APPENDIX G – AIR PERMITTING INFORMATION

G-1 Updates and Clarifications Relevant to Air Analysis
G-2 Siemens Technology Selection Memo
G-3 Ambient Air Quality Analysis (Attachment L)
G-4 Permit Application for Stationary Sources of Air Pollution – New Source Review

APPENDIX G-1 – UPDATES AND CLARIFICATIONS RELEVANT TO AIR ANALYSIS

MEMO

To:	James Grillo, Connecticut Department of Energy and Environmental Protection (CTDEEP)
From:	Steven Babcock
Date:	August 8, 2016
Subject:	Killingly Energy Center - Updates and Clarifications Relevant to Air Analysis

NTE Connecticut, LLC (NTE) submitted an application for a permit to construct and operate for the proposed Killingly Energy Center (KEC) located in Killingly, CT. The application proposed to install and continuously operate a natural gas fired heater to prevent condensation in the natural gas delivered to the combustion turbine generator (CTG). Based upon NTE's expected operation of the natural gas fired heater and consistent with the air dispersion report submitted to CTDEEP on May 25, 2016, NTE will limit operation of this source to 4,000 hours per year. This will result in a reduction in annual emissions from the natural gas heater and the overall project.

In addition to limiting the annual operating hours of the natural gas heater, a minor discrepancy was identified between the proposed operating hours of the auxiliary boiler in the air permit application and what was used in the air dispersion modeling analysis as documented in the Ambient Air Quality Analysis report. The air permit proposed to limit operation of the auxiliary boiler to 4,600 hours per year whereas the air dispersion modeling report limited operating hours to 4,000 per year when predicting annual impact concentrations. The dispersion modeling has been revised to reflect a limit of 4,600 hour per year for the auxiliary boiler, consistent with the air permit application. The revised dispersion modeling analysis has also taken into account the lower carbon monoxide emission rates from the CTG presented in a memo to CTDEEP dated July 14, 2016. The auxiliary boiler is not a significant contributor to the maximum predicted impact concentrations for KEC and, therefore, the increase in operating hours did not materially affect the modeling results.

These changes will align the proposed operating restrictions and emissions in the air permit application and air dispersion modeling analysis. Updated modeling files will be provided to Jude Catalano. Attached to this memo is the following revised information to reflect the proposed changes:

- Table E-6: Facility-Wide Annual Potential Emissions (tons per year [tpy]);
- Revised application forms
    - Att. E212 GH
    - Att. F
    - Att. G3
- Appendix A: Supporting Emission Calculations
- Appendix B: Revised Ambient Air Quality Analysis report pages

No changes to the modeling procedures documented in the modeling report dated May 25, 2016 have been made. Therefore, the revised air dispersion modeling analysis presents only the revised inputs and results, as applicable. Specifically, the results now reflect the revisions to the emissions and operating limits described in the memo to CTDEEP dated July 14, 2016 and this memo. The revised pages for the Ambient Air Quality Analysis report include the following:

- Table L-2 PSD Regulatory Threshold Evaluation
- Table L-5. Load Scenarios and Emission Rates - Combined Cycle Combustion Turbine Firing Natural Gas
- Table L-7. Startup Condition Stack Parameters for Each Fuel
- Table L-8. Stack Parameters for Ancillary Equipment
- Table L-10. Maximum Predicted Impact Concentrations
- Table L-15. Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds
- Appendix L-A: DETAILED SOURCE PARAMETER DATA,
    - Combined Cycle Combustion Turbine and Ancillary Equipment Emissions Estimates
- Appendix L-C: DETAILED AERMOD RESULTS SUMMARY,
    - Combined Cycle Combustion Turbine Emissions Estimates,
    - AERMOD Scaled Impacts – turbine only (µg/m3) – 150 ft. turbine stack,
    - Combined Cycle Combustion Turbine – Start-up/Shutdown (SU/SD) Emissions Estimates
    - AERMOD SU/SD Scaled Impacts – turbine only (µg/m3) – 150 ft. turbine stack
    - Killingly Energy Center – Detailed Results Table

TABLE E-6: FACILITY-WIDE ANNUAL POTENTIAL EMISSIONS (tons per year [tpy])

Table E-6: Facility-Wide Annual Potential Emissions (tons per year [tpy])

Pollutant	CTG & Duct Burners	Auxiliary Boiler	Natural Gas Heater	Emergency Generator	Fire Pump	Facility Total
NO_x[a]	133.9	1.64	0.29	2.92	0.30	139.1
CO[a]	133.8	7.14	0.89	1.60	0.26	143.6
VOC[a]	48.3	0.78	0.08	0.15	0.02	49.3
SO_2	24.7	0.29	0.04	0.003	0.0005	25.1
$PM_{10}/PM_{2.5}$	100.8	0.97	0.12	0.09	0.02	102.0
GHG (as CO_2e)	1,966,937	22,610	2,809	308	49	1,993,260[b]
H_2SO_4	8.76	0.02	0.003	0.0002	0.00003	8.8
Lead (Pb)	0.0018	$9.5x10^{-5}$	$1.2x10^{-5}$	$1.4x10^{-6}$	$2.3x10^{-7}$	0.002
NH_3	49.5	N/A	N/A	N/A	N/A	49.5
Max Individual HAP (hexane)	7.06	0.35	0.04	N/A	N/A	7.5
Total HAPs	14.1	0.37	0.05	0.01	0.003	14.6

[a] Includes incremental emissions due to start-up and shutdown.
[b] Includes 547 tpy of fugitive GHG emissions from circuit breakers and natural gas handling.

REVISED APPLICATION FORMS

Attachment E212: Unit Emissions Supplemental Application Form

Applicant Name: NTE Connecticut, LLC
Unit No.: GH

DEEP USE ONLY
App. No.:

Complete this form in accordance with the instructions (DEEP-NSR-INST-212) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete a separate form for *each* unit.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I: Unit Emission Information

Pollutant	Potential Emissions at Maximum Capacity		Proposed Allowable Emissions		
	lb/hr	tpy	lb/hr	Other Units *(specify)*	tpy
Criteria Air Pollutants					
PM	0.06	0.26	0.06	0.005 lb/MMBtu	0.12
PM_{10}	0.06	0.26	0.06	0.005 lb/MMBtu	0.12
$PM_{2.5}$ Total (filterable + condensable)	0.06	0.26	0.06	0.005 lb/MMBtu	0.12
SO_x	0.02	0.08	0.02	0.0015 lb/MMBtu	0.04
NO_x	0.13	0.57	0.13	0.012 lb/MMBtu	0.29
CO	0.44	1.9	0.44	0.037 lb/MMBtu	0.89
VOC	0.04	0.18	0.04	0.0034 lb/MMBtu	0.08
Pb	5.9E-06	2.6E-05	5.9E-06	4.9E-07 lb/MMBtu	1.2E-05
GHG	1,404	6,151	1,404	119 lb/MMBtu	2,809
Hazardous or Other Air Pollutants					
See Appendix A					

Potential Emissions Calculation Basis: <u>**Vendor Data**</u>

Proposed Allowable Emissions Calculation Basis: <u>**Vendor Data and 4,000 hrs/yr of operation**</u>

Part II: Regulatory Standards

Enter the regulatory standard(s) and the proposed allowable emissions for each pollutant emitted by the unit using the same units (e.g., ppmvd, lb/MMBTU, lb/hour, lb/day, etc.). More than one regulatory standard will often apply to a unit for a particular pollutant, list all that apply. Enter the regulatory citation(s) for the standard(s).

NOTE: The applicant should be aware of any existing regulatory standard applicable to the unit and should not propose allowable emissions in excess of the regulatory standard(s).

Pollutant	Regulatory Standard(s) *(specify units)*	Proposed Allowable Emissions *(specify units)*	Regulatory Citation(s)
Criteria Air Pollutants			
PM			
PM_{10}			
$PM_{2.5}$ Total (filterable + condensable)			
SO_x			
NO_x			
CO			
VOC			
Pb			
GHG			
Hazardous or Other Air Pollutants *(Standards other than RCSA §22a-174-29)*			

Part III: Attachments

Please check the attachment being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E212-A, etc.) and be sure to include the applicant's name.

☒ Attachment E212-A: *Sample Calculations*- Submit sample calculations used to determine all emissions rates, excluding GHG. See Attachment E212-C for GHG emissions. **REQUIRED**

☒ Attachment E212-B: *RCSA section 22a-174-29 Hazardous Air Pollutants Compliance* – Submit a completed CTMASC spreadsheet**,** or equivalent, to demonstrate compliance with RCSA section 22a-174-29. **REQUIRED**

☒ Attachment E212-C: *Greenhouse Gas Emissions* – Submit a completed CO_2 Equivalents Calculator Spreadsheet, or equivalent, used to quantify Greenhouse Gas emissions, **REQUIRED**

Attachment F: Premises Information Form

Applicant Name: NTE Connecticut, LLC

DEEP USE ONLY
App. No.: ______

Complete this form in accordance with the [instructions](DEEP-NSR-INST-217) (DEEP-NSR-INST-217) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete Parts I through VI of this form, as applicable, for only the equipment which is located at the premises prior to the submittal of this application package. Unit(s) or modifications that are the subject of this application package are addressed in Part VII of this form.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152

Note: This form is not required if you indicated in Part IV.8 of the *Permit Application for Stationary Sources of Air Pollution New Source Review Form (DEEP-NSR-APP-200) that* the premises is operating under the General Permit to Limit Potential to Emit.

Part I: Premises Information Summary

Answer each question unless directed to do otherwise. Complete the Part(s) indicated as well as Part VII.

Question	Check One	If Yes….
A. Is this a new premises? (i.e. no air pollution emitting equipment on site)	☒ Yes ☐ No	Skip Questions B through G and continue on to Part VII of this form.
B. Is the premises operating under a Title V permit?	☐ Yes ☐ No	Permit Number: Issue Date: Skip Questions C through G and continue on to Part VII of this form.
C. Is there any equipment operating under a New Source Review Permit (permit) or Air Registration (registration) at the premises?	☐ Yes ☐ No	Complete Part II of this form.
D. Are there any external combustion units, automotive refinishing operations, nonmetallic mineral processing equipment, emergency engines or surface coating operations operating under RCSA section 22a-174-3b at the premises?	☐ Yes ☐ No	Complete Part III of this form.
E. Are there any external combustion units, automotive refinishing operations, nonmetallic mineral processing equipment, emergency engines or surface coating operations operating under RCSA section 22a-174-3c at the premises?	☐ Yes ☐ No	Complete Part IV of this form.
F. Are there any emissions units operating at the premises that have potential emissions of any air pollutant below the permitting thresholds of RCSA section 22a-174-3a which have not been captured in Question E?	☐ Yes ☐ No	Complete Part V of this form.
G. Is the premises operating under a premises-wide annual limitation (other than GPLPE or RCSA section 22a-174-3c) for any air pollutant?	☐ Yes ☐ No	Complete Part VI of this form.

