.2.1 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 was used in the modeling for all pollutants except NO_2. (The approach for NO_2 is discussed below in 4.5.5.) The regulatory default 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.

4.5.2.2 Meteorological Data

NYSDEC and USEPA recommend using a five-year data set 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 meteorological data selected for the sequential modeling consist of hourly surface observations calculated from one-minute Automated Surface Observing System (ASOS) data collected at the Poughkeepsie Airport from March 10, 2005 through March 9, 2010. Upper air radiosonde[1] data concurrent with the surface meteorological data were obtained from the National Climatic Data Center (NCDC) for Albany, New York. A wind rose depicting the five years of meteorological data used in the modeling is presented in Figure 4-2. 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 (periods with wind speeds too low to be accurately modeled) were reduced from about 40 percent of hours to less than 10 percent.

The inputs to AERMET for surface characteristics (surface roughness, Albedo, and Bowen ratio) were determined using the AERSURFACE preprocessor. The following seasonal assignments were made for the indicated calendar months:

- Late autumn after frost and harvest, or winter with no snow: December, January, February, March
- Transitional spring (partial green coverage, short annuals): April, May

[1] A radiosonde is a unit used in weather balloons that measures atmospheric parameters and transmits them to a fixed receiver. Radiosonde data is an important component of numerical weather prediction.

- 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 surface characteristics were compared to the area surrounding the Project Development Area. Specifically, land use distribution and estimated values of surface roughness (z_0), Albedo and Bowen ratio for the area surrounding the Project Development Area were compared to surface parameters for the area surrounding the airport. The predominant land use around the Project Development Area 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 Development Area, while the two sites have comparable Albedo and Bowen ratio. To ensure that model predictions are based on meteorological inputs representative of the Project Development Area, AERMOD was run with two sets of input meteorology, created using AERSURFACE parameters from both the airport and the Project Development Area. The modeling results show that maximum impacts were predicted using the surface parameters for the area surrounding the airport. As such, the air quality analysis presented in subsequent sections of this document use surface characteristics consistent with 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 Development Area. Under these conditions, the 282.5 foot stacks will be above the inversion layer, and the inversion will prevent the plumes from mixing down to ground level. Poughkeepsie Airport 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 the Poughkeepsie Airport. As such, the airport data accurately represents conditions at plume height including potential inversions.

4.5.2.3 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 Project Development Area 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 Auer's categories (i.e. urban, rural, water) to the land within a 3-km radius of the Project Development Area (Auer, 1978). Based on an evaluation of land use in the vicinity of the Project Development Area, 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.

4.5.2.4 Receptors

A receptor grid consisting of 1,710 receptors contained within five nested (overlapping) 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 Project Development Area, 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 = -3,000 to +800 m, and from Y = -800 to +1,600 m, plus from X = -3,000 to -2,000 m, and from Y = -1,200 to -900 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 Development Area, in the vicinity of peak predicted impacts from the turbine stacks. For NO_2, the outer grid was extended to a distance of 30 km from the project, with 1,000 m spacing, in order to define the Significant Impact Area (SIA) for this pollutant.

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.

Using Lakes AERMOD View® software, a topographic map of the model region was generated using the AERMAP elevations.

Surveyed topographic information was available for the Project Development Area. 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 an uninhabited area about 1.4 km (4,600 feet) to the west of the Project Development Area.

4.5.2.5 AERMOD Modeling Results

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

4.5.2.5.1 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/hot 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 not 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 4.4. (As noted previously, modeling was initially performed using two sets of meteorological data, reflecting surface characteristics around the Poughkeepsie Airport and around the Project Development Area. The airport data set consistently gave higher predictions for all controlling scenarios. The results discussed below were therefore obtained with data processed using surface characteristics around the airport site.

4.5.2.5.2 Comparison with SILs

The operating scenarios that yielded the highest predicted impacts for each pollutant and averaging time were identified. The maximum predicted impacts for any modeled year from these scenarios were evaluated relative to SILs 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 4-21. Table 4-21 also presents the turbine operating scenario and year of meteorological data that resulted in the worst-case predicted impact. As indicated in Table 4-21, for 1-hour average SO_2 and NO_2, and for 24-hour and annual average $PM_{2.5}$, USEPA guidance [USEPA 2010a, USEPA 2010b, and USEPA 2010d] recommends that significant impacts be evaluated by averaging the maximum impacts for the 5 years of meteorological data. As such, the maximum values predicted for each year at each receptor were averaged, and the highest of these 5-year average maximum values is reported.

Table 4-21: Maximum Predicted Impacts – Cricket Valley Energy

Pollutant	Averaging Time	Impact ($\mu g/m^3$)	Combined Cycle Unit Scenario[a]	Year	SIL	SMC
NO_2	Annual	0.57	100%, 59°F, DB plus ancillary equipment	2007	1	14
	1-hour	68.6[b]	Cold start plus auxiliary boiler	5-year average	7.5[c]	_[d]
CO	1-hour	1,484	Cold start plus auxiliary boiler	2005	2,000	n/a
	8-hour	343	Cold start plus auxiliary boiler (2.4 hours)	2009	500	575
SO_2	1-hour	6.8	100%, 59°F, DB	5-year average	7.8[e]	_[d]
	3-hour	3.24	100%, 59°F, DB	2006	25	n/a
	24-hour	0.98	100%, 59°F, DB	2008	5	13
	Annual	0.10	100%, 59°F, DB plus ancillary equipment	2007	1	n/a
PM_{10}	24-hour	4.90	49%, 59°F	2008	5	10
	Annual	0.43	49%, 59°F, plus ancillary equipment	2007	1	n/a
$PM_{2.5}$	24-hour	3.00	100%, 59°F, DB plus ancillary equipment	5-year average	1.2[f]	4[f]
	Annual	0.301	49%, 59°F, plus ancillary equipment	5-year average	0.3[e]	n/a

a. Combined cycle unit 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. Five-year average maximum predicted 1-hour impact.

c. In guidance published June 28, 2010, USEPA recommends use of 4 ppb as an Interim SIL for 1-hour NO_2

d. Not yet proposed.

e. Interim value based on EPA guidance

f. On September 29, 2010, USEPA finalized SILs and the SMC for $PM_{2.5}$.

Peak impacts are below the SILs for annual NO_2, and for CO, 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. 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. Therefore, additional modeling is not required for these pollutants.

The modeling results also indicate that the maximum predicted project impacts exceed the interim SIL for 1-hour NO_2 and the 24-hour and annual SILs for $PM_{2.5}$. If a major source or major modification is predicted to have maximum impacts greater than SILs, then a cumulative modeling impact, including other nearby facilities, is required.

The USEPA promulgated SILs for $PM_{2.5}$ on September 29, 2010 as indicated in Table 4-1 of this document. As presented above, predicated impacts for the 24-hour and annual $PM_{2.5}$ exceed the SIL. The distance to the farthest receptor that exceeds the SIL defines the SIA. The SIA is defined as a circle with a radius equal to this distance and the center located at the Project Development Area. This cumulative modeling is described in Section 4.5.4.

