



Phase 1 Preliminary Assessment

Air Quality

Seneca Compressed Air Energy Storage Project

New York State Electric and Gas

Town of Reading

Schuyler County, New York

Environmental Resources Management

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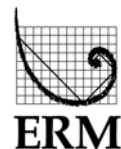


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EXECUTIVE SUMMARY



A preliminary assessment of potential air quality requirements and impacts reveals that the Seneca compressed air energy storage (CAES) Project will be a major emission source under New York State Department of Environmental Conservation (NYSDEC) air pollution control regulations and thereby be subject to Prevention of Significant Deterioration (PSD) pre-construction permitting. The CAES Project will be a major PSD source because potential emissions of greenhouse gases (GHG) will exceed the applicable PSD thresholds. In addition, once a source triggers major source status for one PSD air pollutant, any other PSD contaminant that exceeds its corresponding significant emissions increase threshold would also be subject to PSD review. Based on current emissions information available for the CAES Project, particulate matter (PM) including PM 10 microns or smaller (PM₁₀) and PM 2.5 microns or smaller (PM_{2.5}) will also be subject to PSD review because projected emissions of these pollutants exceed their corresponding PSD significant emission increase thresholds.

It should be recognized that the CAES Project will be required to install and operate a selective catalytic reduction (SCR) unit and an oxidation catalyst to avoid triggering more stringent air permitting requirements for nitrogen oxides and carbon monoxide.

Additionally, the CAES Project also will be subject to Title V permitting. However, when compared to PSD pre-construction permitting requirements, the requirements for obtaining a Title V operating permit are less burdensome and the process can be deferred for one year.

Finally, there will be other less burdensome air pollution control regulations that will apply to the CAES Project, but none have nearly the impact on project costs and schedule that the PSD permitting effort will have.

This report presents a preliminary assessment of potential air quality impacts and regulatory requirements associated with the Seneca compressed air energy storage (CAES) Project. Two CAES plant Cycles are currently under review that will comprise a 130 to 180 MW compressed air energy storage facility that consists of an electrically driven compression cycle and a turbine expansion cycle to produce electricity. The CAES plant is intended to provide sufficient storage to allow full operation during peak demand time periods in support of transmission system and market needs (approximately 10 hours per day). The CAES Project will be located west of Seneca Lake in Reading, Schuyler County, New York off of State Route 14A (see Figure 1). The property occupies approximately 18 acres, of which, approximately 13 acres of the property will be developed with CAES process equipment, support buildings, storm water retention pond, and parking areas. Various linear corridors that contain underground water pipelines, a natural gas pipeline and overhead power lines will also be associated with CAES project.

As mentioned above, two different Cycles are currently being evaluated for the CAES Project. The first cycle (Cycle 1) will use natural gas-fired external combustion units to heat the storage air prior to admitting it to expansion turbine generators. The second cycle (Cycle 2) will use a natural gas-fired utility scale combustion turbine with a heat exchanger downstream of the combustion turbine (CT) exhaust to heat the storage air prior to admitting it to the expansion turbine generators.

Support plant equipment that will be additional sources of air emissions include a small duct burner downstream of the CT in Cycle 2 to support fast startup, a natural gas-fired emergency generator, a diesel-fired fire water pump engine, and an induced draft cooling tower to cool noncontact water used to cool the electric driven compressors.



The CAES Project will be located in an area of New York State that is attaining US Environmental Protection Agency's (USEPA) primary and secondary National Ambient Air Quality Standards (NAAQS) for all criteria air pollutants with the exception of ozone.¹ The State of New York is in the ozone transport region (OTR) and is classified by the New York State Department of Environmental Conservation (NYSDEC) as a moderate nonattainment area for ozone. Precursors to the formation of ozone are nitrogen oxides and volatile organic compounds. The "primary" standard has been established to protect the public, including children, people with asthma, and the elderly from health risk. The "secondary" standard was established to prevent unacceptable effects on public welfare, e.g., unacceptable damage to crops and vegetation, buildings and property, and ecosystems.

The attainment status of existing air quality in a geographic region is important because it establishes the requirements for performing technical analyses such as air dispersion modeling, applying air pollution control equipment, and conducting other impact analyses to support pre-construction air permitting. Similarly, with respect to identifying pre-construction permitting requirements, a key regulatory applicability factor will be whether the CAES Project will be deemed a "major" source of emissions under any of a number of state and federal regulatory programs and thereby potentially trigger more rigorous permitting under NYSDEC and/or USEPA air pollution control regulations. Furthermore, with recent changes in air pollution control regulations, certain aspects of the air permitting process may be precedent setting and require innovative solutions in order to gain requisite approvals from state and federal agencies. Some of the critical air permitting requirements that will likely need to be addressed to successfully permit the CAES Project are summarized below.