Part II: Permits and Registrations

Complete this part, if “Yes” was answered to Question C in Part I of this form. List each piece of equipment operating under a permit or registration located at this premises. Provide the potential emissions for each pollutant as limited by such permit or registration in tons per year for each unit. Calculate the total potential emissions from equipment operating under permits or registrations for the premises.

Permit / Registration Number	Equipment Description	Permit/Registration Issuance Date	Potential Emissions from Permit or Registration (tpy)								
			PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Totals											

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

Part III: Units Operating Under RCSA section 22a-174-3b

Complete this part, if “Yes” was answered to Question D in Part I of this form. Enter the following information for each unit operating under RCSA section 22a-174-3b. Such units may include external combustion units, automotive refinishing operations, nonmetallic mineral processing equipment, emergency engines or surface coating operations. Calculate the total potential emissions from the equipment as limited by RCSA section 22a-174-3b.

Equipment Type	Const. Date	Maximum Rated Capacity of Equipment	Potential Emissions as Limited by RCSA section 22a-174-3b (tpy)								
			PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Totals											

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

Emissions Calculation Basis: ____

Part IV: Units Operating Under RCSA section 22a-174-3c

Complete this part, if “Yes” was answered to Question E in Part I of this form. Check off the types of equipment that is operating at the premises under RCSA section 22a-174-3c. Check all that apply. Calculate the total potential emissions from the equipment limited by RCSA section 22a-174-3c for each pollutant.

Equipment Operating Under RCSA section 22a-174-3c (Check all that apply)		Fuels Used (Check all that apply)	Number of Fuels Used	Potential Emissions for Each Pollutant (tpy)	Total Potential Emissions for Each Pollutant (tpy)
External Combustion Unit	☐	☐ Gaseous Fuel ☐ Distillate Oil or a blend of distillate oil and biodiesel fuel ☐ Residual Oil or a blend of residual oil and biodiesel fuel (boiler only) ☐ Propane		**15**	
Emergency Engine	☐				
Nonmetallic Mineral Processing Equipment	☐	**N/A**	**N/A**	**15**	
Automotive Refinishing Operation	☐	**N/A**	**N/A**	**15**	
Surface Coating Operation	☐	**N/A**	**N/A**	**15**	
				Totals for Each Pollutant (tpy)	

Potential emissions of any individual air pollutant for a stationary source operating under RCSA section 22a-174-3c is less than 15 tons per year unless otherwise determined by a permit or order. Please be aware that if different units are operating with the same fuel, the most stringent limitation for that fuel applies to the premises.

Part V: Other Equipment

Complete this part, if "Yes" was answered to Question F in Part I of this form. Only include units which have not been captured elsewhere on this form and have potential emissions between 5 and 15 tons per year of any individual pollutant. If it is determined that premises-wide annual emissions of a pollutant are within 90% of major source thresholds, include all units with potential emissions greater than one ton per year on this table. Calculate the total potential emissions.

Equipment Description	Const. Date	Maximum Rated Capacity of Equipment	Potential Emissions as Defined in RCSA section 22a-174-1(91) (tpy)								
			PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Totals											

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

Emissions Calculation Basis: ____

Part VI: Premises-Wide Annual Limitations

Complete this part, if “Yes” was answered to Question G in Part I of this form. List all premises-wide annual limitations applicable to this premises that appear in a permit or order. **Do not include limitations under RCSA section 22a-174-3c.**

Permit or Order Number	Pollutant Limited	Enforceable Premises-Wide Limitation (tpy)

Part VII: Premises Summary

Ozone Non-Attainment Status: ☒ **Serious** ☐ **Severe**

$PM_{2.5}$ Attainment Status: ☒ **Attainment** ☐ **Non-Attainment**

A. Current Premises Potential Emissions

List the applicable potential emissions totals from Parts II through VI, if required to complete those sections. Calculate the *Total Current Premises Potential Emissions* applying any applicable premise-wide limitations. A source that answered "Yes" to Question A or B in Part I of this form would only complete the last three rows of the table below.

Form Part	Part Description	Potential Emissions (tpy)								
		PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Part II	**Total Potential Emissions as Limited by Permit or Registration**									
Part III	**Total Potential Emissions as Limited by RCSA section 22a-174-3b**									
Part IV	**Total Potential Emissions as Limited by RCSA section 22a-174-3c**									
Part V	**Total Potential Emissions from Other Sources**									
Part VI	**Applicable Premises-Wide Annual Limitations**									
Total Current Premises Potential Emissions		0	0	0	0	0	0	0	0	0
Major Source Thresholds (severe/serious)		**100**	**100**	**100**	**100**	**25/50**	**25/50**	**100**	**100**	**100,000**
Existing Major Stationary Source?		☐	☐	☐	☐	☐	☐	☐	☐	☐

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

If any pollutant is checked above**,** this premises **is** an existing major stationary source.

If no pollutants are checked above, this premises **is not** an existing major stationary source.

Go on to Part VII.B.

B. Proposed Project Allowable Emissions

List the proposed allowable emissions from the proposed project for the equipment or modifications included in this application package from *Attachment E: Unit Emissions (DEEP-AIR-APP-212)*.

Totals	Pollutant Emissions (tpy)								
	PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Proposed Allowable Emissions	102.0	102.0	102.0	25.1	139.1	49.3	143.6	0.02	1,993,260
Major Source Thresholds (severe/serious)	**100**	**100**	**100**	**100**	**25/50**	**25/50**	**100**	**100**	**100,000**
Project Major Source?	☒	☒	☒	☐	☒	☐	☒	☐	☒

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

If any pollutant is checked above, the proposed project **is** major in and of itself.

If no pollutants are checked above, the project **is not** major in and of itself.

Go on to Part VII.C.

C. New Premises Total Emissions

List the *Current Premises Potential Emissions* and the *Proposed Allowable Emissions* values from Parts VII.A and B. Calculate the *New Premises Total Emissions*.

Totals	Pollutant Emissions (tpy)								
	PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Total Current Premises Potential Emissions (Part VII.A)	0	0	0	0	0	0	0	0	0
Proposed Allowable Emissions (Part VII.B)	102.0	102.0	102.0	25.1	139.1	49.3	143.6	0.02	1,993,260
New Premises Total Emissions	102.0	102.0	102.0	25.1	139.1	49.3	143.6	0.02	1,993,260
Major Source Thresholds (severe/serious)	**100**	**100**	**100**	**100**	**25/50**	**25/50**	**100**	**100**	**100,000**
Premises Major Source After Project?	☒	☒	☒	☐	☒	☐	☒	☐	☒

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

If any pollutant is checked above, the premises **will be** considered a major stationary source after the approval of the proposed project.

If no pollutants are checked above, the premises **will not be** considered a major stationary source after the approval of the proposed project.

Go on to Part VII.D**.**

D. Form Requirements

Based on the results in Parts VII.A through VII.C of this form the following forms are required to be completed for each pollutant:

Premises Major Stationary Source?	Project Itself Major Stationary Source?	Premises After Project is Major Stationary Source?	Forms Required to Be Completed
Part VII.A	**Part VII.B**	**Part VII.C**	
Yes	**Yes**	**--**	• Attachment H: Major Modification Determination Form • Attachment I: Prevention of Significant Deterioration of Air Quality (PSD) Program Form • Attachment J: Non-Attainment Review Form (for NOx, VOC or $PM_{2.5}$ only)
Yes	**No**	**--**	• Attachment H: Major Modification Determination Form (This form will direct you to complete Attachments **I** or J, if required.)
No	**Yes**	**--**	• Attachment I: Prevention of Significant Deterioration of Air Quality (PSD) Program Form • Attachment J: Non-Attainment Review Form (for NOx, VOC or $PM_{2.5}$ only)
No	**No**	**--**	Attachments H, I and J are not required.
--	**--**	**Yes**	If not already operating under one, the applicant is required to apply for a Title V permit within 12 months of becoming a major stationary source or the applicant must limit premises potential emissions by obtaining an approval of registration to operate under the General Permit to Limit Potential to Emit (GPLPE).

Attachment G3: Summary of Best Available Control Technology Reviews

Complete this form in accordance with the instructions (DEEP-NSR-INST-214) to ensure the proper handling of your application. Print or type unless otherwise noted.

List each emissions unit subject to the BACT requirements. For each emissions unit listed, indicate the Emissions Unit number and all pollutants that are subject to the BACT requirements. *Attachment G: Analysis of Best Available Control Technology* (DEEP-NSR-APP-214a) should be completed for each emissions unit-pollutant combination listed in this table.

		Pollutants Subject to BACT									
Unit Description	**Unit Number**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_X**	**CO**	**VOC**	**GHG**	**Other** (please specify)	
Combustion Turbine	CT	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4 & NH3
Duct Burner	DB	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4 & NH3
Auxliary Boiler	DB1	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Emergency Generator Engine	DB2	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Emergency Fire Pump Engine	AB	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Natural Gas Heater	GH	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Fugitive Emissions	FG	☐	☐	☐	☐	☐	☐	☐	☒	☐	H2SO4
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
Baseline Project Emissions Total in tons per year (tpy):		102.0	102.0	102.0	25.1	139.1	143.6	49.3	1,993,260	58.3	**Comments:**
Allowable Project Emissions Total in tons per year (tpy):		102.0	102.0	102.2	25.1	139.1	143.6	49.3	1,993,260	58.3	

APPENDIX A: SUPPORTING EMISSION CALCULATIONS

NTE Connecticut, LLC - Killingly Energy Center

Facility-Wide Potential Annual Emissions (TPY)

Pollutant	CTG & Duct Burners	Auxiliary Boiler	Natural Gas Heater	Emergency Generator	Fire Pump	Fugitive Emissions	Facility Total
NO_x	133.9	1.64	0.29	2.92	0.30	N/A	139.1
CO	133.8	7.14	0.89	1.60	0.26	N/A	143.6
VOC	48.3	0.78	0.08	0.15	0.02	N/A	49.3
SO_2	24.7	0.29	0.04	0.003	0.0005	N/A	25.1
PM	100.8	0.97	0.12	0.09	0.02	N/A	102.0
PM_{10}	100.8	0.97	0.12	0.09	0.02	N/A	102.0
$PM_{2.5}$	100.8	0.97	0.12	0.09	0.02	N/A	102.0
CO_2e	1,966,937	22,610	2,809	308	49	547	1,993,260
H_2SO_4	8.76	0.02	0.003	0.0002	0.00003	N/A	8.8
Lead (Pb)	1.8E-03	9.5E-05	1.2E-05	1.4E-06	2.3E-07	N/A	0.002
NH_3	49.5	N/A	N/A	N/A	N/A	N/A	49.5
Total HAPS	14.13	0.36	0.05	0.01	0.003	N/A	14.6

Potential To Emit Operating Scenario

The CTG will operate at full rated load for 8,760 hours per year.