For the scenario with maximum predicted 24-hour impacts, 130 receptors have predicted $PM_{2.5}$ impacts above the SIL (1.2 µg/m^3). The largest source-receptor distance is 6.08 km. This distance, therefore, defines the SIA. Only one receptor has a predicted maximum annual average impact above 0.3 µg/m^3, and it is located within this SIA.

Additional modeling was required to determine the SIA for 1-hour average NO_2, using the "ozone limiting" Plume Volume Molar Ratio Method (PVMRM) option available with AERMOD. USEPA guidance on modeling procedures to determine compliance with the 1-hour average NAAQS for NO_2 is summarized in two companion memos (USEPA 2010b, USEPA 2010c). These memos present a 3-tier screening procedure and assign an interim SIL of 4 ppb (7.5 µg/m^3). PVMRM is a "Tier 3" screening method for estimating NO_2 impacts, as described in the June 28, 2010 USEPA memorandum (USEPA, 2010c). The receptor grid was expanded to cover a region extending 30 km in all directions around the project site. (Receptors for the added area were placed at 1 km spacing.) The maximum impact is predicted at a receptor 2 km west of the Project Development Area, in the vicinity of the peak 24-hour impact for $PM_{2.5}$. All of the receptors with predicted impacts above the SIL are on elevated terrain. The maximum distance to a receptor with significant impact is 29.6 km east-northeast of the Project Development Area. Cumulative impact modeling for 1-hour average NO_2 is presented in Section 4.5.5.

4.5.3 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 demonstrates that impacts from a project are less than the SMCs then a source can be exempted from preconstruction monitoring requirements that might otherwise apply under the PSD program.

Table 4-21 provides a summary of maximum predicted project impacts relative to the SMCs. On September 29, 2010 the USEPA promulgated an SMC for $PM_{2.5}$. Table 4-21 presents the recently promulgated SMC value.

As indicated above, maximum predicted project impacts are less than the SMCs for NO_2, CO, SO_2, PM_{10} and $PM_{2.5}$ However, because the SMC for $PM_{2.5}$ was only recently promulgated, a waiver from preconstruction monitoring had previously been requested from USEPA Region 2 (on February 26, 2010). The waiver request indicates that measured $PM_{2.5}$ concentrations from the existing monitoring station at Thomaston, Connecticut (090050004) is representative of conditions in the project vicinity, based on geographic proximity and comparable population density. The USEPA approved the waiver request. A copy of the waiver request and USEPA's approval of the Thomaston, Connecticut monitoring site are provided in Appendix 4-A.

Based on the most current three years of air quality data from the approved monitor, the estimated $PM_{2.5}$ background concentrations are 8.8 µg/m^3 (3-year average of annual average concentrations) and 24.6 µg/m^3 (3-year average of 98th percentile [8th high] 24-hour average concentrations).

4.5.4 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. As agreed upon with NYSDEC, the cumulative modeling includes all permitted (major and non-major) 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 (for a total of approximately 56 km). Cumulative impacts were predicted using the worst-case operating scenario for the project (Case 5: turbines at 100% load, 59°F with duct burning), and all other sources at maximum permitted emission rates.

The search distance for facilities was 56 km from the Project Development Area. The SIA is located entirely within Dutchess County, but the 56-km search area extends into Connecticut and Massachusetts. Both the Connecticut Department of Environmental

Protection and the Massachusetts Department of Environmental Protection confirmed that there are no major sources of particulate matter emissions within 56 km of the project located in Connecticut or Massachusetts (correspondence is provided in Appendix 4-A). The NYSDEC provided an inventory of all permitted sources of particulate matter within 60 km of the project. From the data provided, three (non-major) permitted facilities were identified within the SIA and six major sources of $PM_{2.5}$ were identified within 56 km of the project, for a total of nine sources. No PSD increment-consuming sources (major sources constructed after promulgation of the PSD increments) of $PM_{2.5}$ within 56 km of the project were identified. Therefore, no cumulative modeling with other sources is required with to demonstrate compliance with PSD increment consumption. As shown in Table 4-22, the maximum impact of the CVE project is less than the available PSD increment.

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 were provided in this NYSDEC information. CVE worked with NYSDEC to fill the remaining data gaps, which involved confirming location coordinates, developing estimates of potential $PM_{2.5}$ emission rates from the identified sources and developing estimates for building dimensions and missing stack parameters. The emissions inventory information is documented in Appendix 4-B.

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 impacts are less than SILs.

The peak 24-hour impacts for $PM_{2.5}$ at receptors where the project has a predicted significant impact are summarized in Table 4-22. Annual impacts were assessed at the one receptor where predicted project impacts are above the annual SIL. Modeling demonstrates that the CVE project is in compliance with NAAQS/NYSAAQS and PSD increments. Because NYSDEC has indicated that there are no other PSD increment consuming sources in the region, CVE increment consumption for 24-hour and annual $PM_{2.5}$ can be compared to the entire increments, 9 $\mu g/m^3$ and 4 µg/m3, respectively. Predicted PSD increment consumption (from CVE alone) for 24-hour and annual $PM_{2.5}$ is 3.0 $\mu g/m^3$ and 0.301 $\mu g/m^3$ respectively, well below the corresponding increments.

Table 4-22: Peak Predicted Annual and 24-Hour $PM_{2.5}$ Cumulative Impacts

		5-year Average Maximum ($\mu g/m^3$)	PSD Increment ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
Comparison with PSD Increment						
CVE Project	24-hour	3.00	9	n/a	n/a	n/a
	Annual	0.301	4	n/a	n/a	n/a
Comparison with NAAQS						
All Sources	24-hour	6.70	n/a	24.6	31.3	35.0
	Annual	0.80	n/a	8.8	9.6	15.0

The estimated peak 24-hour concentration from all sources combined (5-year average maximum predicted 24-hour impact, plus 98th percentile observed background concentration) is 31.3 µg/m^3, below the NAAQS of 35 µg/m^3. The predicted annual average impact at the peak receptor is 9.6 µg/m^3, below the NAAQS of 15 µg/m^3. These results demonstrate that the project will comply with the applicable PSD increments and air quality standards for $PM_{2.5}$.

4.5.5 Cumulative Impact Modeling for NO_2

Cumulative impact modeling was performed to assess the impacts of the project plus other sources of NO_x in the surrounding region. With concurrence from NYSDEC, permitted (major and non-major) sources within the approximately 29 km SIA were included in the modeling. In addition, major sources outside of the SIA, to a distance of 50 km were also included in the cumulative modeling. Cumulative impacts were predicted using the worst-case operating scenario for the project (cold start for one turbine, plus auxiliary boiler), and all other identified sources at maximum permitted short-term emission rates.

As described above, the search distance was 29 km from the project stacks for all permitted sources of NO_x emissions, and 50 km for major sources. The SIA encompasses Dutchess County and western Connecticut, but not Massachusetts. However, the 50-km search area extends into neighboring New York counties, plus Connecticut and Massachusetts. The Massachusetts Department of Environmental Protection confirmed that there are no major sources of NO_x emissions in Massachusetts located within 50 km of the project (correspondence is provided in Appendix 4-A). The NYSDEC and Connecticut Department of Environmental Protection provided an inventory of all permitted sources of NO_x in New York and Connecticut, respectively, within 50 km of the project. From the data provided, 14 non-major permitted facilities were identified within 29 km of the project (nine in New York, five in Connecticut). In addition, ten major sources of NO_x located within 50 km of the project (seven in New York, three in Connecticut) were identified for a total of 24 sources.