¹ USEPA's Office of Air Quality Planning and Standards (OAQPS) has set primary and secondary National Ambient Air Quality Standards for six principal pollutants, which are called "criteria" pollutants and include carbon monoxide, nitrogen dioxide, lead, particulate matter (both PM 10 and PM 2.5), ozone, and sulfur dioxide. See <http://www.epa.gov/air/criteria.html>

GHG Tailoring Rule

USEPA recently has begun regulating greenhouse gas (GHG) emissions as a pollutant under the Clean Air Act and issued the “GHG Tailoring Rule” to implement Prevention of Significant Deterioration (PSD) pre-construction permitting and Title V Operating Permit requirements. PSD permitting for GHG emissions is a new concept in the US, and federal and state agencies are currently determining how to implement these permitting requirements for affected sources. The PSD permitting process is rigorous and involves public review. In addition, projects requiring a PSD permit are more likely to undergo extensive environmental review under programs like New York State Public Service Commission’s Article X or NYSDEC State Environmental Quality Review (SEQR). The federal PSD pre-construction permitting program, which is implemented by NYSDEC, has established applicability thresholds that define a “major” source. The PSD “major” source threshold that applies to the CAES Project is 250 tons per year (tpy) of any PSD-regulated pollutant. For GHGs, the major source threshold is 250 tpy on a mass basis for the aggregate of GHGs² and 100,000 tons per year of carbon dioxide equivalents (CO₂e).

Under USEPA’s new GHG Tailoring Rule, the CAES Project will trigger PSD permitting because emissions of carbon dioxide equivalents (CO₂e) will exceed 100,000 tons per year and carbon dioxide emissions will exceed 250 tons per year on a mass basis, the applicability thresholds for new projects. Additionally, by triggering PSD permitting for CO₂e emissions, other PSD-regulated air pollutants emitted may be caught in the PSD permitting web. Under the PSD requirements, which are implemented in New York by NYSDEC, once a source triggers “major” source status for one regulated PSD air pollutant, then each regulated PSD contaminant emitted from the source that exceeds the significant emission increase thresholds found in NYCRR Subpart 231-7 is also subject to the PSD permitting requirements (see additional discussion below).

² Under USEPA’s GHG Tailoring Rule, GHG PSD applicability is based on both a GHG mass and carbon dioxide equivalents (CO₂e) emissions basis. The mass basis threshold is required to conform to the historical PSD regulation that requires PSD applicability to be based on mass emissions of the affected PSD pollutant, i.e., the 100 or 250 tpy thresholds.



Sources subject to PSD permitting must:

- Apply best available control technology (BACT) to the PSD-affected pollutant(s);
- Conduct an air quality impact analysis to demonstrate compliance with the NAAQS for the PSD-affected pollutant(s);
- Analyze impacts to soil, vegetation, and visibility; and
- Demonstrate no adverse impacts on Federal Class 1 areas

Additionally, because potential CO₂e emissions will exceed 100,000 tons per year, the CAES facility also will be subject to Title V permitting; an air-quality operating permit program. However, when compared to PSD pre-construction permitting requirements, the requirements for obtaining a Title V operating permit are less burdensome and the process can be deferred for one year.

Compliance with National Ambient Air Quality Standards (NAAQS) and State of New York Air Quality Standards

Depending on the Cycle selected and finalized emissions profile, there may be the need to demonstrate compliance with the NAAQS if PSD permitting is triggered. Based on current available information, this may apply to particulate matter (PM), including PM 10 microns or smaller (PM₁₀) and PM 2.5 microns or smaller (PM_{2.5}). However, even if no other PSD-pollutant, other than CO₂e (for which there are no NAAQS and thus no modeling requirements), triggers PSD permitting, based on ERM's recent permitting work nationally, we expect that NYSDEC's may require some level of dispersion modeling to demonstrate compliance with the recently adopted short term one-hour NAAQS for nitrogen dioxide (NO₂) as part of permitting the CAES Project³. For NO₂, this entails running air dispersion models to predict ambient concentrations of NO₂ at ground

³ Note: a short term one-hour NAAQS has recently been established for sulfur dioxide (SO₂) as well but it is not expected that NYSDEC would require a demonstration of compliance with this standard given that natural gas is the principal fuel that will be used at the CAES plant and SO₂ emissions will be insignificant.

level in the surrounding area and then comparing the modeled results with corresponding NAAQS. It is noted that the new one-hour NO₂ standard is quite stringently low, which can pose problems in demonstrating compliance with the NO₂ NAAQS. The extent of modeling required for PM₁₀, PM_{2.5}, and/or NO₂ will not be known until Phase 2 of the CAES Project is initiated and after a pre-application meeting with NYSDEC staff of the Office of Air Resources, Climate Change & Energy, Division of Air Resources.

In addition to demonstrating compliance with NAAQS for the affected pollutants, permitting will also require demonstrating compliance with State of New York Air Quality Standards under Chapter III- Air Resources, Subchapter B: Air Quality Classifications and Standards Part 257: Air Quality Standards.

While the ultimate air permitting requirements that will need to be satisfied will not be determined until the design basis for the CAES Project has been finalized, based on what we currently know about expected emission levels for the CAES Project (as summarized below), the following more substantial air permitting requirements will likely be triggered or at least need to be discussed with NYSDEC and subsequently ruled out:

1. Pre-construction air permitting and Title V permitting under 6 New York Code of Rules and Regulations (NYCRR) 201;
2. New Source Review (meaning PSD) permitting under 6 NYCRR 231; and
3. Demonstration of compliance with National Ambient Air Quality Standards (requires air dispersion modeling).

Non-attainment Area New Source Review

As mentioned above, the State of New York is in the ozone transport region (OTR) and is classified by NYSDEC as a moderate nonattainment area for ozone. Precursors to the formation of ozone are nitrogen oxides and volatile organic compounds. Emissions of these two pollutants will be well-controlled through the installation and operation of a selective catalytic reduction (SCR) system and an oxidation catalyst, respectively. The resulting controlled emissions will be below 6 NYCRR Part 231-13.1 nonattainment area new source review (NNSR) major source thresholds



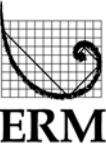
and thus the CAES Project will not be subject to NNSR pre-construction permitting.