Higher emission rates occur during gas firing with duct firing and ULSD firing without duct firing

Duct firing will be unlimited

ULSD firing will be limited to 720 hours per year per turbine without duct firing

Over the course of 8,760 operating hours, the average annual temperature will be 59°F

ULSD firing expected to occur during cold winter months

ULSD emission rate for 720 hrs/yr applied when the lb/hr rate is greater than the duct firing lb/hr rate

The potential to emit is the sum of the steady state potential to emit plus the net increase due to startup/shutdown operation

Operating Condition	Operating Load	Fuel	Ambient Temp. (°F)	Duct Firing	Maximum Annual Hours
Case #36	100%	Nat. Gas	59	On	8,760
Case #65	100%	ULSD	-10	Off	720
Total					**8,760**

Pollutant	Case #36	Case #69	8760 PTE	SU/SD	PTE
	lb/hr	lb/hr	tpy	tpy	tpy
NO_x	28.4	54.9	133.9	0.0	133.9
CO	14.7	13.4	64.4	69.4	133.8
VOC	9.9	7.7	43.4	4.9	48.3
$PM_{10}/PM_{2.5}$	22.4	30.0	100.8	0	100.8
SO_2	5.6	4.0	24.7	0	24.7
H_2SO_4	2.0	1.5	8.76	0	8.76
CO_2e	448,064	460,328	1,966,937	0	1,966,937
NH_3	10.5	20.3	49.5	0	49.5

NTE Connecticut, LLC - Killingly Energy Center
Siemens Model SGT6-8000H (or equivalent) Combined Cycle Combustion Turbine Emissions Estimates

Ambient Temperature (°F):	100					59					-10			
Case #:	1	2	3	4	5	36	37	38	39	40	32	33	34	35
Fuel	Natural Gas													
Number of GTs Operating														
GT Operating Load	100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%
Fuel Heating Value, Btu/lb (HHV)	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
Inlet Fogger State (On or Off)														
Ambient Relative Humidity, %	45	45	45	45	45	60	60	60	60	60	100	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,672	2,672	2,490	1,983	1,444	2,871	2,869	2,827	2,269	1,515	2,974	2,971	2,380	1,598
DB Heat Input (MMBtu/hr/unit, HHV)	834					895					920			
Net Power (kW)						532,724		433,008						
Gross Power (kW)						549,200		446,400						
Heat Rate (Btu/kW-hr, net, HHV)						7,069		6,529						
HRSG Stack Exhaust Gas														
Exhaust Flow, lb/hr	4,780,636	4,742,975	4,491,475	3,798,752	3,012,719	5,126,628	5,086,165	5,037,546	4,141,668	3,076,733	5,197,878	5,156,718	4,160,194	3,114,531
Stack Temperature, °F	186.0	191.0	188.0	190.0	188.0	185.0	180.0	180.0	178.0	178.0	188.0	180.0	178.0	178.0
Exhaust Flow, acfm	1,360,753	1,352,033	1,271,742	1,077,307	850,706	1,443,471	1,414,751	1,398,751	1,147,081	850,251	1,464,925	1,429,259	1,148,386	857,812
O_2, Vol. %	8.41	11.09	11.33	11.93	12.70	8.74	11.45	11.54	11.85	12.84	8.69	11.46	11.62	12.67
CO_2, Vol. %	5.61	4.34	4.28	4.00	3.64	5.66	4.38	4.36	4.22	3.75	5.80	4.49	4.42	3.92
H_2O, Vol. %	13.83	11.49	10.81	10.28	9.61	11.77	9.39	9.12	8.85	7.98	10.90	8.45	8.31	7.38
N_2, Vol. %	71.32	72.24	72.73	72.93	73.20	72.97	73.91	74.11	74.21	74.56	73.75	74.72	74.78	75.15
Ar, Vol. %	0.84	0.85	0.85	0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.86	0.88	0.88	0.88
MW, lb/lb-mole	27.96	28.10	28.17	28.20	28.24	28.19	28.34	28.36	28.38	28.43	28.30	28.45	28.46	28.51
HRSG Stack Exhaust Gas Emissions														
NOx, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NOx, lb/MMBtu as NO2 (Siemens)	0.0075	0.0075	0.0076	0.0075	0.0074	0.0075	0.0075	0.0075	0.0074	0.0074	0.0075	0.0075	0.0075	0.0074
NOx, lb/MMBtu as NO2 (EPA Method 19)	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
NOx, lb/hr as NO2 (Siemens)	26.40	20.10	18.80	14.80	10.70	28.40	21.60	21.30	16.90	11.20	29.30	22.40	17.80	11.80
NOx, lb/hr as NO2 (Method 19)	25.83	19.69	18.35	14.62	10.64	27.75	21.14	20.83	16.72	11.16	28.69	21.90	17.53	11.78
VOC, ppmvd @ 15% O2 as CH4	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0
VOC ppm (Method 19)	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0
VOC, lb/MMBtu (Siemens)	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013
VOC, lb/MMBtu as CH4 (EPA Method 19)	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013
VOC, lb/hr as CH4 (Siemens)	9.20	3.60	3.30	2.60	1.90	9.90	3.80	3.80	3.00	2.00	10.30	3.90	3.10	2.10
VOC, lb/hr as CH4 (Method 19)	9.00	3.43	3.20	2.55	1.85	9.67	3.68	3.63	2.91	1.94	10.00	3.81	3.05	2.05
CO, ppmvd @ 15% O2	1.7	0.9	0.9	0.9	0.9	1.7	0.9	0.9	0.9	0.9	1.7	0.9	0.9	0.9
CO, lb/MMBtu (Siemens)	0.0039	0.0021	0.0021	0.0021	0.0021	0.0039	0.0021	0.0021	0.0021	0.0020	0.0039	0.0021	0.0021	0.0021
CO, lb/MMBtu (EPA Method 19)	0.0038	0.0020	0.0020	0.0020	0.0020	0.0038	0.0020	0.0020	0.0020	0.0020	0.0038	0.0020	0.0020	0.0020
CO, lb/hr (Siemens)	13.70	5.60	5.20	4.10	3.00	14.70	6.00	5.90	4.70	3.10	15.20	6.20	4.90	3.30
CO, lb/hr (Method 19)	13.37	5.39	5.03	4.00	2.91	14.36	5.79	5.71	4.58	3.06	14.85	6.00	4.80	3.23
SO2 ppm (Method 19)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
SO2, lb/hr (Siemens)	5.00	3.80	3.60	2.90	2.10	5.40	4.10	4.10	3.30	2.20	5.60	4.30	3.40	2.30
SO2, lb/hr (calculated)	5.26	4.01	3.74	2.98	2.17	5.65	4.30	4.24	3.40	2.27	5.84	4.46	3.57	2.40
SO2, lb/MMBtu	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
H2SO4, lb/hr	1.80	1.40	1.30	1.10	0.80	2.00	1.50	1.50	1.20	0.80	2.00	1.60	1.30	0.90
H2SO4, lb/MMBtu	0.00051	0.00052	0.00052	0.00055	0.00055	0.00053	0.00052	0.00053	0.00053	0.00053	0.00051	0.00054	0.00055	0.00056
$PM/PM_{10}/PM_{2.5}$, lb/hr	20.70	11.50	10.90	9.20	8.00	22.40	12.50	12.40	10.20	8.00	22.90	12.80	10.30	8.00
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0059	0.0043	0.0044	0.0046	0.0055	0.0059	0.0044	0.0044	0.0045	0.0053	0.0059	0.0043	0.0043	0.0050
NH_3, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NH_3, lb/MMBtu (EPA Method 19)	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027
NH_3, lb/hr (Siemens)	9.80	7.50	7.00	5.50	4.00	10.50	8.00	7.90	6.30	4.20	10.90	8.30	6.60	4.40
NH_3, lb/hr (Method 19)	9.55	7.28	6.78	5.40	3.93	10.25	7.81	7.70	6.18	4.13	10.60	8.09	6.48	4.35
CO_2, lb/hr (40 CFR 75, App. G, Eq. G-4)	416,712	317,605	295,959	235,752	171,635	447,609	341,057	336,047	269,653	180,065	462,871	353,170	282,827	189,969
CH_4, lb/hr (40 CFR 98, Subpart C, Table 2)	7.73	5.89	5.49	4.37	3.18	8.30	6.33	6.23	5.00	3.34	8.59	6.55	5.25	3.52
N_2O, lb/hr (40 CFR 98, Subpart C, Table 2)	0.77	0.59	0.55	0.44	0.32	0.83	0.63	0.62	0.50	0.33	0.86	0.66	0.52	0.35
CO_2e, lb/hr (CH4 GWP = 25, N2O GWP = 298)	417,136	317,927	296,260	235,991	171,810	448,064	341,403	336,388	269,927	180,248	463,341	353,529	283,114	190,162
CO_2e, lb/MMBtu	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0
CO_2e, lb/MW-hr (gross)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HCOH (lb/hr)	0.767	0.585	0.545	0.434	0.316	0.824	0.628	0.619	0.496	0.332	0.852	0.650	0.521	0.350

NTE Connecticut, LLC - Killingly Energy Cer
Siemens Model SGT6-8000H (or equivalent)