The NYSDEC and Connecticut Department of Environmental Protection 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 were provided. CVE worked with NYSDEC and Connecticut Department of Environmental Protection to fill the remaining data gaps, which involved confirming location coordinates, developing estimates of potential NO_x emission rates from the identified sources and developing estimates for building dimensions and missing stack parameters. The “stack ratio” of NO_2 to NO_x (a model input required for the PVMRM option) was also estimated for each emission unit, using values approved by USEPA. The emissions inventory information is provided in Appendix 4-B.

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 impacts are less than SILs.

Maximum daily 1-hour NO_2 impacts were assessed at all receptors where the 5-year average of the highest 1-hour concentration in each year exceeded the SIL. Peak 1-hour concentrations were determined by taking the 5-year average 98th percentile (8th highest) daily maximum predicted 1-hour impact from cumulative modeling of all sources and adding the estimated background concentration. This peak impact was compared to the NAAQS of 188 µg/m^3. (The NAAQS is based upon the 98th percentile, which corresponds to the 8th-highest value for each year.)

Five receptors where the project's 5-year average maximum impact exceeds the SIL show 5-year average 98th percentile concentrations above the standard. AERMOD was run to predict 1-hour concentrations for these five receptors, with and without the CVE project's contribution. The difference between these predicted concentrations is the contribution from the CVE project. At any of the five receptors, for each day that impacts exceeded the SIL, maximum daily 1-hour predictions with and without the project were compared to each other. For these five receptors, 1-hour impacts above the NAAQS were predicted for a total of 284 receptor-days over the 5-year modeling period. (Exceedances were predicted at multiple receptors for some days.) The largest contribution from the CVE project to any of the 284 predicted NAAQS exceedances is 0.17 µg/m^3, far below the SIL of 7.5 µg/m^3. This demonstrates that, while the project has predicted impacts exceeding the SIL at these receptors, these exceedances are not predicted to occur simultaneously with peak impacts from other sources. These results demonstrate that the project will not cause or contribute significantly to any predicted violation of the 1-hour air quality standards for NO_2. The results of this cumulative modeling are summarized in Table 4-23. It should be noted that the background estimate used for this analysis is highly conservative. If the background value were based on the 3-year average second-highest daily maximum observed values, similar to other short-term standards for CO and PM_{10}, rather than the highest, the results would show no predicted NAAQS violations.

Table 4-23: Peak 1-Hour NO_2 Impacts at Receptors with Significant Project Impact

5-year Average 98th Percentile 1-hour Prediction (µg/m^3)	Receptor Location		Impact All Sources (µg/m^3)	Background (µg/m^3)	Number of Days with 1-hr Maximum > 188 µg/m^3	Highest CVE Contribution (µg/m^3)	Significant Impact Level (µg/m^3)
	X	Y					
214.18	-12000	-18000	91.38	122.8	87	0.12	7.5
206.00	-10000	-15000	83.20	122.8	67	0.17	7.5
199.63	-11000	-16000	76.83	122.8	56	0.05	7.5
188.63	-9000	-15000	65.83	122.8	35	0.06	7.5
188.39	-3000	-300	65.59	122.8	39	0.07	7.5

4.5.6 Class I Impact Analyses

As discussed in Section 4.1.2.3, there are no PSD Class I areas within 100 km of the proposed Project Development Area. The closest designated PSD Class I area is the Lye Brook Wilderness Area, located 167 km north-northeast of the Project Development Area 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 4-A.

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 Development Area, is the State Park nearest to the project. This park is primarily used for golfing, with a picnic area, camping and hiking. 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 steady state operating scenario with maximum emissions (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 4-24.

Table 4-24: 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	1.93	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	0.684	0.05	0.008
	Terrain	2.00	0.570	0.05	0.007
Catskill State Park – Visual Impacts Outside Park		**Criteria**	**Plume**	**Criteria**	**Plume**
	Sky	2.00	0.831	0.05	0.009
	Terrain	2.00	0.738	0.05	0.009

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, indicating that the project will not cause adverse visual impacts at these receptors.

4.5.7 Additional Impacts Analyses

4.5.7.1 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 results of the analysis are presented in Table 4-25. 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 47.0 tpy of SO_2 and 279.4 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 the 18 receptors is below 0.029 percent for all locations.

Table 4-25: 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	0.00000346	0.0024%	0.025844	4.136114	0.001114	0.0269%
W. Adirondacks	0.000332	0.201734	0.00000356	0.0018%	0.022323	5.179167	0.000962	0.0186%
Catskills	0.001961	0.263758	0.00002103	0.0080%	0.133946	7.107259	0.005774	0.0812%
West Point	0.003102	0.332539	0.00003326	0.0100%	0.316492	11.260204	0.013642	0.1212%
Chautauqua	0.000145	0.178049	0.00000155	0.0009%	0.002438	1.581787	0.000105	0.0066%
Brookhaven	0.001895	0.671944	0.00002032	0.0030%	0.288423	18.500769	0.012432	0.0672%
Bennett's Bridge	0.00031	0.409691	0.00000332	0.0008%	0.029299	3.440833	0.001263	0.0367%
Green Mountains	0.000359	0.121215	0.00000385	0.0032%	0.318198	8.233134	0.013716	0.1666%
Berkshires	0.00253	0.32963	0.00002713	0.0082%	0.497436	9.387031	0.021441	0.2284%
Connecticut	0.007858	0.291966	0.00008426	0.0289%	0.002035	0.589719	0.000088	0.0149%
Muskoka	0.000084	0.03358	0.00000090	0.0027%	0.020244	1.366437	0.000873	0.0639%
S. Nova Scotia	0.000454	0.065597	0.00000487	0.0074%	0.029463	2.380087	0.001270	0.0534%
New Hampshire	0.00036	0.090665	0.00000386	0.0043%	0.002756	0.499722	0.000119	0.0238%
SW Quebec	0.000061	0.016791	0.00000065	0.0039%	0.009958	1.015349	0.000429	0.0423%
S. Quebec	0.000109	0.024986	0.00000117	0.0047%	0.004136	0.368393	0.000178	0.0484%
NE Quebec	0.000046	0.008503	0.00000049	0.0058%	0.003676	0.24335	0.000158	0.0651%
Newfoundland	0.000076	0.012184	0.00000081	0.0067%	0.043456	3.27392	0.001873	0.0572%
Hubbard Brook	0.000588	0.138607	0.00000630	0.0045%	0.012498	7.170561	0.000539	0.0075%

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

Local impacts from acid precipitation formed due to the 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 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.

4.5.7.2 Impact on Industrial, Commercial and Residential Growth

The proposed project is 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 Project Development Area, 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.

4.5.7.2.1 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 (New York 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. As discussed in Section 6.3, 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.