Air Toxics Review under 6 NYCRR 212 and DAR-1 Air Guide 1

NYSDEC has an Air Toxics Program that it implements under 6 NYCRR 212 to address the control of toxic air pollutants emitted from industrial processes. The CAES Project would not be subject to this regulation because it is a combustion installation, a source category that is exempt under 6 NYCRR 212.

It is noted, however, that NYSDEC could require an assessment of off-site impacts of air contaminants emitted from the CAES Projects under its Policy DAR-1: Guidelines for the Control of Toxic Ambient Air Contaminants Air Guide 1. The need to undertake such an assessment will be discussed during Phase 2 of the Project at a pre-application meeting with NYSDEC's Division of Air Resources staff.

Finally, there will be other less burdensome air pollution control regulations that will apply to the CAES Project but none have nearly the impact on project costs and schedule that the PSD permitting effort will have.



The majority of emissions from the CAES Project will result from the combustion of natural gas to heat the storage air prior to admitting it to the expansion turbine generators. The proposed method for heating the storage air under Cycle 1 is through the use of a 589 MMBtu/hour process heater. Cycle 2 will utilize a conventional 979 MMBtu/hour utility scale stationary combustion turbine.

Potential emissions from these large combustion sources have been estimated based on a worst-case operating scenario of 8,760 hours per year. Vendor-provided emission rates along with USEPA AP-42 emission factors have been applied to each Cycle scenario to estimate annual emissions of carbon dioxide equivalents (CO₂e), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO₂), volatile organic compounds (VOC), particulate matter (PM) including PM 10 microns or smaller (PM₁₀) and PM 2.5 microns or smaller (PM_{2.5}) and ammonia (resulting from the use of SCR). The emission factors used to estimate emissions for the two cycles are presented in Attachment A. The emission factors for PM₁₀ and PM_{2.5} include both the filterable and condensable fractions of PM, as required.

Selective catalytic reduction (SCR) will be used with both Cycle 1 and Cycle 2 to provide post-combustion NO_x control. Combustor water injection also will be used on the Cycle 1 process heater to reduce NO_x emissions. An oxidation catalyst will be used to control CO and VOC emissions from the large combustion units for both Cycles. Both uncontrolled and controlled emissions are provided for NO_x, CO, and VOC.

In addition, emissions from facility support equipment, including a small duct burner downstream of the CT in Cycle 2, a natural gas-fired emergency generator, a diesel-fired fire water pump engine, and an induced draft cooling tower, are presented below as well.

Emissions from the proposed natural gas fired emergency generator were calculated assuming compliance with the 40 CFR 60, Subpart JJJJ, New Source Performance Standards (NSPS) for Stationary Emergency Engines. Emissions from the diesel fire pump engine were calculated in a similar manner referencing the Subpart IIII NSPS standards for Diesel Fire



Pumps. In both cases, 500 hours per year of operation were assumed. Note that NYSDEC allows up 500 hours of operation for engines to still be deemed “emergency” status.

Particulate emissions from the induced draft cooling tower were calculated using AP-42 Chapter 13.4 Emission Factors for Wet Cooling Towers.

Estimated annual potential emissions of key regulatory air pollutants for Cycle 1 and Cycle 2 are presented in the following tables (Tables 3A through 3E); where potential emissions are based on running the major combustion emission sources 8,760 hours per year. For comparison, as a possible alternative permitting strategy, ERM also calculated annual emissions based on running the major combustion emissions sources 3,120 hours per year, i.e., operating 12 hours per day and 260 cycles per year. This latter scenario would result in slightly less rigorous permitting requirements but would place restrictions on plant operations. More in-depth analyses of various permitting strategies and options will be conducted under Phase 2 of the Project.



Table 3A. CAES Cycle 1 Estimated Annual Potential Emissions at Full Operation – 8760 Hours per Year for Major Emission Sources (TPY)

	CO ₂ e	CO		NO _x		SO ₂	VOC		PM	PM-10	PM-2.5	NH ₃
		Inlet	Outlet ^a	Inlet	Outlet ^a		Inlet	Outlet ^a				
Cycle 1	322,989	381.0	12.5	469.6	20.8	4.9	not provided	6.2	46.4	46.4	46.4	18.1
Support Equipment	198	4.7	4.7	2.5	2.5	0.1	-	1.4	2.4	2.4	2.4	-
Total	323,187	385.7	17.2	472.1	23.4	5.0	-	7.6	48.8	48.8	48.8	18.1
Attainment Major Facility Threshold (TPY) ^b	250/100,000		250	-	250	250	-	-	250	250	250	-
Non-Attainment Major Facility Threshold (TPY) ^c	-	-	-	-	100	-	-	50	-	-	-	-
Significant Increase Threshold For Attainment Areas (TPY) ^d	75,000	-	100	--	40	40	-	-	25	15	10	-
Significant Increase Threshold For Non-Attainment Areas (TPY) ^e	-	-	-	-	40	-	-	40	-	-	-	-
PSD Permitting Triggered	Yes	-	No ^f	-	No ^f	No	No	No	Yes	Yes	Yes	No

^a Outlet from oxidation catalyst and SCR unit
^b 6 NYCRR Part 231-13.5 Major Facility Thresholds For Attainment and Unclassified Areas
^c 6 NYCRR Part 231-13.1 Major Facility Thresholds And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^d 6 NYCRR Part 231-13.6 Significant Project Thresholds and Significant Net Emission Increase Thresholds for Attainment and Unclassified Areas. Note: According to NYSDEC NH₃ is not a regulated NSR pollutant.
^e 6 NYCRR Part 231-13.3 Significant Project Thresholds, Significant Net Emissions Increase Thresholds, And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^f Will require federally enforceable permit condition mandating the operation of oxidation catalyst and SCR unit whenever attendant emission source is running.