Ambient Temperature (°F):	100				59				-10		
Case #:	41	42	43	44	68	69	70	71	65	66	67
Fuel	ULSD										
Number of GTs Operating											
GT Operating Load	100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444
Evaporative Cooler Status (On or Off)	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	---	---	---	---	---	---	---	---	---	---	---
Inlet Fogger State (On or Off)											
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,740	2,567	2,055	1,874	2,828	2,783	2,226	1,941	2,827	2,289	2,029
DB Heat Input (MMBtu/hr/unit, HHV)											
Net Power (kW)											
Gross Power (kW)											
Heat Rate (Btu/kW-hr, net, HHV)											
HRSG Stack Exhaust Gas											
Exhaust Flow, lb/hr	4,833,827	4,620,398	3,833,176	3,574,417	5,155,459	5,106,515	4,228,784	3,791,268	5,500,484	4,510,924	4,056,678
Stack Temperature, °F	211.0	207.0	202.0	200.0	200.0	199.0	194.0	193.0	212.0	204.0	202.0
Exhaust Flow, acfm	1,409,478	1,336,669	1,098,107	1,020,083	1,463,706	1,446,835	1,187,159	1,060,412	1,577,200	1,276,412	1,143,842
O_2, Vol. %	11.50	11.77	12.24	12.48	12.25	12.34	12.78	13.08	13.13	13.35	13.52
CO_2, Vol. %	5.26	5.17	4.95	4.82	5.15	5.12	4.91	4.75	4.87	4.76	4.67
H_2O, Vol. %	10.88	10.18	9.40	9.08	8.08	7.81	7.13	6.72	5.71	5.32	5.13
N_2, Vol. %	71.52	72.03	72.56	72.76	73.66	73.86	74.32	74.57	75.41	75.68	75.79
Ar, Vol. %	0.84	0.85	0.85	0.85	0.86	0.87	0.87	0.87	0.88	0.89	0.89
MW, lb/lb-mole	28.33	28.39	28.45	28.48	28.62	28.65	28.70	28.73	28.85	28.88	28.89
HRSG Stack Exhaust Gas Emissions											
NOx, ppmvd @ 15% O2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NOx, lb/MMBtu as NO2 (Siemens)	0.0178	0.0178	0.0177	0.0176	0.0178	0.0178	0.0177	0.0176	0.0178	0.0176	0.0175
NOx, lb/MMBtu as NO2 (EPA Method 19)	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194
NOx, lb/hr as NO2 (Siemens)	48.90	45.80	36.30	32.90	50.40	49.60	39.30	34.10	50.40	40.40	35.60
NOx, lb/hr as NO2 (Method 19)	53.25	49.88	39.93	36.42	54.96	54.08	43.26	37.72	54.9	44.49	39.44
VOC, ppmvd @ 15% O2 as CH4	2.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
VOC ppm (Method 19)	2.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
VOC, lb/MMBtu (Siemens)	0.0026	0.0012	0.0025	0.0025	0.0013	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
VOC, lb/MMBtu as CH4 (EPA Method 19)	0.0027	0.0014	0.0027	0.0027	0.0014	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027
VOC, lb/hr as CH4 (Siemens)	7.00	3.20	5.20	4.60	3.60	7.00	5.60	4.80	7.20	5.80	5.00
VOC, lb/hr as CH4 (Method 19)	7.42	3.48	5.57	5.08	3.83	7.54	6.03	5.26	7.66	6.20	5.50
CO, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
CO, lb/MMBtu (Siemens)	0.0043	0.0044	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0044	0.0043	0.0043
CO, lb/MMBtu (EPA Method 19)	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047
CO, lb/hr (Siemens)	11.90	11.20	8.90	8.10	12.30	12.10	9.60	8.30	12.30	9.90	8.70
CO, lb/hr (Method 19)	12.97	12.15	9.72	8.87	13.38	13.17	10.53	9.18	13.38	10.83	9.60
SO2 ppm (Method 19)	0.17	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
SO2, lb/hr (Siemens)	3.90	3.60	2.90	2.70	4.00	3.90	3.20	2.80	4.00	3.20	2.90
SO2, lb/hr (calculated)	4.11		3.08	2.81	4.24	4.17	3.34	2.91	4.24	3.43	3.04
SO2, lb/MMBtu	0.0015	0.0014	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
H2SO4, lb/hr	1.40	1.30	1.10	1.00	1.50	1.40	1.20	1.00	1.50	1.20	1.10
H2SO4, lb/MMBtu	0.00051	0.00051	0.00054	0.00053	0.00053	0.00050	0.00054	0.00052	0.00053	0.00052	0.00054
$PM/PM_{10}/PM_{2.5}$, lb/hr	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0109	0.0117	0.0146	0.0160	0.0106	0.0108	0.0135	0.0155	0.0106	0.0131	0.0148
NH_3, ppmvd @ 15% O2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH_3, lb/MMBtu (EPA Method 19)	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072
NH_3, lb/hr (Siemens)	18.10	17.00	13.50	12.20	18.70	18.40	14.60	12.60	18.70	15.00	13.20
NH_3, lb/hr (Method 19)	19.68	18.43	14.76	13.46	20.31	19.99	15.99	13.94	20.30	16.44	14.57
CO_2, lb/hr (40 CFR 75, App. G, Eq. G-4)	444,638	416,510	333,445	304,077	458,908	451,561	361,231	314,929	458,746	371,494	329,315
CH_4, lb/hr (40 CFR 98, Subpart C, Table 2)	18.12	16.98	13.59	12.39	18.71	18.41	14.72	12.84	18.70	15.14	13.42
N_2O, lb/hr (40 CFR 98, Subpart C, Table 2)	3.62	3.40	2.72	2.48	3.74	3.68	2.94	2.57	3.74	3.03	2.68
CO_2e, lb/hr (CH4 GWP = 25, N2O GWP = 298)	446,171	417,946	334,595	305,125	460,491	453,118	362,477	316,015	460,328	372,775	330,450
CO_2e, lb/MMBtu	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8
CO_2e, lb/MW-hr (gross)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HCOH (lb/hr)	0.633	0.593	0.474	0.433	0.653	0.642	0.514	0.448	0.653	0.529	0.469

NTE Connecticut, LLC - Killingly Energy Center
Summary of Startup and Shutdown Emissions - Siemens Model SGT6-8000H (or equivalent)

Startup/Shutdown Operating Data

hot starts/unit/gas	208	number/yr	0.50	hrs/event	6	Avg. hrs downtime	6.50	hrs/event
warm starts/unit/gas	42	number/yr	0.58	hrs/event	16	Avg. hrs downtime	16.58	hrs/event
cold starts/unit/gas	0	number/yr	0.58	hrs/event	64	Avg. hrs downtime	64.58	hrs/event
shutdowns/unit/gas	250	number/yr	0.30	hrs/event	N/A	Avg. hrs downtime	N/A	hrs/event
hot starts/unit/ULSD	0	number/yr	0.53	hrs/event	6	Avg. hrs downtime	6.53	hrs/event
warm starts/unit/ULSD	10	number/yr	0.58	hrs/event	16	Avg. hrs downtime	16.58	hrs/event
cold starts/unit/ULSD	0	number/yr	0.58	hrs/event	64	Avg. hrs downtime	64.58	hrs/event
shutdowns/unit/ULSD	10	number/yr	0.30	hrs/event	N/A	Avg. hrs downtime	N/A	hrs/event

Startup/Shutdown Emissions Self-Correcting Analysis

		Natural Gas Start				ULSD Start			
		NOx	CO	VOC	PM	NOx	CO	VOC	PM
Emissions per cold start	lbs	100	470	40	6.8	150	2200	240	20.3
Emissions per warm start	lbs	130	430	40	8.1	170	2300	260	20.4
Emissions per hot start	lbs	110	370	40	6.9	150	1970	260	18.5
Emissions per shutdown	lbs	60	200	60	3.3	130	420	170	11.3
Shutdown/Cold start - duration (w/ downtime)	hrs	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88
Shutdown/Warm start - duration (w/ downtime)	hrs	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88
Shutdown/Hot start - duration (w/ downtime)	hrs	6.80	6.80	6.80	6.80	6.83	6.83	6.83	6.83
Shutdown/Cold start - avg hourly emissions[1]	lb/hr	2.47	10.33	1.54	0.15	4.32	40.38	6.32	0.49
Shutdown/Warm start - avg hourly emissions[1]	lb/hr	11.25	37.31	5.92	0.67	17.77	161.11	25.47	1.87
Shutdown/Hot start - avg hourly emissions[1]	lb/hr	25.00	83.82	14.71	1.49	40.98	349.76	62.93	4.35
Steady state average hourly (annual)[2]	lb/hr	28.40	14.70	9.90	22.40	54.94	13.38	7.66	30.00
Cold Start Net increase	lb/event	0.0	0.0	0.0	0.0	0.0	1752.0	0.0	0.0
Warm Start Net increase	lb/event	0.0	381.8	0.0	0.0	0.0	2494.1	300.7	0.0
Hot Start Net increase	lb/event	0.0	470.0	32.7	0.0	0.0	2298.6	377.7	0.0
Cold start - self correcting?	lb/hr	yes	yes	yes	yes	yes	no	yes	yes
Warm start - self correcting?	lb/hr	yes	no	yes	yes	yes	no	no	yes
Hot start - self correcting?	lb/hr	yes	no	no	yes	yes	no	no	yes

[1] Includes balance of the hour at the steady state annual average hourly rate
[2] Based upon average annual hourly emissions with 4,250 hr/yr gas with duct firing, 720 hr/yr oil firing and gas without duct firing balance of the year.

Startup/Shutdown Potential Emissions Increase (tpy/unit)

SUSD Type	Gas NOx	Gas CO	Gas VOC	Oil NOx	Oil CO	Oil VOC
Shutdown/Cold Start	-	-	-	-	0.00	-
Shutdown/Warm Start	-	8.02	-	-	12.47	1.50
Shutdown/Hot Start	-	48.88	3.40	-	0.00	0.00
TOTAL	**0.00**	**56.90**	**3.40**	**0.00**	**12.47**	**1.50**

Note: Maximum of hot start/warm start/transition used for worst case hot start

NTE Connecticut, LLC - Killingly Energy Center
Summary of Startup and Shutdown Emissions - Siemens Model SGT6-8000H (or equivalent)

Startup/Shutdown Parameters (per turbine)

Type	Operating Condition	Exhaust Flow (ACFM)	Temp (°F)	Temp (°K)	NOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)	PM (lb/hr)	Stack Diameter (ft)	Exit Velocity (m/s)
Hot Start - gas	Startup	1,105,782	175	352.4	124.2	377.4	45.0	18.1	22.5	14.13
Warm Start - gas	Startup	1,161,532	177	353.6	141.8	436.1	44.1	17.5	22.5	14.84
Cold Start - gas	Startup	952,830	174	351.9	111.8	476.1	44.1	16.1	22.5	12.17
Shutdown - gas	Shutdown	807,358	176	353.0	79.9	210.3	66.9	18.9	22.5	10.32
Hot Start - ULSD	Startup	794,409	267	403.6	175.6	1976.2	263.6	32.5	22.5	10.15
Warm Start - ULSD	Startup	862,055	268	404.1	192.9	2305.6	263.2	32.9	22.5	11.01
Cold Start - ULSD	Startup	781,795	267	403.6	172.9	2205.6	243.2	32.8	22.5	9.99
Shutdown - ULSD	Shutdown	778,466	263	401.3	168.5	429.4	175.4	32.3	22.5	9.95

Notes
1.) Data is from vendor estimates with 25% compliance margin applied
2.) Cold startup (SU) data are based on CTG shutdown (SD) >64 hours
3.) Warm SU data CTG SD between 16 and 64 hours
4.) Hot SU data CTG SD <16 hours, 6 hour average presumed based upon daily cycling of CTG
5.) ULSD starts presumed to be Warm starts

Example Calculation of Net Increase in Emissions Due To Shutdown and Startup Operation

Shutdown and Hot Startup Cycle For CO - Natural Gas Firing

	Shutdown	Downtime	Startup	SUSD Totals	
Duration (hrs)	0.30	6.00	0.50	**6.80**	**A**
Emissions (lbs)	200	0	370	**570.0**	**B**

Shutdown and Startup Cycle Emission Rate (lb/hr) =	83.82	**C** = B / A
Full Load Steady State Emission Rate (lb/hr) =	14.70	**D** (Case #36, full load on gas with duct firing at 59°F)
Net Increase in Emissions Due To Shutdown/Startup (lb/hr) =	69.12	**E** = C - D (avg over the shutdown/downtime/startup cycle)

If "E" is less than or equal to zero then there is no net increase in emissions over steady state from shutdown and startup operation.
If "E" is greater than zero, then there is a net increase in emissions over steady state from shutdown and startup operation.
If there is a net increase in emissions, then the impact on potential annual emissions from shutdown and startup must be quantifed.