4.5.7.2.2 Industry

The project will add a new industry to the area that will provide for substantial economic benefit through primary and secondary effects, as discussed in Section 6.7. 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.

4.5.7.3 Environmental Justice

An Environmental Justice analysis has been completed for the project, as provided in Section 6.7.4. As detailed in that analysis, no Environmental Justice Areas of concern are located in the project area. In addition, project air quality impacts are consistent with ambient quality standards, indicating that the air quality impact of the project is protective of human health and the environment.

4.5.7.4 Soils and Vegetation Analysis

PSD review requirements include an analysis to determine the potential air quality impacts on sensitive vegetation or soil types that may be present in the vicinity of a proposed project. Ambient air quality screening levels are provided for sensitive vegetation are provided in USEPA guidance (USEPA, 1980) and in related technical publications.

Soil characteristics for the Project Development Area and surrounding area are described in Section 2.2.3. None of the identified soil types has been identified as having any particular sensitivity to the air pollutants emitted by the CVE project.

The predominant land use classifications in the area surrounding the project are deciduous and evergreen forest and wooded wetlands. As discussed in Section 3.2.1, the Great Swamp CEA extends from the Project Development Area south into Putnam County. This area has been identified as the largest and most high quality red maple hardwood swamp in southern New York. About 10 percent of the surrounding area is classified as Pasture/Hay, and another 5 percent as cropland. The 2007 Census of Agriculture lists “Nursery & Floriculture,” “Vegetables & Potatoes,” and “Fruits & Nuts” as significant crop categories for Dutchess County.

Maximum predicted project impacts are compared to the relevant screening levels in Tables 4-26, 4-27, 4-28 and 4-29. All predicted project impacts are well below the vegetation impact threshold levels. The screening analysis and USEPA guidance support the conclusion that the proposed project will not adversely impact vegetation or soils in the project surroundings.

Table 4-26: Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds

Averaging Period	Predicted Project Impact ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
1-hour	68.6 (1-hour)	66,000[a]	Leaf Injury to plant
2-hour		1,130[b]	Affects to alfalfa
Annual	0.57	100[c]	Protects all vegetation
		190[d]	Metabolic and growth impact to plants

a. "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976.

b. "Synergistic Inhibition of Apparent Photosynthesis Rate of Alfalfa by Combinations of SO_2 and NO_2" Environmental Science and Technology, vol. 8(6): p.574-576, 1975. The limit is based on a concentration in ambient air of 0.6 ppm NO_2 (U 1,130 • g/m^3) which was found to depress the photosynthesis rate of alfalfa during a 2-hour exposure.

c. "Secondary National Ambient Air Quality Standard (• g/m^3) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the Clean Air Act). These thresholds are the most stringent of those found in the literature survey.

d. "Air Quality Criteria for Oxides of Nitrogen," EPA/600/8-91/049aF-cF.3v, Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1993.

Table 4-27: Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds

Averaging Period	Predicted Impact ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
1-hour	1,484	40,000[a]	Protects all vegetation
8-hour	343 (8-hour)	10,000[a]	Protects all vegetation
Multiple day		10,000[b]	No known effects to vegetation
1-week		115,000[c]	Effects to some vegetation
Multiple week		115,000[d]	No effect on various plant species

a. Secondary NAAQS (• g/m^3) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the CAA). These thresholds are the most stringent of those found in the literature survey.

b. "Air Quality Criteria for Carbon Monoxide," EPA/600/8-90/045F (NTIS PB93-167492), Office of Health and Environment Assessment, Environmental Criteria and Assessment Office, USEPA, Research Triangle Park, NC. 1991. Various CO concentrations were examined the lowest of these was 10,000 • g/m^3. Concentrations this low had no effects to various plant species. For many plant species, concentrations as high as 230,000 • g/m^3 caused no effects. The exception was legume seedlings which were found to experience abnormal leaf growth when exposed to CO concentrations of only 27,000 • g/m^3. Also related to this family of plants, CO concentrations in the soil of 113,000 • g/m^3 were found to inhibit nitrogen fixation. It is clear that ambient CO concentrations as low as 10,000 • g/m^3 will not affect vegetation.

c. "Diagnosing Injury Caused by Air Pollution", EPA-68-02-1344, Prepared by Applied Science Associates, Inc. under contract to the Air Pollution Training Institute, Research Triangle Park, North Carolina. 1976. A CO concentration of 115,000 • g/m^3 was found to affect certain plant species.

d. "Polymorphic Regions in Plant Genomes Detected by an M13 Probe" Zimmerman, P.A., et al. 1989. Genome 32: 824-828. 115,000 • g/m^3 was the lowest CO concentration included in this study. This concentration was not found to cause a reduction in growth rate to a variety of plant species.

Table 4-28: Predicted Air Quality Impacts Compared to Particulate and SO_2 Vegetation Impact Thresholds

Averaging Period	Predicted Impact (µg/m^3)	Threshold for Impact to Vegetation (µg/m^3)	Applicability
SO_2			
1-hour SO_2	6.8	131[a]	Suggested worst-case limit
3-hour SO_2	3.2	390[b]	Protects SO_2 sensitive species
3-hour SO_2		1,300[c]	Protects all vegetation
24-hour SO_2	0.98	63[d]	Insignificant effect to wheat and barley
Annual SO_2	0.10	130[b]	Protects SO_2 sensitive species
PM_{10}			
24-hour PM_{10}	4.9	150[c]	Protects all vegetation
Annual PM_{10}	0.43	50[c]	Protects all vegetation
Annual PM_{10}		579[e]	Damage to sensitive species (fir tree)

a. "Crop and Forest Losses due to Current and Projected Emissions from Coal-Fired Power Plants in the Ohio River Basin" Loucks, O.L., R.W. Miller, et al., 1980. The Institute of Ecology. In this publication, the authors propose 1-hour thresholds from 131 to 262 • g/m^3.

b. "Impacts of Coal-Fired Power Plants on Fish, Wildlife, and their Habitats" Dvorak, A.J., et al. Argonne National Laboratory. Argonne, Illinois. Fish and Wildlife Service Publication No. FWS/OBS-78/29. March 1978. This document indicates the lowest 3-hour SO_2 concentration expected to cause injury to sensitive plants growing under compromised conditions is approximately 390 • g/m^3. Similarly, a threshold of 130 • g/m^3 is suggested for chronic exposure.

c. Secondary NAAQS (• g/m^3) which is a limit set to avoid damage to vegetation resulting in economic losses in commercial crops, aesthetic damage to cultivated trees, shrubs, and other ornamentals, and reductions in productivity, species richness, and diversity in natural ecosystems to protect public welfare (Section 109 of the CAA). These thresholds are the most stringent of those found in the literature survey.

d. "Concurrent Exposure to SO_2 and/or NO_2 Alters Growth and Yield Responses of Wheat and Barley to Low Concentrations of O_3" (New Phytologist, 118 (4). 1991. pp. 581-592). This paper indicates exposure to 63 • g/m^3 of SO_2 during the growing season had insignificant effects to wheat but did affect the weight of Barley seeds.

e. "Responses of Plants to Air Pollution" Lerman, S.L., and E.F. Darley. 1975. "Particulates," pp. 141-158 (Chap. 7). In J.B. Mudd and T.T. Kozlowski (eds.). Academic Press. New York, NY. Results of studies conducted indicated concluded that particulate deposition rates of 365 g/m^2/yr caused damage to fir trees, but rates of 274 g/m^2/year and 400 to 600 g/m^2/yr did not cause damage to vegetation. 365 g/m^2/yr translates to W579 • g/m^3, using a worst-case deposition velocity of 2 centimeters per second.