Table 3B. CAES Cycle 2 Estimated Annual Potential Emissions at Full Operation - 8760 Hours per Year for Major Emission Sources (TPY)

	CO ₂ e	CO		NO _x		SO ₂	VOC		PM	PM-10	PM-2.5	NH ₃
		Inlet	Outlet ^a	Inlet	Outlet ^a		Inlet	Outlet ^a				
Cycle 2	527,034	236.9	20.1	148.1	32.9	4.5	8.8	5.3	49.5	49.5	49.5	30.2
Support Equipment	198	4.7	4.7	2.5	2.5	0.1	1.4	1.4	2.4	2.4	2.4	-
Total	527,232	241.6	24.8	150.6	35.4	4.6	10.2	6.7	51.9	51.9	51.9	30.2
Attainment Major Facility Threshold (TPY) ^b	250/100,000		250	-	250	250	-	-	250	250	250	-
Non-Attainment Major Facility Threshold (TPY) ^c	-	-	-	-	100	-	-	50	-	-	-	-
Significant Increase Threshold For Attainment Areas (TPY) ^d	75,000	-	100	-	40	40	-	-	25	15	10	-
Significant Increase Threshold For Non-Attainment Areas (TPY) ^e	-	-	-	-	40	-	-	40	-	-	-	-
PSD Permitting Triggered	Yes	-	No ^f	-	No ^f	No	No	No	Yes	Yes	Yes	No

^a Outlet from oxidation catalyst and SCR unit
^b 6 NYCRR Part 231-13.5 Major Facility Thresholds For Attainment and Unclassified Areas
^c 6 NYCRR Part 231-13.1 Major Facility Thresholds And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^d 6 NYCRR Part 231-13.6 Significant Project Thresholds and Significant Net Emission Increase Thresholds for Attainment and Unclassified Areas. Note: According to NYSDEC NH₃ is not a regulated NSR pollutant.
^e 6 NYCRR Part 231-13.3 Significant Project Thresholds, Significant Net Emissions Increase Thresholds, And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^f Will require federally enforceable permit condition mandating the operation of oxidation catalyst and SCR unit whenever attendant emission source is running.



Table 3C. CAES Cycle 1 Estimated Annual Potential Emissions at Reduced Operation - 3120 Hours per Year for Major Emission Sources (TPY)

	CO ₂ e	CO		NO _x		SO ₂	VOC		PM	PM-10	PM-2.5	NH ₃
		Inlet	Outlet ^a	Inlet	Outlet ^a		Inlet	Outlet ^a				
Cycle 1	116,512	137.4	4.5	169.4	7.5	1.8	not provided	2.3	16.8	16.8	16.8	6.5
Support Equipment	198	4.7	4.7	2.5	2.5	0.1	-	1.4	1.7	1.7	1.7	-
Total	116,710	142.2	9.2	171.9	10.1	1.9	-	3.7	18.5	18.5	18.5	6.5
Attainment Major Facility Threshold (TPY) ^b	250/100,000		250	-	250	250	-	-	250	250	250	-
Non-Attainment Major Facility Threshold (TPY) ^c	-	-	-	-	100	-	-	50	-	-	-	-
Significant Increase Threshold For Attainment Areas (TPY) ^d	75,000	-	100	-	40	40	-	-	25	15	10	-
Significant Increase Threshold For Non-Attainment Areas (TPY) ^e	-	-	-	-	40	-	-	40	-	-	-	-
PSD Permitting Triggered	Yes	-	No ^f	-	No ^f	No	No	No	No	Yes	Yes	No

^a Outlet from oxidation catalyst and SCR unit
^b 6 NYCRR Part 231-13.5 Major Facility Thresholds For Attainment and Unclassified Areas
^c 6 NYCRR Part 231-13.1 Major Facility Thresholds And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^d 6 NYCRR Part 231-13.6 Significant Project Thresholds and Significant Net Emission Increase Thresholds for Attainment and Unclassified Areas. Note: According to NYSDEC NH₃ is not a regulated NSR pollutant.
^e 6 NYCRR Part 231-13.3 Significant Project Thresholds, Significant Net Emissions Increase Thresholds, And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^f Will require federally enforceable permit condition mandating the operation of oxidation catalyst and SCR unit whenever attendant emission source is running.