Calculation of Impact on Potential Annual Emissions Due to a Net Increase in Emissions From Shutdown and Startup Operation

Net Increase in Emissions Due To Shutdown/Startup (lb/event) =	470.04	**F** = E x A
Number of Shutdown and Startup Cycles Per Year =	208	**G**
Net Increase in Annual Emissions (tpy) =	48.88	**H** = F x G / 2000

The net increase in emissions resulting from shutdown and startup operation is added to the steady state potential annual emissions to determine the total potential to emit from the CTG.

NTE Connecticut, LLC - Killingly Energy Center
Emissions From Ancillary Equipment

Pollutant	Auxiliary Boiler 84.0 MMBtu/hr		Natural Gas Heater 12.0 MMBtu/hr		Emergency Generator kW 1,380 (mechanical)		Fire Pump kW 227.5 (mechanical)	
NO_x	7	ppmvd @ 3% O_2	10	ppmvd @ 3% O_2	6.40	g/kW-hr	4.0	g/kW-hr
	0.0085	lb/MMBtu	0.012	lb/MMBtu	1.55	lb/MMBtu	1.00	lb/MMBtu
	0.71	lb/hr	0.146	lb/hr	19.46	lb/hr	2.01	lb/hr
	1.64	TPY	0.29	TPY	2.92	TPY	0.30	TPY
CO	50	ppmvd @ 3% O_2	50	ppmvd @ 3% O_2	3.5	g/kW-hr	3.5	g/kW-hr
	0.037	lb/MMBtu	0.037	lb/MMBtu	0.85	lb/MMBtu	0.87	lb/MMBtu
	3.11	lb/hr	0.444	lb/hr	10.64	lb/hr	1.76	lb/hr
	7.14	TPY	0.89	TPY	1.60	TPY	0.263	TPY
VOC	9.6	ppmvd @ 3% O_2	8	ppmvd @ 3% O_2	0.32	g/kW-hr	0.20	g/kW-hr
	0.0041	lb/MMBtu	0.0034	lb/MMBtu	0.078	lb/MMBtu	0.050	lb/MMBtu
	0.34	lb/hr	0.04	lb/hr	0.97	lb/hr	0.100	lb/hr
	0.78	TPY	0.08	TPY	0.15	TPY	0.015	TPY
$PM_{10}/PM_{2.5}$	N/A	ppmvd @ 3% O_2	N/A	ppmvd @ 3% O_2	0.20	g/kW-hr	0.20	g/kW-hr
	0.005	lb/MMBtu	0.005	lb/MMBtu	0.048	lb/MMBtu	0.050	lb/MMBtu
	0.42	lb/hr	0.06	lb/hr	0.61	lb/hr	0.10	lb/hr
	0.97	TPY	0.12	TPY	0.091	TPY	0.015	TPY
SO_2	0.0015	lb/MMBtu	0.0015	lb/MMBtu	0.0015	lb/MMBtu	0.0015	lb/MMBtu
	0.13	lb/hr	0.0180	lb/hr	0.02	lb/hr	0.0030	lb/hr
	0.29	TPY	0.04	TPY	0.003	TPY	0.0005	TPY
H_2SO_4	0.00011	lb/MMBtu	0.00011	lb/MMBtu	0.00011	lb/MMBtu	0.00011	lb/MMBtu
	0.010	lb/hr	0.00138	lb/hr	0.0014	lb/hr	0.00023	lb/hr
	0.02	TPY	0.00	TPY	0.0002	TPY	0.00003	TPY
Pb	4.9E-07	lb/MMBtu	4.9E-07	lb/MMBtu	1.1E-06	lb/MMBtu	1.1E-06	lb/MMBtu
	4.1E-05	lb/hr	5.9E-06	lb/hr	1.3E-05	lb/hr	2.1E-06	lb/hr
	9.5E-05	TPY	0.00	TPY	2.0E-06	TPY	3.2E-07	TPY
CO_2	116.9	lb/MMBtu	116.9	lb/MMBtu	163.1	lb/MMBtu	163.1	lb/MMBtu
	9,820	lb/hr	1,403	lb/hr	2,046	lb/hr	329	lb/hr
	22,587	TPY	2,806	TPY	307	TPY	49	TPY
CH_4	0.0022	lb/MMBtu	0.0022	lb/MMBtu	0.0066	lb/MMBtu	0.0066	lb/MMBtu
	0.1852	lb/hr	0.0265	lb/hr	0.083	lb/hr	0.013	lb/hr
	0.43	TPY	0.05	TPY	0.0124	TPY	0.0020	TPY
N_2O	0.00022	lb/MMBtu	0.0	lb/MMBtu	0.0013	lb/MMBtu	0.0013	lb/MMBtu
	0.0185	lb/hr	0.0026	lb/hr	1.7E-02	lb/hr	0.0027	lb/hr
	0.043	TPY	0.005	TPY	2.5E-03	TPY	4.0E-04	TPY
CO_2e	9,831	lb/hr	1,404	lb/hr	2,053	lb/hr	330	lb/hr
	22,610	TPY	2,809	TPY	308	TPY	49	TPY

NOTES:

Natural Gas SO2 emissions based upon a sulfur content of 0.5 gr/100 dscf

ULSD SO_2 emissions based upon a sulfur content of 15 ppmw

Aux Boiler and Gas Heater criteria pollutant emission factors from BACT analysis

Emergency Generator criteria pollutant emission factors based on Tier 2 emission standards in 40 CFR 89.

Fire Pump criteria pollutant emission factors based on post -2009 emission standards in 40 CFR 60 Subpart IIII.

H_2SO_4 emissions assume a 5% conversion of SO2 --> SO3 (on a molar basis)

Fuel specific CO_2, CH_4 and N_2O emission factors from 40 CFR 98, Subpart C

Pb emission factor for ULSD from "Survey of Ultra-Trace Metals in Gas Turbine Fuels"

Potential HAP Emissions (tpy)

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs & Duct Burners	Auxiliary Boiler	Nat. Gas Heater	Em. Generator	Fire Pump	
Organic Compounds						
Acetaldehyde	5.03E-01			4.74E-05	2.32E-04	5.03E-01
Acrolein	8.05E-02			1.48E-05	2.80E-05	8.05E-02
Benzene	1.46E-01	4.06E-04	5.04E-05	1.46E-03	2.82E-04	1.48E-01
1,3-Butadiene	4.96E-03				1.18E-05	4.97E-03
Dichlorobenzene	4.70E-03	2.32E-04	2.88E-05			4.96E-03
Ethylbenzene	4.02E-01					4.02E-01
Formaldehyde	3.05E+00	1.43E-02	1.78E-03	1.48E-04	3.57E-04	3.06E+00
Hexane	7.06E+00	3.48E-01	4.32E-02			7.45E+00
Propylene oxide	3.65E-01			7.24E-03	1.08E-03	3.73E-01
Toluene	1.65E+00	6.38E-04	7.92E-05	5.29E-04	1.24E-04	1.65E+00
Xylene	8.05E-01			3.63E-04	3.66E-04	8.06E-01
PAHs						
Acenaphthene	7.06E-06	3.48E-07	4.32E-08	8.81E-06	4.29E-07	1.67E-05
Acenaphthylene	7.06E-06	4.64E-07	5.76E-08	1.74E-05	1.53E-05	4.02E-05
Anthracene	9.41E-06	3.48E-07	4.32E-08	2.31E-06	5.65E-07	1.27E-05
Benzo(a)anthracene	7.06E-06	3.48E-07	4.32E-08	1.17E-06	5.08E-07	9.13E-06
Benzo(a)pyrene	4.70E-06	2.32E-07	2.88E-08	4.84E-07	5.68E-08	5.51E-06
Benzo(b)fluoranthene	7.06E-06	3.48E-07	4.32E-08	4.10E-07	3.00E-08	7.89E-06
Benzo(g,h,i)perylene	4.70E-06	2.32E-07	2.88E-08	1.05E-06	1.48E-07	6.16E-06
Benzo(k)fluoranthene	7.06E-06	3.48E-07	4.32E-08	2.09E-06	4.68E-08	9.58E-06
Chrysene	7.06E-06	3.48E-07	4.32E-08	2.88E-06	1.07E-07	1.04E-05
Dibenz(a,h)anthracene	4.70E-06	2.32E-07	2.88E-08	6.51E-07	1.76E-07	5.79E-06
7,12-Dimethylbenz(a) an	6.27E-05	3.09E-06	3.84E-07			6.62E-05
Fluoranthene	1.18E-05	5.60E-07	6.96E-08	7.58E-06	2.30E-06	2.23E-05
Fluorene	1.10E-05	5.22E-07	6.48E-08	2.41E-05	8.82E-06	4.45E-05
Indeno(1,2,3-cd)pyrene	7.06E-06	3.48E-07	4.32E-08	7.79E-07	1.13E-07	8.34E-06
3-Methylchloranthrene	7.06E-06	3.48E-07	4.32E-08			7.45E-06
2-Methylnaphthalene	9.41E-05	4.64E-06	5.76E-07			9.93E-05
Naphthalene	1.72E-02	1.20E-04	1.49E-05	2.45E-04	2.56E-05	1.76E-02
Phenanthrene	6.66E-05	3.28E-06	4.08E-07		8.89E-06	7.92E-05
Pyrene	1.96E-05	9.47E-07	1.18E-07	6.98E-06	1.44E-06	2.91E-05
TOTAL PAH	2.79E-02	1.31E-04	1.63E-05	3.99E-04	5.08E-05	2.85E-02
Metals						
Arsenic	7.84E-04	3.86E-05	4.80E-06	8.69E-08	1.40E-08	8.28E-04
Beryllium	4.33E-05	2.32E-06	2.88E-07			4.59E-05
Cadmium	4.31E-03	2.13E-04	2.64E-05	9.65E-09	1.55E-09	4.55E-03
Chromium	5.04E-03	2.70E-04	3.36E-05	2.33E-05	3.75E-06	5.37E-03
Chromium VI	9.07E-04	4.83E-05	6.00E-06	4.21E-06	6.77E-07	9.67E-04
Cobalt	3.21E-04	1.58E-05	1.97E-06			3.39E-04