Table 4-29: Predicted Air Quality Impacts Compared to Formaldehyde Vegetation Impact Thresholds

Averaging Period	Predicted Impact (μg/m^3)	Threshold for Impact to Vegetation (μg/m^3)	Applicability
Repeated 4.5 hour	0.755 (1-hour)	18[a]	Sensitive species affected
5-hour		840[b]	Signs of injury to sensitive species (alfalfa)
5-hour		367[c]	Signs of injury to pollen tube length (lily)
Repeated 7-hour		78[d]	Stimulated shoot growth (beans)

a. "Formaldehyde-Contaminated Fog Effects on Plant Growth" Barker J.R. & Shimabuku R.A. (1992). In Proceedings of the 85th Annual Meeting and Exhibition, Air and Waste Management Association, pp. 113. 92150.01. Pittsburgh, PA. The authors examined the effects on vegetation grown in fog with formaldehyde concentrations of 18 and 54 • g/m^3. Exposure rates were 4.5 hours per night, 3 nights/week, for 40 days. The growth rate of rapeseed was found to be affected in this study. However, slash pine grown under the same conditions showed a significant increase in needle and stem growth. No effects were observed in wheat or aspen at test concentrations

b. "Investigation on Injury to Plants from Air Pollution in the Los Angeles Area" Haagen-Smit AJ, Darley EE, Zaitlin M, Hull H, Noble WM (1952). Plant physiology, 27:18–34. The authors found a 5-hour exposure to 700 ppb caused mild atypical signs of injury in alfalfa, but no injury to spinach, beets, or oats.

c. "Effects of Exposure to Various Injurious Gases on Germination of Lily Pollen" Masaru N, Syozo F, Saburo K (1976). Environmental pollution, 11:181–188. The authors fund a significant reduction of the pollen tube length of lily following a 5-hour exposure to ambient formaldehyde concentrations of 367 ppb.

d. "Formaldehyde exposure affects growth and metabolism of common bean" Mutters RG, Madore M, Bytnerowicz A (1993). Journal of the Air and Waste Management Association, 43:113–116. The authors found that repeated exposure of sensitive plants to ambient formaldehyde concentrations of 78 • g/m^3 could cause plant shoots to grow faster than the roots. It is pointed out that this effect would not be a problem except for crops growing in a water starved condition.

4.5.8 Construction-Related Activities

Project-related air quality impacts during the 36-month construction effort are expected to include fugitive dust emissions from ground excavation, cut-and-fill operations, building demolition and debris removal, concrete pouring and equipment erection, and engine emissions from vehicles. Because the construction period is limited and activities change during the construction phases, these emissions are temporary and will vary throughout the period.

Emissions of fugitive dust will depend to a large degree on meteorological conditions, soil properties (moisture, silt content) and the construction practices employed. To control airborne particulate emissions, the following construction practices will be employed:

- Water and/or other wetting agents will be applied periodically to areas of exposed and dry soils
- Covered trucks will be used for transport of soils and other dry materials
- Storage of spoils on the site will be controlled
- Final grading and landscaping of exposed areas will be completed as soon as practical.

Construction-related engines will include on-site construction equipment as well as delivery trucks and worker vehicles. Emissions from on-site construction equipment will be minimized by ensuring the equipment meets the appropriate federal emission standards for non-road engines, and utilizing best management practices to minimize idling of equipment. Emissions from on-road heavy duty engines will be minimized through compliance with the NYSDEC air regulation (6 NYCRR 217-3) which limits idling from these vehicles. Emissions from worker vehicles will be minimized by implementation of sufficient off-site parking.

4.5.9 Emission Reduction Credits

As discussed in Section 4.1.1.2, the project will be required to obtain offsets for its NO_x and VOC emissions at a ratio of 1.15 to 1. 6 NYCRR Part 231-5.2(d) requires that the emission offset information for VOC and NO_x be submitted before NYSDEC issues a final permit determination. At that time, CVE will submit:

- 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 321.3 tons of NO_x offsets and 135.8 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.

4.6 New York State Environmental Quality Review Analyses

4.6.1 Acid 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. This analysis was also performed to respond to PSD review requirements. Results of this analysis, presented in Section 4.5.7.1, indicate that the project will have little or no contribution to the acidity of precipitation in the surrounding area. In addition, impacts at greater distances will be negligible due to the dispersion of these gases.

4.6.2 Non-Criteria Pollutants

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 combustion turbine generators 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) (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 GE 7FA.05 combustion turbines. Tables 4-30 and 4-31 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.

4.6.3 Accidental 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%). An air 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: an expected "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 expected "worst case" scenario, and 172 lb/hr, for the "typical" scenario. (Estimated emissions increase with wind speed, but impacts decrease due to greater dilution.)