Table 3D. CAES Cycle 2 Estimated Annual Potential Emissions at Reduced Operation - 3120 Hours per Year for Major Emission Sources (TPY)

	CO _{2e}	CO		NO _x		SO ₂	VOC		PM	PM-10	PM-2.5	NH ₃
		Inlet	Outlet ^a	Inlet	Outlet ^a		Inlet	Outlet ^a				
Cycle 2	190,155	85.5	7.3	53.5	11.9	1.6	3.2	1.9	17.9	17.9	17.9	10.9
Support Equipment	198	4.7	4.7	2.5	2.5	0.1	1.4	1.4	1.7	1.7	1.7	-
Total	190,353	90.2	12.0	56.0	14.4	1.7	4.6	3.3	19.6	19.6	19.6	10.9
Attainment Major Facility Threshold (TPY) ^b	250/100,000	-	250	-	250	250	-	-	250	250	250	-
Non-Attainment Major Facility Threshold (TPY) ^c	-	-	-	-	100	-	-	50	-	-	-	-
Significant Increase Threshold For Attainment Areas (TPY) ^d	75,000	-	100	-	-	40	-	-	25	15	10	-
Significant Increase Threshold For Non-Attainment Areas (TPY) ^e	-	-	-	-	40	-	-	40	-	-	-	-
PSD Permitting Triggered	Yes	-	No ^f	-	No ^f	No	No	No	No	Yes	Yes	No

^a Outlet from oxidation catalyst and SCR unit
^b 6 NYCRR Part 231-13.5 Major Facility Thresholds For Attainment and Unclassified Areas
^c 6 NYCRR Part 231-13.1 Major Facility Thresholds And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^d 6 NYCRR Part 231-13.6 Significant Project Thresholds and Significant Net Emission Increase Thresholds for Attainment and Unclassified Areas. Note: According to NYSDEC NH₃ is not a regulated NSR pollutant.
^e 6 NYCRR Part 231-13.3 Significant Project Thresholds, Significant Net Emissions Increase Thresholds, And Offset Ratios For Ozone Nonattainment Areas And The Ozone Transport Region
^f Will require federally enforceable permit condition mandating the operation of oxidation catalyst and SCR unit whenever attendant emission source is running.



Table 3E. Estimated Emissions for CAES Facility Support Equipment (TPY)

	<i>CO2e</i>	<i>CO</i>	<i>NOx</i>	<i>SO2</i>	<i>VOC</i>	<i>PM</i>	<i>PM-10</i>	<i>PM-2.5</i>
Emergency Generator	140.0	4.4	2.2	0.0	1.1	0.0	0.0	0.0
Fire Pump	57.8	0.3	0.3	0.1	0.3	0.0	0.0	0.0
Cooling Tower^a	-	-	-	-	-	2.4/1.7	2.4/1.7	2.4/1.7
Total (tpy)	197.8	4.7	2.5	0.1	1.4	2.4/1.7	2.4/1.7	2.4/1.7

a (8760/3120 hours per year)

Cycle 1 and Cycle 2 operating scenarios would be deemed a Subpart 231 PSD major source because CO_{2e} (100,000 tpy) and CO₂ (250 tpy) emissions exceed the permitting threshold.

Furthermore, under the full operating mode (8760), emissions of PM, PM₁₀ and PM_{2.5} will also be subject to PSD review because projected emissions of these pollutants exceed their corresponding PSD significant emission increase thresholds. Only PM emissions would be excluded from PSD review if the operating scenario was reduce to 3120 hours per year.

Finally, it should be recognized that the CAES Project will be required to install and operate a selective catalytic reduction (SCR) unit and an oxidation catalyst to avoid triggering PSD review for nitrogen oxides and carbon monoxide and avoid nonattainment area new source review (NNSR) for nitrogen oxides.



While the technical analyses to be carried under Phase 2 will be required to substantiate these preliminary findings and also will be needed to complete permit applications, air emissions released during operation of the CAES Project are not anticipated to adversely impact that regional air quality attainment status and also not contribute to further degradation of the moderate nonattainment status for ozone for the area. Similarly, air emissions during CAES plant construction are anticipated to be minor and will cease upon completion of the construction phase with no long-term effects. Therefore, no adverse long term impacts to local air quality are anticipated to result from the Project.

Based on results of this preliminary assessment, the CAES Project will need to satisfy the PSD permitting requirements for CO₂e, PM, PM₁₀ and PM_{2.5}. As outlined above, sources subject to PSD permitting must:

- Apply best available control technology (BACT) to the PSD-affected pollutant(s);
- Conduct an air quality impact analysis to demonstrate compliance with the NAAQS for the PSD-affected pollutant(s);
- Analyze impacts to soil, vegetation, and visibility; and
- Demonstrate no adverse impacts on Federal Class 1 areas

BACT Review. BACT requirements are intended to ensure that a proposed project will incorporate control systems that reflect the latest demonstrated practical techniques for that particular facility. The BACT evaluation requires the documentation of performance levels achievable for control technology on a pollutant-by-pollutant basis.

One of the challenging permitting requirements going forward will be completing the BACT analysis for CO₂e emissions. USEPA has published a GHG BACT Guidance document that presents information on BACT applicability to new and modified sources, and outlines a five step process for determining BACT. USEPA recommends that a "top-down" approach be taken when evaluating available air pollution control technologies. This approach to the BACT process involves determining the most stringent control technique available for a similar or identical emission



source. If it can be shown that the most stringent level of control currently in use on a similar emission unit is technically, environmentally, or economically impractical on a case-by-case basis for the particular source, then the next most stringent level of control is determined and similarly evaluated. The process continues until a control technology and associated emission level is determined which cannot be eliminated by any technical, environmental or economic objections.

Working with NYSDEC staff to determine BACT for CO₂e will require additional time because this topic is covering new territory for them. Note that BACT reviews will need to be performed for PM, PM₁₀ and PM_{2.5} emissions as well.