Potential HAP Emissions (tpy)

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs & Duct Burners	Auxiliary Boiler	Nat. Gas Heater	Em. Generator	Fire Pump	
Lead	1.77E-03	9.47E-05	1.18E-05	1.45E-06	2.32E-07	1.88E-03
Manganese	1.62E-03	7.15E-05	8.88E-06	5.31E-07	8.52E-08	1.70E-03
Mercury	9.80E-04	4.83E-05	6.00E-06	1.94E-08	3.11E-09	1.03E-03
Nickel	7.56E-03	4.06E-04	5.04E-05	2.78E-06	4.47E-07	8.02E-03
Selenium	9.54E-05	4.64E-06	5.76E-07	4.82E-07	7.74E-08	1.01E-04
Max. Single HAP						**7.45**
Total All HAPs	**1.41E+01**	**3.65E-01**	**4.53E-02**	**1.06E-02**	**2.60E-03**	**14.55**

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Potential HAP Emissions

HAP	CTG and Duct Burner HAP Emissions						
	CTG (gas)		CTG (ULSD)		Duct Burners		Potential To Emit
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	tpy
Organic Compounds							
Acetaldehyde	4.00E-05	1.15E-01					5.03E-01
Acrolein	6.40E-06	1.84E-02					8.05E-02
Benzene	1.20E-05	3.45E-02	5.50E-05	1.56E-01	2.10E-06	1.88E-03	1.46E-01
1,3-Butadiene	4.30E-07	1.23E-03	1.60E-05	4.52E-02			4.96E-03
Dichlorobenzene					1.20E-06	1.07E-03	4.70E-03
Ethylbenzene	3.20E-05	9.19E-02					4.02E-01
Formaldehyde	2.19E-04	6.28E-01	2.31E-04	6.53E-01	7.50E-05	6.71E-02	3.05E+00
Hexane					1.80E-03	1.61E+00	7.06E+00
Propylene oxide	2.90E-05	8.33E-02					3.65E-01
Toluene	1.30E-04	3.73E-01			3.40E-06	3.04E-03	1.65E+00
Xylene	6.40E-05	1.84E-01					8.05E-01
PAHs							
Acenaphthene					1.80E-09	1.61E-06	7.06E-06
Acenaphthylene					1.80E-09	1.61E-06	7.06E-06
Anthracene					2.40E-09	2.15E-06	9.41E-06
Benzo(a)anthracene					1.80E-09	1.61E-06	7.06E-06
Benzo(a)pyrene					1.20E-09	1.07E-06	4.70E-06
Benzo(b)fluoranthene					1.80E-09	1.61E-06	7.06E-06
Benzo(g,h,i)perylene					1.20E-09	1.07E-06	4.70E-06
Benzo(k)fluoranthene					1.80E-09	1.61E-06	7.06E-06
Chrysene					1.80E-09	1.61E-06	7.06E-06
Dibenz(a,h)anthracene					1.20E-09	1.07E-06	4.70E-06
7,12-Dimethylbenz(a) anthracene					1.60E-08	1.43E-05	6.27E-05
Fluoranthene					3.00E-09	2.69E-06	1.18E-05
Fluorene					2.80E-09	2.51E-06	1.10E-05
Indeno(1,2,3-cd)pyrene					1.80E-09	1.61E-06	7.06E-06
3-Methylchloranthrene					1.80E-09	1.61E-06	7.06E-06
2-Methylnaphthalene					2.40E-08	2.15E-05	9.41E-05
Naphthalene	1.30E-06	3.73E-03	3.50E-05	9.90E-02	6.10E-07	5.46E-04	1.72E-02
Phenanthrene					1.70E-08	1.52E-05	6.66E-05
Pyrene					5.00E-09	4.48E-06	1.96E-05
TOTAL PAH	2.20E-06	6.32E-03	4.00E-05	1.13E-01	6.98E-07	6.25E-04	2.79E-02
Metals							
Arsenic			4.60E-08	1.30E-04	2.00E-07	1.79E-04	0.0007841
Beryllium			3.10E-07	8.77E-04	1.20E-08	1.07E-05	4.329E-05
Cadmium			5.11E-09	1.44E-05	1.10E-06	9.85E-04	0.0043123
Chromium			1.24E-05	3.50E-02	1.40E-06	1.25E-03	0.0050412
Chromium VI			2.23E-06	6.30E-03	2.52E-07	2.26E-04	0.0009074
Cobalt					8.20E-08	7.34E-05	0.0003215

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Potential HAP Emissions

HAP	CTG and Duct Burner HAP Emissions						
	CTG (gas)		CTG (ULSD)		Duct Burners		Potential To Emit
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	tpy
Lead			1.05E-06	2.97E-03	4.90E-07	4.39E-04	0.0017681
Manganese			1.80E-07	5.10E-04	3.70E-07	3.31E-04	0.0016157
Mercury			1.02E-08	2.89E-05	2.50E-07	2.24E-04	0.0009801
Nickel			1.48E-06	4.17E-03	2.10E-06	1.88E-03	0.0075576
Selenium			2.55E-07	7.22E-04	2.40E-08	2.15E-05	9.535E-05
Max. Single HAP							
Total All HAPs	**5.36E-04**		**3.95E-04**		**1.89E-03**		**1.41E+01**

Notes:

1. Blank entry indicates no emission factor reported in the reference cited.
2. Organic HAP emission factors for CTGs are from Tables 3.1-3 and 3.1.4 of AP-42 except gas-firing for formaldehyde which is based on the NESHAP Subpart YYYY MACT floor limit of 91 ppb at 15% O2.
3. Emission factors for the HRSG and auxiliary boiler are from AP-42 Tables 1.4-3 and 1.4-4.
4. Emission factors for organics from the emergency diesel generator are from AP-42 Tables 3.4-3 and 3.4-4, for the fire pump from AP-42 Table 3.3-2.
5. Metal emission factors for ULSD firing are based on the paper “Survey of Ultra-Trace Metals in Gas Turbine Fuels”, 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detected in any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit was used.
6. Hexavalent chrome is based on 18% of the total chrome emissions per EPA 453/R-98-004a.
7. No reduction by oxidation catalysts presumed for organic HAPs.
8. lb/hr values are at 59°F and do not represent maximum values at higher firing rates at colder temperatures.

NTE Connecticut, LLC - Killingly Energy Center
Ancillary Source Potential HAP Emissions (lb/hr)

HAP	Auxiliary Boiler		Natural Gas Heater		Em. Generator		Fire Pump	
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr
Organic Compounds								
Acetaldehyde					2.52E-05	3.16E-04	7.67E-04	1.55E-03
Acrolein					7.88E-06	9.88E-05	9.25E-05	1.86E-04
Benzene	2.10E-06	1.76E-04	2.10E-06	2.52E-05	7.76E-04	9.73E-03	9.33E-04	1.88E-03
1,3-Butadiene							3.91E-05	7.88E-05
Dichlorobenzene	1.20E-06	1.01E-04	1.20E-06	1.44E-05				
Ethylbenzene								
Formaldehyde	7.40E-05	6.22E-03	7.40E-05	8.88E-04	7.89E-05	9.90E-04	1.18E-03	2.38E-03
Hexane	1.80E-03	1.51E-01	1.80E-03	2.16E-02				
Propylene oxide					3.85E-03	4.83E-02	3.56E-03	7.17E-03
Toluene	3.30E-06	2.77E-04	3.30E-06	3.96E-05	2.81E-04	3.52E-03	4.09E-04	8.24E-04
Xylene					1.93E-04	2.42E-03	2.85E-04	2.44E-03
PAHs								
Acenaphthene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	4.68E-06	5.87E-05	1.42E-06	2.86E-06
Acenaphthylene	2.40E-09	2.02E-07	2.40E-09	2.88E-08	9.23E-06	1.16E-04	5.06E-05	1.02E-04
Anthracene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	1.23E-06	1.54E-05	1.87E-06	3.77E-06
Benzo(a)anthracene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	6.22E-07	7.80E-06	1.68E-06	3.38E-06
Benzo(a)pyrene	1.20E-09	1.01E-07	1.20E-09	1.44E-08	2.57E-07	3.22E-06	1.88E-07	3.79E-07
Benzo(b)fluoranthene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	2.18E-07	2.73E-06	9.91E-08	2.00E-07
Benzo(g,h,i)perylene	1.20E-09	1.01E-07	1.20E-09	1.44E-08	5.56E-07	6.97E-06	4.89E-07	9.85E-07
Benzo(k)fluoranthene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	1.11E-06	1.39E-05	1.55E-07	3.12E-07
Chrysene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	1.53E-06	1.92E-05	3.53E-07	7.11E-07
Dibenz(a,h)anthracene	1.20E-09	1.01E-07	1.20E-09	1.44E-08	3.46E-07	4.34E-06	5.83E-07	1.17E-06
7,12-Dimethylbenz(a) anthracene	1.60E-08	1.34E-06	1.60E-08	1.92E-07				
Fluoranthene	2.90E-09	2.44E-07	2.90E-09	3.48E-08	4.03E-06	5.06E-05	7.61E-06	1.53E-05
Fluorene	2.70E-09	2.27E-07	2.70E-09	3.24E-08	1.28E-05	1.61E-04	2.92E-05	5.88E-05
Indeno(1,2,3-cd)pyrene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	4.14E-07	5.19E-06	3.75E-07	7.56E-07
3-Methylchloranthrene	1.80E-09	1.51E-07	1.80E-09	2.16E-08				
2-Methylnaphthalene	2.40E-08	2.02E-06	2.40E-08	2.88E-07				
Naphthalene	6.20E-07	5.21E-05	6.20E-07	7.44E-06	1.30E-04	1.63E-03	8.48E-05	1.71E-04
Phenanthrene	1.70E-08	1.43E-06	1.70E-08	2.04E-07			2.94E-05	5.92E-05
Pyrene	4.90E-09	4.12E-07	4.90E-09	5.88E-08	3.71E-06	4.65E-05	4.78E-06	9.63E-06
TOTAL PAH	6.80E-07	5.71E-05	6.80E-07	8.16E-06	2.12E-04	2.66E-03	1.68E-04	3.38E-04
Metals								
Arsenic	2.00E-07	1.68E-05	2.00E-07	2.40E-06	4.62E-08	5.80E-07	4.62E-08	9.31E-08
Beryllium	1.20E-08	1.01E-06	1.20E-08	1.44E-07				
Cadmium	1.10E-06	9.24E-05	1.10E-06	1.32E-05	5.13E-09	6.44E-08	5.13E-09	1.03E-08
Chromium	1.40E-06	1.18E-04	1.40E-06	1.68E-05	1.24E-05	1.56E-04	1.24E-05	2.50E-05
Chromium VI	2.50E-07	2.10E-05	2.50E-07	3.00E-06	2.24E-06	2.81E-05	2.24E-06	4.51E-06
Cobalt	8.20E-08	6.89E-06	8.20E-08	9.84E-07				
Lead	4.90E-07	4.12E-05	4.90E-07	5.88E-06	7.69E-07	9.65E-06	7.69E-07	1.55E-06
Manganese	3.70E-07	3.11E-05	3.70E-07	4.44E-06	2.82E-07	3.54E-06	2.82E-07	5.68E-07
Mercury	2.50E-07	2.10E-05	2.50E-07	3.00E-06	1.03E-08	1.29E-07	1.03E-08	2.08E-08
Nickel	2.10E-06	1.76E-04	2.10E-06	2.52E-05	1.48E-06	1.86E-05	1.48E-06	2.98E-06
Selenium	2.40E-08	2.02E-06	2.40E-08	2.88E-07	2.56E-07	3.21E-06	2.56E-07	5.16E-07
Max. Single HAP								
Total All HAPs	**1.89E-03**	**1.59E-01**	**1.89E-03**	**2.27E-02**	**5.61E-03**	**7.04E-02**	**7.66E-03**	**1.73E-02**