Table 4-30: Maximum Predicted Non-Criteria Pollutant Annual Impacts

Air Toxic Compound	Maximum Projected Impacts (µg/m^3)					AGC (µg/m^3)
	CTs and DB	Auxiliary Boiler	Fire Pump	Black-Start Generators	Total	
1,3-Butadiene	2.70E-05	0.00E+00	5.84E-06	0.00E+00	3.28E-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	2.51E-03	0.00E+00	1.15E-04	1.55E-05	2.64E-03	4.50E-01
Acrolein	4.02E-04	0.00E+00	1.38E-05	4.84E-06	4.20E-04	2.00E-02
Anthracene	2.52E-08	1.81E-08	2.79E-07	7.55E-06	7.88E-06	2.00E-02
Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+02
Benzene	7.75E-04	1.58E-05	1.39E-04	4.77E-04	1.41E-03	1.30E-01
Benzo(a)anthracene	1.89E-08	1.36E-08	2.51E-07	3.82E-07	6.65E-07	2.00E-02
Benzo(a)pyrene	1.26E-08	9.05E-09	0.00E+00	1.58E-07	1.79E-07	9.10E-04
Butane	2.20E-02	1.58E-02	0.00E+00	0.00E+00	3.79E-02	5.70E+04
Chrysene	1.89E-08	1.36E-08	5.27E-08	9.40E-07	1.02E-06	2.00E-02
Dibenz(a,h)anthracene	1.26E-08	9.05E-09	8.71E-08	2.13E-07	3.21E-07	2.00E-02
Ethane	3.25E-02	2.34E-02	0.00E+00	0.00E+00	5.59E-02	2.90E+03
Ethylbenzene	2.01E-03	0.00E+00	0.00E+00	0.00E+00	2.01E-03	1.00E+03
Formaldehyde	7.69E-03	5.66E-04	1.76E-04	4.85E-05	8.48E-03	6.00E-02
Hexane	4.83E-05	3.47E-05	0.00E+00	0.00E+00	8.30E-05	7.00E+02
Naphthalene	8.80E-05	4.60E-06	1.27E-05	7.98E-05	1.85E-04	3.00E+00
Pentane	2.73E-02	1.96E-02	0.00E+00	0.00E+00	4.69E-02	4.20E+03
Phenanthrene	1.78E-07	1.28E-07	4.39E-06	2.51E-05	2.98E-05	2.00E-02
Polycyclic aromatic hydrocarbons	1.39E-04	5.90E-07	2.51E-05	1.30E-04	2.95E-04	2.00E-02
Propane	1.68E-02	1.21E-02	0.00E+00	0.00E+00	2.89E-02	4.30E+04
Propylene	0.00E+00	0.00E+00	3.85E-05	1.71E-03	1.75E-03	3.00E+03
Propylene Oxide	1.82E-03	0.00E+00	0.00E+00	0.00E+00	1.82E-03	2.70E-01
Pyrene	5.25E-08	3.77E-08	7.14E-07	2.28E-06	3.08E-06	2.00E-02
Sulfuric Acid	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00
Toluene	8.19E-03	2.56E-05	6.11E-05	1.73E-04	8.45E-03	5.00E+03
Xylene (Total)	4.02E-03	0.00E+00	4.26E-05	1.19E-04	4.18E-03	1.00E+02
Arsenic	2.10E-06	1.51E-06	0.00E+00	0.00E+00	3.61E-06	2.30E-04
Barium	4.62E-05	3.32E-05	0.00E+00	0.00E+00	7.94E-05	1.20E+00
Beryllium	1.26E-07	9.05E-08	0.00E+00	0.00E+00	2.16E-07	4.20E-04
Cadmium	1.15E-05	8.29E-06	0.00E+00	0.00E+00	1.98E-05	2.40E-04
Chromium	1.47E-05	1.06E-05	0.00E+00	0.00E+00	2.52E-05	1.20E+00
Cobalt	8.82E-07	6.33E-07	0.00E+00	0.00E+00	1.51E-06	1.00E-03
Copper	8.92E-06	6.41E-06	0.00E+00	0.00E+00	1.53E-05	2.00E-02
Manganese	3.99E-06	2.87E-06	0.00E+00	0.00E+00	6.85E-06	5.00E-02
Mercury	2.73E-06	1.96E-06	0.00E+00	0.00E+00	4.69E-06	3.00E-01
Molybdenum	1.15E-05	8.29E-06	0.00E+00	0.00E+00	1.98E-05	1.20E+00
Nickel	2.20E-05	1.58E-05	0.00E+00	0.00E+00	3.79E-05	4.20E-03
Selenium	2.52E-07	1.81E-07	0.00E+00	0.00E+00	4.33E-07	2.00E+01
Vanadium	2.41E-05	1.73E-05	0.00E+00	0.00E+00	4.15E-05	2.00E-01
Zinc	3.04E-04	2.19E-04	0.00E+00	0.00E+00	5.23E-04	4.50E+01

Table 4-31: Maximum Predicted Non-Criteria Pollutant Short-Term Impacts

Air Toxic Compound	Maximum Projected Impacts (μg/m^3)					SGC (μg/m^3)
	CTs and DB	Auxiliary Boiler	Fire Pump	Black-Start Generators	Total	
1,3-Butadiene	1.95E-03	0.00E+00	4.01E-03	0.00E+00	5.96E-03	
2-Methylnaphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Acetaldehyde	1.81E-01	0.00E+00	7.87E-02	1.01E-02	2.70E-01	4.50E+03
Acrolein	2.90E-02	0.00E+00	9.49E-03	3.16E-03	4.16E-02	1.90E-01
Anthracene	1.82E-06	1.51E-06	1.92E-04	4.94E-03	5.14E-03	
Ammonia	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E+03
Benzene	5.59E-02	1.32E-03	9.58E-02	3.12E-01	4.65E-01	1.30E+03
Benzo(a)anthracene	1.36E-06	1.13E-06	1.72E-04	2.50E-04	4.25E-04	
Benzo(a)pyrene	9.09E-07	7.55E-07	0.00E+00	1.03E-04	1.05E-04	
Butane	1.59E+00	1.32E+00	0.00E+00	0.00E+00	2.91E+00	
Chrysene	1.36E-06	1.13E-06	3.62E-05	6.14E-04	6.53E-04	
Dibenz(a,h)anthracene	9.09E-07	7.55E-07	5.98E-05	1.39E-04	2.00E-04	
Ethane	2.35E+00	1.95E+00	0.00E+00	0.00E+00	4.30E+00	
Ethylbenzene	1.45E-01	0.00E+00	0.00E+00	0.00E+00	1.45E-01	5.40E+04
Formaldehyde	5.55E-01	4.72E-02	1.21E-01	3.17E-02	7.55E-01	3.00E+01
Hexane	3.48E-03	2.89E-03	0.00E+00	0.00E+00	6.38E-03	
Naphthalene	6.35E-03	3.84E-04	8.70E-03	5.22E-02	6.76E-02	7.90E+03
Pentane	1.97E+00	1.64E+00	0.00E+00	0.00E+00	3.61E+00	
Phenanthrene	1.29E-05	1.07E-05	3.02E-03	1.64E-02	1.94E-02	
Polycyclic aromatic hydrocarbons	1.00E-02	4.93E-05	1.72E-02	8.51E-02	1.12E-01	
Propane	1.21E+00	1.01E+00	0.00E+00	0.00E+00	2.22E+00	
Propylene	0.00E+00	0.00E+00	2.65E-02	1.12E+00	1.15E+00	
Propylene Oxide	1.31E-01	0.00E+00	0.00E+00	0.00E+00	1.31E-01	3.10E+03
Pyrene	3.79E-06	3.15E-06	4.91E-04	1.49E-03	1.99E-03	
Sulfuric Acid	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E+02
Toluene	5.91E-01	2.14E-03	4.20E-02	1.13E-01	7.48E-01	3.70E+04
Xylene (Total)	2.90E-01	0.00E+00	2.92E-02	7.75E-02	3.97E-01	4.30E+03
Arsenic	1.52E-04	1.26E-04	0.00E+00	0.00E+00	2.77E-04	
Barium	3.33E-03	2.77E-03	0.00E+00	0.00E+00	6.10E-03	
Beryllium	9.09E-06	7.55E-06	0.00E+00	0.00E+00	1.66E-05	1.00E+00
Cadmium	8.33E-04	6.92E-04	0.00E+00	0.00E+00	1.53E-03	
Chromium	1.06E-03	8.81E-04	0.00E+00	0.00E+00	1.94E-03	
Cobalt	6.36E-05	5.29E-05	0.00E+00	0.00E+00	1.16E-04	
Copper	6.44E-04	5.35E-04	0.00E+00	0.00E+00	1.18E-03	1.00E+02
Manganese	2.88E-04	2.39E-04	0.00E+00	0.00E+00	5.27E-04	
Mercury	1.97E-04	1.64E-04	0.00E+00	0.00E+00	3.61E-04	1.80E+00
Molybdenum	8.33E-04	6.92E-04	0.00E+00	0.00E+00	1.53E-03	
Nickel	1.59E-03	1.32E-03	0.00E+00	0.00E+00	2.91E-03	6.00E+00
Selenium	1.82E-05	1.51E-05	0.00E+00	0.00E+00	3.33E-05	
Vanadium	1.74E-03	1.45E-03	0.00E+00	0.00E+00	3.19E-03	
Zinc	2.20E-02	1.83E-02	0.00E+00	0.00E+00	4.02E-02	

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 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-minute AEGL-2 is 160 ppm. The predicted distance to AEGL-2 is 38 to 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. For ammonia, the 60-minute AEGL-1 is 30 ppm. The predicted distance range for AEGL-1 is 99 to 109 yards; this impact area extends off-site by 20 to 30 yards to the south side of the property, which abuts an existing industrial area.