Ambient Air Quality Impacts Analysis. Another key requirement of PSD permitting that will need to be addressed under Phase 2 of the Project is the need to demonstrate compliance with both National Ambient Air Quality Standards (NAAQS) and State of New York Air Quality Standards under Chapter III- Air Resources, Subchapter B: Air Quality Classifications and Standards Part 257: Air Quality Standards. This effort will require submitting a modeling protocol to NYSDEC for review and approval. Often preliminary modeling is conducted in advance of submitting a protocol to gain advance knowledge of expected impacts before committing to a modeling approach with the State.

As mentioned above, even if no other PSD-pollutants, other than CO₂e (for which there are no NAAQS and thus no air dispersion modeling requirements), trigger PSD permitting, based on ERM's recent permitting work nationally, NYSDEC may require some level of dispersion modeling to demonstrate compliance with the recently adopted short term one-hour NAAQS for nitrogen dioxide (NO₂) as part of permitting the CAES Project.

As part of the PSD permitting process, an analysis of impacts to soil, vegetation, and visibility, and demonstration of no adverse impacts on Federal Class 1 areas also will need to be completed.

Also, NYSDEC could require an assessment of off-site impacts of air contaminants emitted from the CAES Projects under its Policy DAR-1: Guidelines for the Control of Toxic Ambient Air Contaminants Air Guide 1.

Other Related Issues. The schedule for PSD permitting can range from 12 to 18 months covering the time to complete all the technical analyses and



prepare the application, to time for NYSDEC to review the application submittal and deemed it complete and then subsequently perform their technical reviews through to allowing time for the public (including US EPA) to comment on the draft permit.

Additionally, because potential CO₂e emissions will exceed 100,000 tons per year, the CAES facility also will be subject to Title V permitting. However, when compared to PSD pre-construction permitting requirements, the requirements for obtaining a Title V operating permit are less burdensome and the process can be deferred for one year.

It is also noted that the preceding discussion covers the major emission sources during the operational phase of the CAES Project. Air emissions also will result during construction of the CAES plant. The construction phase is anticipated to result in short-term impacts to local air quality from the combustion exhaust of construction vehicles and equipment as well as the generation of dust during site preparation involving earth moving and other associated activities. These impacts are anticipated to be minor and will cease upon completion of the construction phase with no long-term effects.

Finally, there will be other less burdensome air pollution control regulations that will apply to the CAES Project but none have nearly the impact on project costs and schedule that the PSD permitting effort will have.

A preliminary review of potential air pollution control regulations applicable to the CAES Project has been completed and the results are presented in Attachment B. This initial assessment will be refined under Phase 2 after the CAES Cycle has been selected and final plant design information is available.

Attachment A – Source of Emission Factors



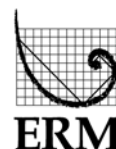
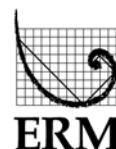


Table A-1. Cycle 1 - 589 MMBtu/Hr Process Heater Emission Factors

Contaminant	Emission Factor (HHV)	Source of Emission Factor
CO _{2e}	73,742 lbs/hour	Worley Parsons, Air Environmental Overview
CO - Uncontrolled	87.0 lbs/hour	Worley Parsons, Air Environmental Overview
CO - Controlled	2.9 lbs/hour	Worley Parsons, Air Environmental Overview
NO _x - Uncontrolled	107.2 lbs/hour	Worley Parsons, Air Environmental Overview
NO _x - Controlled	4.8 lbs/hour	Worley Parsons, Air Environmental Overview
VOC - Uncontrolled	Not provided	
VOC - Controlled	0.0024 lbs/MMBtu	Worley Parsons, 11/02/11 Takats Email
SO ₂	0.0019 lb/MMBtu	Worley Parsons, 11/02/11 Takats Email
PM/PM-10/ PM-2.5*	0.018 lb/MMBtu	Worley Parsons, 11/02/11 Takats Email
NH ₃	0.0070 lbs/MMBtu	Worley Parsons, 11/02/11 Takats Email

* Provided as emission factor for PM-10



**Table A-2. Cycle 2 - Combustion Turbine (979 MMBtu/hr)
100% Load - Average Ambient**

Contaminant	Emission Factor	Source of Emission Factor
CO ₂ e	120,314 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
CO - Uncontrolled	54.08 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
CO - Controlled	4.57 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
NO _x - Uncontrolled	33.8 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
NO _x - Controlled	7.50 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
VOC - Uncontrolled	2.0 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
VOC - Controlled	1.2 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
SO ₂	1.03 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
PM/PM-10/ PM-2.5*	11.3 lbs/hour	Worley Parsons, CAES-1-LI-022-0009
NH ₃	6.9 lbs/hour	Worley Parsons, CAES-1-LI-022-0009

* Stack PM emissions are assumed to be PM-2.5

Table A-3. Cycle 2 - Duct Burner (100 MMBtu/hr)

Contaminant	AP-42 1.4 Natural Gas Combustion	Emission Factor for 100 MMBtu/Hr Duct Burner
CO ₂ e	120,000 lbs/10 ⁶ SCF	11,765 lbs/hour
CO	84 lbs/10 ⁶ SCF	8.24 lbs/hour
NO _x	100 lbs/10 ⁶ SCF	9.80 lbs/hour
VOC	5.5 lbs/10 ⁶ SCF	0.54 lbs/hour
SO ₂	0.6 lbs/10 ⁶ SCF	0.059 lbs/hour
PM/PM-10/ PM-2.5	7.6 lbs/10 ⁶ SCF	0.75 lbs/hour