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Maximum Potential MASC Toxic Emissions

HAP	CTG and Duct Burner MASC Toxic Emissions						
	CTG (gas)		Duct Burners		CTG + Duct Burners	CTG (ULSD)	
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/hr	lb/MMBtu	lb/hr
Organic Compounds							
Acetaldehyde	4.00E-05	1.19E-01			1.19E-01		
Acrolein	6.40E-06	1.90E-02			1.90E-02		
Benzene	1.20E-05	3.57E-02	2.10E-06	1.93E-03	3.76E-02	5.50E-05	1.55E-01
Dichlorobenzene			1.20E-06	1.10E-03	1.10E-03		
Ethylbenzene	3.20E-05	9.52E-02			9.52E-02		
Formaldehyde	2.19E-04	6.51E-01	7.50E-05	6.90E-02	7.20E-01	2.31E-04	6.53E-01
Hexane			1.80E-03	1.66E+00	1.66E+00		
Toluene	1.30E-04	3.87E-01	3.40E-06	3.13E-03	3.90E-01		
Xylene	6.40E-05	1.90E-01			1.90E-01		
PAHs							
Naphthalene	1.30E-07	3.87E-04	6.10E-08	5.61E-05	4.43E-04	3.50E-06	9.89E-03
TOTAL PAH	2.20E-07	6.54E-04	6.98E-08	6.42E-05	7.19E-04	4.00E-06	1.13E-02
Metals							
Arsenic			2.00E-07	1.84E-04	1.84E-04	4.60E-08	1.30E-04
Cadmium			1.10E-06	1.01E-03	1.01E-03	5.11E-09	1.44E-05
Chromium			1.40E-06	1.29E-03	1.29E-03	1.24E-05	3.50E-02
Cobalt			8.20E-08	7.54E-05	7.54E-05		
Lead			4.90E-07	4.51E-04	4.51E-04	1.05E-06	2.97E-03
Manganese			3.70E-07	3.40E-04	3.40E-04	1.80E-07	5.10E-04
Mercury			2.50E-07	2.30E-04	2.30E-04	1.02E-08	2.89E-05
Nickel			2.10E-06	1.93E-03	1.93E-03	1.48E-06	4.17E-03
Selenium						2.55E-07	7.22E-04

Notes:
1. Only emission factors reported above their detection limited in AP-42 used in the analysis.
2. Organic HAP emission factors for CTGs are from Tables 3.1-3 and 3.1.4 of AP-42 except gas-firing for formaldehyde which is based on the NESHAP Subpart YYYY MACT floor limit of 91 ppb at 15% O2.
3. Emission factors for the HRSG and auxiliary boiler are from AP-42 Tables 1.4-3 and 1.4-4.
4. Emission factors for organics from the emergency diesel generator are from AP-42 Tables 3.4-3 and 3.4-4, for the fire pump from AP-42 Table 3.3-2.
5. Metal emission factors for ULSD firing are based on the paper “Survey of Ultra-Trace Metals in Gas Turbine Fuels”, 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detected in any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit was used.
6. Hexavalent chrome is based on 18% of the total chrome emissions per EPA 453/R-98-004a.
7. No reduction by oxidation catalysts presumed for organic HAPs except for PAHs where a 90% efficiency is taken into account for polycyclic compounds.
8. lb/hr values are at 59°F and do not represent maximum values at higher firing rates at colder temperatures.

NTE Connecticut, LLC - Killingly Energy Center
Summary of Estimated Fugitive GHG Emissions

Circuit Breaker SF6 Emissions

SF6 Storage Capacity	111	lbs
SF6 Leak Rate	0.5%	per year
SF6 emissions	0.555	lbs/year
GHG emissions (CO2e)	**6.3**	**tons per year**

Natural Gas Handling Fugitive Emissions

Component Type	Component Count	Emission factor (scfh/component)[1]	CH4 Emissions (tpy)[2]	GHG Emissions (tpy)
Connector	10	1.69	3.08	77.04
Flanges, Regulator, Other	10	0.772	1.41	35.19
Control Valves	10	9.34	17.03	425.76
Orifice Meter	3	0.212	0.12	2.90
TOTALS			**21.64**	**540.9**

[1] Emission factors are from 40 CFR 98, Subpart W, Table W-7

[2] Conservatively assumes 100% CH4

NTE Connecticut, LLC - Killingly Energy Center
Summary of Baseline Emissions

SUMMARY OF BASELINE EMISSION RATES AND REDUCTIONS

Pollutant	Combustion Turbine				Auxiliary Boiler			
	Baseline Emission Rate (lb/MMBtu)[2]	Baseline (tpy)[3]	BACT (tpy)[4]	Reduction (tpy)	Baseline Emission Rate (lb/MMBtu)[5]	Baseline (tpy)[6]	BACT (tpy)[7]	Reduction (tpy)
NO_x	0.32	5278	133.9	5144	0.10	16.8	1.6	15.2
CO	0.082	1352.6	64.4	1288.2	0.084	14.1	7.1	7.0
VOC	0.0021	34.6	4.9	29.7	0.0055	0.92	0.78	0.1
GHGs[8]	119	2,866,710	1,966,937	899,773	N/A	N/A	N/A	N/A

[1] Emissions presented are on a per turbine basis

[2] From AP-42 Section 3.1 for uncontrolled natural gas fired combustion turbines except for GHGs

[3] Baseline calculated from gas firing at 59F of 2,827 MMBtu/hr (CT) and 895 MMBtu/hr (DB) for 8,760 hr/yr

[4] Proposed ton per year emissions excluding contribution from startup and shutdown emissions.

[5] From AP-42 Section 1.4 for uncontrolled natural gas fired boilers <100 MMBtu/hr.

[6] Based upon the rated heat input of the auxiliary boiler of 84 MMBtu/hr for 4,000 hr/yr

[7] Proposed ton per year emissions.

[8] Baseline based upon conventional steam generation with a heat rate of 10,000 Btu/kWh for 550MW firing gas

APPENDIX B: REVISED AMBIENT AIR QUALITY ANALYSIS REPORT PAGES

Table L-2 PSD Regulatory Threshold Evaluation

Table L-5. Load Scenarios and Emission Rates - Combined Cycle Combustion Turbine Firing Natural Gas

Table L-7. Startup Condition Stack Parameters for Each Fuel

Table L-8. Stack Parameters for Ancillary Equipment

Table L-10. Maximum Predicted Impact Concentrations

Table L-15. Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds

Appendix L-A: DETAILED SOURCE PARAMETER DATA,

- **Combined Cycle Combustion Turbine and Ancillary Equipment Emissions Estimates**

Appendix L-C: DETAILED AERMOD RESULTS SUMMARY,

- **Combined Cycle Combustion Turbine Emissions Estimates,**
- **AERMOD Scaled Impacts – turbine only (ug/m3) – 150 ft. turbine stack,**
- **Combined Cycle Combustion Turbine – Start-up/Shutdown (SU/SD) Emissions Estimates**
- **AERMOD SU/SD Scaled Impacts – turbine only (ug/m3) – 150 ft. turbine stack**
- **Killingly Energy Center – Detailed Results Table**

Table L-2. PSD Regulatory Threshold Evaluation

Pollutant	Project Annual **Potential** Emissions (tpy)	PSD Major Source Threshold (tpy)	PSD Significant Emission Rate (tpy)	PSD Review Applies
CO[a]	143.6	100	100	Yes
NO_x[a]	139.1	100	40	Yes
SO_2	25.1	100	40	No
PM	102.0	100	25	Yes
PM_{10}	102.0	100	15	Yes
$PM_{2.5}$	102.0	100	10	Yes
VOC[a]	49.3	100	40	Yes
Pb	0.002	100	0.6	No
H_2SO_4	8.8	100	7	Yes
GHGs (as CO_2e)	1,992,260[b]	N/A	75,000	Yes

[a] Includes incremental emissions due to startup and shutdown.
[b] Incudes 547 tpy of fugitive GHG emissions from circuit breakers and natural gas handling.
CO_2e = carbon dioxide equivalents

Table L-5. Load Scenarios and Emission Rates - Combined Cycle Combustion Turbine Firing Natural Gas

Parameter	Units	Natural Gas													
		100 °F					59°F					-10°F			
		1	2	3	4	5	36	37	38	39	40	32	33	34	35
GT Operating Load		100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%
Fuel Higher Heating Value (HHV)	Btu/lb	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150
Evaporative Cooler Status	On or Off	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	On or Off	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
Exhaust velocity	m/s	17.39	17.27	16.25	13.76	10.87	18.44	18.08	17.87	14.66	10.86	18.72	18.26	14.67	10.96
Exhaust temperature	K	358.7	361.5	359.8	360.9	359.8	358.2	355.4	355.4	354.3	354.3	359.8	355.4	354.3	354.3
NO_X	g/s	3.326	2.533	2.369	1.865	1.348	3.578	2.722	2.684	2.129	1.411	3.692	2.822	2.243	1.487
CO	g/s	1.726	0.706	0.655	0.517	0.378	1.852	0.756	0.743	0.592	0.391	1.915	0.781	0.617	0.416
PM	g/s	2.608	1.449	1.373	1.159	1.008	2.822	1.575	1.562	1.285	1.008	2.885	1.613	1.298	1.008
SO_2	g/s	0.630	0.479	0.454	0.365	0.265	0.680	0.517	0.517	0.416	0.277	0.706	0.542	0.428	0.290