In summary, the ALOHA predictions indicate that potential impacts would remain well below AEGL-2 at all off-site locations. The AEGL-1 results indicate that, in the unlikely event of a worst-case release scenario, the release could result in temporary discomfort or irritation for a distance of about 20 to 30 yards from the Project Development Area on the south side of the property, but there are no residences within this area.

4.6.4 Combustion Plume Visibility

PSD regulations require consideration of regional visibility (haze) impacts at designated pristine (PSD Class I) areas that may be caused by emissions from proposed projects. As discussed in Section 4.1.2.3, there are no PSD Class I areas within 100 km of the proposed Project Development Area. The closest designated PSD Class I area is the Lye Brook Wilderness Area, located 167 km north-northeast of the Project Development Area 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.

However, 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, although these are not designated Class I areas. The visibility analysis is presented in Section 4.5.6. The results of the analysis indicate that the proposed project's plume would not impact visibility at these areas.

4.6.5 Energy Use and Greenhouse Gas Emissions

There is a general consensus in the scientific community that concentrations of GHG have greatly increased in the atmosphere and continue to increase. These increasing GHG concentrations may have significant climate altering consequences. The continued increase in GHG in the atmosphere is associated with emissions from the combustion of fossil fuels by both stationary and mobile sources, in addition to other emission sources. Atmospheric concentrations of GHG are increasing because these gases have very few chemical removal processes.

While the contribution of any single project to climate change is extremely small, the combined GHG emissions from all human activity may have significant impact on global climate. The nature of the impact dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them. This section provides information on the change in GHG emissions associated with the proposed project including a quantification of direct emissions of GHG pollutants, a qualitative analysis of the indirect emissions of GHG pollutants, and a discussion on the minimization of GHG impacts from the proposed project.

4.6.5.1 GHG Direct Emissions

The principal GHGs are CO_2, CH_4, and N_2O. Because these gases differ in their ability to trap heat, one ton of CO_2 in the atmosphere has a different effect on warming than one ton of CH_4 and one ton of N_2O. For example, CH_4 and N_2O have 21 times and 298 times the global warming potential of CO_2, respectively.

Direct GHG emissions include both stack and fugitive emissions from combustion processes or industrial processes conducted on-site, and from fleet vehicles owned (or leased) and operated by the project. GHGs emissions from the proposed project are primarily attributable to combustion of fuels. The project will not have any other industrial processes releasing GHGs, and will not operate fleet vehicles. The greatest proportion of potential GHGs emissions are from CO_2. Trace amounts of VOCs (expressed as methane) and N_2O, would be emitted in varying quantities depending on operating conditions. However, emissions of

VOCs and N_2O are considered negligible when compared to total CO_2 emissions, and would not be considered significant to climate change issues. In addition, these compounds are also controlled, to varying degrees, by the SCR system and the oxidation catalyst. Table 4-32 presents potential emissions of CO_2 from combustion sources associated with the project. These emissions estimates assume steady-state emissions at 59ºF ambient temperature with a 100 percent capacity factor.

Table 4-32: Summary of Potential Direct CO_2 Emissions from the Cricket Valley Energy Project

Emission Source	CO_2 Emissions (tpy)
Three Combined Cycle Units	3,576,943
Auxiliary Boiler	15,887
Emergency Fire Pump	114
Four Black-Start Generators	4,822
TOTAL	**3,597,766**

4.6.5.2 Indirect GHG Emissions

Indirect GHG emissions can include emissions generated by other facilities supplying energy goods and services at the project, from vehicle trips to or from the Project Development Area during operation (i.e., freight deliveries, employee commuting, customer visits), and from construction phase sources. As shown in Table 4-33, indirect emissions associated with employee trips and deliveries are not considered significant for this project. The number of regular employees and annual deliveries is small enough such that this component is considered negligible compared to direct emissions from combustion sources associated with the project. In addition, the energy consumed by the project will be supplied by the combustion turbines, as such, there are no indirect emissions associated with this energy consumption.

As shown in Table 4-34, GHG emissions from construction related equipment would be considered a minor contributor for this project. The primary source of GHG emissions from construction equipment would be due to combustion of fossil fuels in the equipment engines. The size of these engines will be relatively small compared to the combustion turbines, and the emissions will be of a short duration, only occurring during the construction phase.

Table 4-33: Estimated Indirect CO_2 Emissions during Operation

Activity	Assumptions	Fuel Consumed (gallons)	Pounds of CO_2 per gallon[1]	Tons per year of CO_2
Employee commuting	28 employees x 260 trips per year average x 40 mile round trip/20 mpg	14,560	19.4	141
Light truck deliveries/visitors	5 deliveries per day x 260 delivery days per year x 50 miles per delivery/15 mpg	4,333	19.4	42
Heavy truck deliveries	2 deliveries per day x 260 delivery days per year x 240 miles per delivery/6 mpg	20,800	22.2	231
Annual Operations Total				**414**

[1]Based on USEPA Office of Transportation and Air Quality, Emissions Facts: Average Carbon Dioxide Resulting from Gasoline and Diesel Fuel, 2005.

Table 4-34: Estimated Indirect CO_2 Emissions during the 36-Month Construction Period

Activity	Assumptions	Fuel consumed (gallons)	Pounds of CO_2 per gallon[1]	Tons of CO_2
Worker commuting	Average of 270 worker-trips x 780 days x 100 mile round-trip/20 miles per gallon (mpg)	1,053,000	19.4	10,214
Shuttle busses	100 miles per day x 780 days/6 mpg	13,000	22.2	144
Truck Deliveries	10 per day x 780 days x 500 miles per delivery/6 mpg	650,000	22.2	7,215
Major Equipment Deliveries	75 deliveries x 200 miles per delivery/2 mpg	7,500	22.2	83
Onsite equipment	Based on EPC contractor estimates of fuel use	500,000	22.2	5,550
Construction Total				**23,206**

[1]Based on USEPA Office of Transportation and Air Quality, Emissions Facts: Average Carbon Dioxide Resulting from Gasoline and Diesel Fuel, 2005.