Table A-4. Emergency Generator - 2000 HP Natural Gas Fired

Contaminant	40CFR 60, Subpart JJJJ Emission Standard	AP-42 3.2 Natural Gas Fired Reciprocating Engines	Emission Factor for 2000 HP Generator
CO ₂ e	-	110 lbs/MMBtu	559.9 lbs/hour
NO _x	2.0 g/HP-hr	-	8.87 lbs/hour
CO	4.0 g/HP-hr	-	17.74 lbs/hour
VOC	1.0 g/HP-hr	-	4.43 lbs/hour
PM	-	0.00950 lbs/MMBtu	0.0484 lbs/hour
SO ₂	-	0.000588 lbs/MMBtu	0.00299 lbs/hour

Table A-5. Fire pump - 200 HP Diesel Fired

Contaminant	40CFR 60, Subpart III Emission Standard	AP-42 3.3 Gasoline and Diesel Industrial Engines	Emission Factor for 1500 GPM Fire pump
CO ₂ e	-	1.15 lbs/HP-hr	231.3 lbs/hour
NMHC + NO _x	3.0 g/HP-hr	-	1.33 lbs/hour
CO	2.6 g/HP-hr	-	1.15 lbs/hour
PM	0.15 g/HP-hr	-	0.07 lbs/hour
SO ₂	-	0.00205 lbs/HP-hr	0.41 lbs/hour

Table A-6. Cooling Tower - 60,000 GPM Induced Draft

Contaminant	AP-42 13.4 Wet Cooling Towers	Calculated Emission Factor
PM-10	Drift Loss * TDS Fraction	0.54 lbs/hour

*Attachment B – POTENTIAL APPLICABLE AIR
POLLUTION CONTROL PERMITTING
REQUIREMENTS*



ATTACHMENT B: POTENTIAL APPLICABLE AIR POLLUTION CONTROL PERMITTING REQUIREMENTS

Regulation	Description	Requirement / Standard	Effective Date	Applicability
New York State Regulations				
6 NYCRR 201-8	General Permits	This Subpart is intended to implement the provisions of ECL 19-0311 that provides for the issuance of general permits covering numerous similar emission sources or source categories for purposes of complying with Title V of the Act or to augment other permitting requirements under this Part.	06/26/1996	Yes
6 NYCRR 211	General Prohibitions	General prohibition against air pollution and visible air emissions.	08/06/2010	Yes
6 NYCRR 225	Fuel Composition And Use	Requirements related to fuel composition and use for sulfur limitations, waste fuel, gasoline, and diesel fuel	04/28/1972	Yes
6 NYCRR 231	New Source Review For New And Modified Facilities	Applies to projects in which there is a threshold increase in annual actual emissions from an air contamination source project above the de minimis emission limits found in section 231-1.9 of this Subpart.	09/1971	Yes Facility will be major for CO2e and PM, PM10, and PM2.5.
6 NYCRR 257	Air Quality Standards	Compliance with Air Quality Standards must be demonstrated.		Yes Air quality modeling will be required to demonstrate compliance
40 CFR 60 Federal Regulations				
40 CFR 60 Subpart GG	Stationary gas turbines	Applies to stationary gas turbines with a heat input peak >10.7 gigajoules/hr (10 million Btu) based on the lower heating value of the fuel. Restricts emissions of NO _x according to the formula provided. Restricts sulfur content of fuel to <0.8% by weight.	10/3/77	No <i>§60.4305(b) (40CFR Part 60 Subpart KKKK) Stationary combustion turbines regulated under this subpart are exempt from the requirements of subpart GG of this part.</i>
40 CFR 60 Subpart III	Standards Of Performance For Stationary Compression Ignition Internal Combustion Engines	Applies to manufacturers, owners, and operators of stationary compression ignition (CI) internal combustion engines (ICE).		Yes Facility will operate a diesel-fired fire water pump IC engine.
40 CFR 60 Subpart JJJ	Standards Of Performance For Stationary Spark Ignition Internal Combustion Engines	Applies to manufacturers, owners, and operators of stationary spark ignition (SI) internal combustion engines (ICE)		Yes Facility will operate a natural gas-fired emergency generator.
40 CFR 60 Subpart KKKK	Standards Of Performance For Stationary Combustion Turbines	Applies to the owner or operator of a stationary combustion turbine with a heat input at peak load equal to or greater than 10.7 gigajoules (10 MMBtu) per hour, based on the higher heating value of the fuel, which commenced construction, modification, or reconstruction after February 18, 2005,		Yes Proposed turbine is in the range of 589 MMBtu/hr to 979 MMBtu/hr
40 CFR 63 Subpart YYYY	NESHAP: Combustion Turbines	Applies to combustion turbine operations.	3/5/2004	No Facility will not be a major source of HAP
40 CFR 63 Subpart ZZZZ	NESHAP: Recip. Internal Combustion Engines (RICE MACT)	Applies to RICE operations.	See Regulation	No Facility emergency generator/fire pump engine will be subject to 40 CFR 60 Subparts III and JJJ.
40 CFR 64	Compliance Assurance Monitoring (CAM)	Enhanced monitoring is required for emissions units subject to a NESHAP, PSD, NSPS, and units with the PTE 100% or more of the minimum potential emissions required for the source to be classified as a major source under Title V.	See Regulation	Yes