4.6.5.3 Alternatives Analysis, Minimization Measures and Mitigation Measures

This section provides a consideration of alternative technologies and methods used to reduce GHG emissions from the proposed project. After a thorough review of alternatives, several design elements were incorporated into the project to minimize the emission of GHGs.

Emissions of CO_2 are directly related to the amount of fuel combusted. As such, an effective means of reducing GHG emissions is through highly efficient combustion technologies. By utilizing more efficiency technology, less fuel is required to produce the same amount of output electricity. The project will utilize state-of-the-art combustion turbine technology in combined cycle mode. Combined cycle generation takes advantage of the waste heat from the combustion turbines, capturing that heat in the HRSG and generating steam which then powers a conventional steam turbine. Use of waste heat in this manner makes combined cycle projects considerably more efficient than conventional boiler technology.

The project is proposing to use new model F-series combustion turbines, which utilize highly efficient combustion technology. In addition, the combustion turbines and auxiliary boiler will combust natural gas as their only fuel. Other fossil fuels generate a greater amount of CO_2 per megawatt of power produced or MMBtu of fuel consumed. As such, using natural gas as the only fuel source effectively minimizes the production of CO_2 from combustion.

Section 7 discusses alternatives to the proposed project, including alternate generation technologies considered. A comparison of CO_2 emission rates for the alternate technologies considered is provided in Table 4-35. As discussed in Section 7, renewable energy technologies like wind and solar were rejected as not meeting the project's purpose and need, to supply 1,000 MW of baseload electric generating capacity. In this region, wind and solar projects produce electricity from less than 15 to approximately 30 percent of the time and not always coincident with peak power demand. Further, the space requirements for 1,000 MW of wind or solar would constitute thousands of acres of land, greatly exceeding the available site area. Therefore, these technologies were rejected from further consideration.

A 1,000 MW biomass facility would greatly exceed the supply of waste biomass in the region and would require considerably more water, require significant operational truck traffic, result in higher emissions of conventional air pollutants, and generate considerably more solid waste than the proposed project. Therefore, this technology was rejected from further consideration.

As shown in Table 4-35, simple cycle combustion turbine technology and conventional boilers emit more CO_2 per unit of electric generation than the proposed project. These technologies are also less energy efficient in terms of the amount of electricity generated per unit of fuel.

Table 4-35: Comparison of CO_2 Emission Rates for Alternate Technologies Evaluated

Technology	CO_2 Emissions (pounds/megawatt-hour)[1]
Cricket Valley Energy	817
Natural Gas (simple-cycle)	1,135
Oil	1,672
Coal	2,249
Biomass	0[2]
Solar	0
Wind	0

[1]Primary emission sources only. Based on USEPA emissions factors found at: http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html
[2]Considered carbon neutral as biomass re-growth will theoretically sequester as much CO_2 as emitted when combusted. Without sequestration approximately 2,988 pounds/megawatt-hour.

Further, conventional boiler technology uses considerably more water than the proposed project. Therefore, these technologies were rejected from further consideration.

Many of the existing facilities in the New York region utilize less efficient oil, gas, coal or heavy fuel oil for combustions. These fuels (and sources) result in greater emissions of GHG on a per MW basis than those that result from the proposed project due to both the higher efficiency of the project's technology and the lower emissions of GHG due to the project's choice of natural gas as fuel. Figure 4-6 provides a graphic comparison of the potential CO_2 emissions from the CVE project compared to the average CO_2 emissions from the current fleet of power plants in New York State, illustrating the efficiency of using natural gas and state-of-the-art combustion turbine technology.

The buildings proposed for the project will also be designed to minimize energy demand. The project's facilities will be designed using many of the concepts consistent with the Leadership in Energy and Environmental Design (LEED) standards. These elements include; making maximum use of natural light in building design, using heating and cooling only when necessary for personal comfort and to maintain process functions, and making energy efficiency a priority when selecting equipment (such as Heating, Ventilation, and Air Conditioning, or HVAC, systems) for the facilities. The equipment used during the construction phase of the project will also be chosen to maximize energy efficiency, such as late-model engines that are certified to comply with the federal emission standards for non-road engines.

While the proposed project will result in emissions of GHGs, its operation will displace the operation of older, less efficient units in the electrical grid. Because these units emit more GHG per MW of electricity produced, operation of the project will reduce regional GHG emissions. To quantify this benefit, CVE commissioned a dispatch analysis to demonstrate that the overall effect of the project will be a significant reduction in CO_2 emissions (See

Appendix 1-A). The dispatch study identified the resultant displacement of emissions by unit for the grid and for the region. The study analyzed units within the New York Independent System Operator (NYISO), and included connections with New England, Pennsylvania Jersey Maryland (PJM) and Ontario. The study was performed using a Multi Area Production Simulation (MAPS) model which simulated:

- Operation of the electric grid;
- Historical diurnal, day of the week and seasonal patterns;
- Future load demand forecasts; and
- Specific emissions data for each unit for CO_2, NO_x and SO_2.

The analysis evaluated resultant emissions reductions for future years of operation (2015 through 2020). The modeling demonstrated that the energy generated by the CVE project would primarily displace electricity that would have been generated by less efficient oil, gas, coal or heavy fuel oil power plants. As such, CVE operation resulted in an average annual CO_2 emission reduction across NYISO, PJM, Ontario and New England of 653,242 tpy. In addition, although not considered GHGs, the dispatch analysis also demonstrated overall reductions of NO_x and SO_2 emissions. Table 4-33 summarizes the emission reductions predicted by the dispatch analysis for CO_2, NO_x and SO_2. As presented in this table, the displacement of energy produced by existing facilities with energy from CVE will result in a significant benefit in GHG and other pollutant emissions.

Table 4-36: Summary of Regional Emission Reduction Benefits Associated with CVE Operation

Pollutant	Emission Reduction (tpy)						
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**Avg**
CO_2	549,525	634,602	626,288	716,818	703,256	688,961	**653,242**
NO_x	1,061	1,531	1,599	1,612	1,571	1,475	**1,475**
SO_2	2,867	5,086	4,120	4,533	4,948	4,250	**4,301**

The use of high-efficiency electricity generation is important in combating climate change. The nature of the regulated electricity market favors high efficiency combined cycle generation. This is consistent with New York State goals to increase energy efficiency and reduce emissions of GHG.

4.7 Conclusions

Construction-related activities have the potential to impact air quality on a short-term basis. These include the presence of demolition and construction equipment on the property and in the vicinity, as well as associated fugitive dust that could temporarily occur during the three-year construction process. Construction vehicles will comply with applicable air quality standards, and best management practices will be employed during the construction period to prevent temporary construction impacts from being significant.

The project will be a new major source of air emissions. However, the project will utilize combined cycle technology using only natural gas to power the combustion turbines. In addition, stringent pollution control measures will be incorporated in the project design to meet LAER and BACT as applicable. As discussed in the sections above, the project's air emissions will comply with all applicable state and federal standards and, for most pollutants, will represent an insignificant impact. Development of new, more efficient energy supplies like that represented by the project has the potential to displace the operation of older, less efficient and higher emitting power plants, reducing regional emissions of air pollutants and GHG.

4.8 References

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