Attachment C – Emission Calculations





NYSEG Compressed Air Energy Storage Emission Calculations

Hourly Emission Rates

			Annual Operation (hours)	CO2e (lbs/hour)	NOx		CO		VOC		SO2 (lbs/hour)	PM (lbs/hour)	PM-10 (lbs/hour)	PM-2.5 (lbs/hour)	NH3 (lbs/hour)
					SCR Inlet (lbs/hour)	SCR Outlet (lbs/hour)	CatOx Inlet (lbs/hour)	CatOx Outlet (lbs/hour)	CatOx Inlet (lbs/hour)	CatOx Outlet (lbs/hour)					
Cycle 1	589	MMBtu/Hr	8760	73,741.7	107.2	4.8	87.0	2.9		1.4	1.1	10.6	10.6	10.6	4.1
Cycle 2 CTG	979	MMBtu/Hr	8760	120,314.0	33.8	7.5	54.1	4.6	2.0	1.2	1.0	11.3	11.3	11.3	6.9
Cycle 2 Duct Burner	10	MMBtu/Hr	100	1,176.5	1.0	1.0	0.8	0.8	0.1	0.1	0.0	0.1	0.1	0.1	0.0
Emergency Generator	2000	HP NG	500	559.9	8.9	8.9	17.7	17.7	4.4	4.4	0.0	0.0	0.0	0.0	0.0
Fire Pump Engine	200	HP Diesel	500	231.3	1.3	1.3	1.2	1.2	1.3	1.3	0.4	0.1	0.1	0.1	0.0
Cooling Tower	60,000	GPM	8760	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.0

Annual Emissions at Full Operation (8760 hours per year)

			Annual Operation (hours)	CO2e (tons)	NOx		CO		VOC		SO2 (tons)	PM (tons)	PM-10 (tons)	PM-2.5 (tons)	NH3 (tons)
					SCR Inlet (tons)	SCR Outlet (tons)	CatOx Inlet (tons)	CatOx Outlet (tons)	CatOx Inlet (tons)	CatOx Outlet (tons)					
Cycle 1	589	MMBtu/Hr	8760	322,988.8	469.6	20.8	381.0	12.5	0.0	6.2	4.9	46.4	46.4	46.4	18.1
Cycle 2 CTG	979	MMBtu/Hr	8760	526,975.3	148.0	32.9	236.9	20.0	8.8	5.3	4.5	49.5	49.5	49.5	30.2
Cycle 2 Duct Burner	10	MMBtu/Hr	100	58.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emergency Generator	2000	HP NG	500	140.0	2.2	2.2	4.4	4.4	1.1	1.1	0.0	0.0	0.0	0.0	0.0
Fire Pump Engine	200	HP Diesel	500	57.8	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0
Cooling Tower	60,000	GPM	8760	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	2.4	2.4	0.0
Facility Support Equipment				197.8	2.5	2.5	4.7	4.7	1.4	1.4	0.1	2.4	2.4	2.4	0.0
Cycle 1 and Facility Support Equipment				323,186.6	472.1	23.4	385.7	17.2	1.4	7.6	5.0	48.8	48.8	48.8	18.1
Cycle 2 CTG and Duct Burner				527,034.1	148.1	32.9	236.9	20.1	8.8	5.3	4.5	49.5	49.5	49.5	30.2
Cycle 2 and Facility Support Equipment				527,231.9	150.6	35.4	241.6	24.8	10.2	6.7	4.6	51.9	51.9	51.9	30.2

Annual Emissions at Reduced Operation (3120 hours per year - 12 hours/day for 260 days/year)

			Annual Operation (hours)	CO2e (tons)	NOx		CO		VOC		SO2 (tons)	PM (tons)	PM-10 (tons)	PM-2.5 (tons)	NH3 (tons)
					SCR Inlet (tons)	SCR Outlet (tons)	CatOx Inlet (tons)	CatOx Outlet (tons)	CatOx Inlet (tons)	CatOx Outlet (tons)					
Cycle 1	589	MMBtu/Hr	3160	116,511.9	169.4	7.5	137.4	4.5	0.0	2.2	1.8	16.8	16.8	16.8	6.5
Cycle 2 CTG	979	MMBtu/Hr	3160	190,096.1	53.4	11.9	85.4	7.2	3.2	1.9	1.6	17.9	17.9	17.9	10.9
Cycle 2 Duct Burner	10	MMBtu/Hr	100	58.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Emergency Generator	2000	HP NG	500	140.0	2.2	2.2	4.4	4.4	1.1	1.1	0.0	0.0	0.0	0.0	0.0
Fire Pump Engine	200	HP Diesel	500	57.8	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0
Cooling Tower	60,000	GPM	6240	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.7	1.7	0.0
Facility Support Equipment				197.8	2.5	2.5	4.7	4.7	1.4	1.4	0.1	1.7	1.7	1.7	0.0
Cycle 2 CTG and Duct Burner				190,154.9	53.5	11.9	85.5	7.3	3.2	1.9	1.6	17.9	17.9	17.9	10.9
Cycle 1 and Facility Support Equipment				116,709.7	171.9	10.1	142.2	9.2	1.4	3.7	1.9	18.5	18.5	18.5	6.5
Cycle 2 and Facility Support Equipment				190,352.7	56.0	14.4	90.2	12.0	4.6	3.3	1.7	19.6	19.6	19.6	10.9