Btu/lb = British thermal units per pound; g/s = grams per second; K = degrees Kelvin

Table L-7. Startup Condition Stack Parameters for Each Fuel

Parameter	Units	Startup / Shutdown							
		Natural Gas				ULSD			
		Hot Start	Warm Start	Cold Start	Shutdown	Hot Start	Warm Start	Cold Start	Shutdown
Exhaust velocity	m/s	14.13	14.84	12.17	10.32	10.15	11.01	9.99	9.95
Exhaust temperature	K	352.4	353.6	351.9	353.0	403.6	404.1	403.6	401.3
NO_X	g/s	15.649	17.871	14.091	10.065	22.130	24.304	21.784	21.226
CO	g/s	47.546	54.952	59.992	26.497	249.007	290.502	277.902	54.100
PM	g/s	2.277	2.200	2.027	2.385	4.095	4.142	4.127	4.064
SO_2	g/s	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788
m/s = meters per second									

Table L-8. Stack Parameters for Ancillary Equipment

Parameter	Time	Auxiliary Boiler	Emergency Generator	Fire Pump	Natural Gas Heater
Exhaust velocity (m/s)		8.29	31.19	7.12	17.46
Exhaust temperature (K)		422.0	722.0	789.3	394.3
NO_X (g/s)	1-hour	0.089	2.223	0.253	0.017
	Annual	0.0467	0.076	0.0087	0.0075
CO (g/s)	1-hour	0.392	1.216	0.222	0.056
	8-hour	0392	0.152	0.028	0.056
PM (g/s)	1-hour	0.053	0.069	0.013	0.008
	24-hour	0.053	0.0029	0.0005	0.008
	Annual	0.0278	0.0024	0.00048	0.0035
SO_2 (g/s)	1-hour	0.016	0.0025	0.00038	0.0023
	3-hour	0.016	0.00084	0.00013	0.0023
	24-hour	0.016	0.00011	0.00002	0.0023
	Annual	.0084	0.00009	0.00001	0.0011

Table L-10. Maximum Predicted Impact Concentrations

Pollutant	Averaging Period	Rank Basis for SIL Assessment	Impact Concentration ($\mu g/m^3$)	SIL ($\mu g/m^3$)	Extent of SIA (km)	NAAQS ($\mu g/m^3$)	PSD Class II Increment ($\mu g/m^3$)
NO_2 (Normal Load)	1-hour	H1H (5-year Average)	21.07	7.5	20.2	188	NA
	Annual	H1H	0.93	1	NA	100	25
NO_2 (SUSD)	1-hour	H1H (5-year Average)	84.31	NA	NA	188	NA
	Annual	H1H	0.93	NA	NA	100	25
CO	1-hour	H1H	1,427	2,000	NA	40,000	NA
	8-hour	H1H	131	500	NA	10,000	NA
PM_{10}	24-hour	H1H	3.96	5	NA	150	30
	Annual	H1H	0.35	1	NA	NA	17
$PM_{2.5}$	24-hour	H1H (5-year Average)	3.15	1.2	8.05	35	9
	Annual	H1H (5-year Average)	0.29	0.3	NA	12	4
SO_2	1-hour	H1H (5-year Average)	2.92	7.8	NA	196	NA
	3-hour	H1H	1.51	25	NA	1300	512
	24-hour	H1H	0.99	5	NA	365	91
	Annual	H1H	0.09	1	NA	80	20

Notes:
Maximum highest first highest (H1H) concentrations are used for comparison with the SILs. Impact concentrations are based on maximum predicted across the range of 5 years modeled for all pollutants except $PM_{2.5}$ (both annual and 24-hour), NO_2 (1-hour only), and SO_2 (1-hour only), which are based on the maximum
5-year average H1H values. NO_2 concentrations assume NO_x to NO_2 conversion at 80% (short term) and 75% (annual). $PM_{2.5}$ SIL assessment relative to PSD increment compliance is based on H1H concentrations prediction over the range of 5 years modeled, rather than the 5-year average concentrations that are used for the NAAQS assessment.

SIA = Significant Impact Area, defined as a circle with a radius equal to the distance to the furthest receptor for which the maximum predicted impact exceeds the SIL.

Table L-15. Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts ($\mu g/m^3$)	Threshold for Impact to Vegetation ($\mu g/m^3$)	Applicability
SO_2			
1-hour SO_2	2.9	131[a]	Suggested worst-case limit
3-hour SO_2	1.5	390[b]	Protects SO_2 sensitive species
3-hour SO_2		1,300[c]	Protects all vegetation
24-hour SO_2	1.0	63[d]	Insignificant effect to wheat and barley
Annual SO_2	0.1	130[b]	Protects SO_2 sensitive species
PM_{10}			
24-hour PM_{10}	4.0	150[c]	Protects all vegetation
Annual PM_{10}	0.35	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 $\mu g/m^3$.

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 $\mu g/m^3$. Similarly, a threshold of 130 $\mu g/m^3$ is suggested for chronic exposure.

c. Secondary National Ambient Air Quality Standard ($\mu g/m^3$) 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. "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 $\mu g/m^3$ 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 $\mu g/m^3$, using a worst-case deposition velocity of 2 centimeters per second.

NTE Killingly Energy Center

Siemens Model SGT6-8000H (or equivalent) Combined Cycle Combustion Turbine and Ancillary Equipment Emissions Estimates

	Combustion Turbines													
Case #:	1	2	3	4	5	36	37	38	39	40	32	33	34	35
Fuel	Natural Gas													
Ambient Temperature (°F):	100	100	100	100	100	59	59	59	59	59	-10	-10	-10	-10
GT Operating Load	100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%
Fuel Heating Value, Btu/lb (HHV)	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150
Evaporative Cooler Status (On or	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
Ambient Relative Humidity, %	45	45	45	45	45	60	60	60	60	60	100	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HH	2,672	2,672	2,490	1,983	1,444	2,871	2,869	2,827	2,269	1,515	2,974	2,971	2,380	1,598
DB Heat Input (MMBtu/hr/unit, HH	834	0	0	0	0	895	0	0	0	0	920	0	0	0
Exhaust velocity (m/s)	17.39	17.27	16.25	13.76	10.87	18.44	18.08	17.87	14.66	10.86	18.72	18.26	14.67	10.96
Exhaust temperature (K)	358.71	361.48	359.82	360.93	359.82	358.15	355.37	355.37	354.26	354.26	359.82	355.37	354.26	354.26
NOx (g/s)	3.326	2.533	2.369	1.865	1.348	3.578	2.722	2.684	2.129	1.411	3.692	2.822	2.243	1.487
CO (g/s)	1.726	0.706	0.655	0.517	0.378	1.852	0.756	0.743	0.592	0.391	1.915	0.781	0.617	0.416
PM (g/s)	2.608	1.449	1.373	1.159	1.008	2.822	1.575	1.562	1.285	1.008	2.885	1.613	1.298	1.008
SO2 (g/s)	0.630	0.479	0.454	0.365	0.265	0.680	0.517	0.517	0.416	0.277	0.706	0.542	0.428	0.290

	Combustion Turbines										
Case #:	41	42	43	44	68	69	70	71	65	66	67
Fuel	ULSD										
Ambient Temperature (°F):	100	100	100	100	59	59	59	59	-10	-10	-10
GT Operating Load	100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444
Evaporative Cooler Status (On or	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	---	---	---	---	---	---	---	---	---	---	---
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HH	2,740	2,567	2,055	1,874	2,828	2,783	2,226	1,941	2,827	2,289	2,029
DB Heat Input (MMBtu/hr/unit, HH	0	0	0	0	0	0	0	0	0	0	0
Exhaust velocity (m/s)	18.01	17.08	14.03	13.03	18.70	18.49	15.17	13.55	20.15	16.31	14.61
Exhaust temperature (K)	372.59	370.37	367.59	366.48	366.48	365.93	363.15	362.59	373.15	368.71	367.59
NOx (g/s)	6.709	6.285	5.032	4.588	6.925	6.814	5.451	4.752	6.922	5.606	4.969
CO (g/s)	1.634	1.530	1.225	1.117	1.686	1.659	1.327	1.157	1.686	1.365	1.210
PM (g/s)	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780
SO2 (g/s)	0.491	0.454	0.365	0.340	0.504	0.491	0.403	0.353	0.504	0.403	0.365

	Start-Up and Shutdown								Ancillary Equipment			
Case #:	Hot Start	Warm Start	Cold Start	Shutdown	Hot Start	Warm Start	Cold Start	Shutdown	Auxiliary Boiler	Emergency Generator	Fire Pump	Gas Heater
Fuel	Natural Gas				ULSD							
xhaust velocity (m/s)	14.128	14.840	12.174	10.315	10.150	11.014	9.989	9.946	8.287	31.185	7.115	17.464
aust temperature (K)	352.444	353.556	351.889	353.000	403.556	404.111	403.556	401.333	422.039	722.039	789.261	394.261
NOx (g/s)	15.649	17.871	14.091	10.065	22.130	24.304	21.784	21.226	0.089	2.223	0.253	0.017
CO (g/s)	47.546	54.952	59.992	26.497	249.007	290.502	277.902	54.100	0.392	1.216	0.222	0.056
PM (g/s)	2.277	2.200	2.027	2.385	4.095	4.142	4.127	4.064	0.053	0.069	0.013	0.008
SO2 (g/s)	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.016	0.003	0.000	0.002

NTE Killingly Energy Center

Siemens Model SGT6-8000H (or equivalent) Combined Cycle Combustion Turbine Emissions Estimates

Ambient Temperature (°F):	100					59					-10				100				59				-10		
Case #:	**1**	**2**	**3**	**4**	**5**	**36**	**37**	**38**	**39**	**40**	**32**	**33**	**34**	**35**	**41**	**42**	**43**	**44**	**68**	**69**	**70**	**71**	**65**	**66**	**67**
Fuel	**Natural Gas**														**ULSD**										
Number of GTs Operating																									
GT Operating Load	100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%	100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	---	---	---	---	---	---	---	---	---	---	---
Ambient Relative Humidity, %	45	45	45	45	45	60	60	60	60	60	100	100	100	100	45	45	45	45	60	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,672	2,672	2,490	1,983	1,444	2,871	2,869	2,827	2,269	1,515	2,974	2,971	2,380	1,598	2,740	2,567	2,055	1,874	2,828	2,783	2,226	1,941	2,827	2,289	2,029
DB Heat Input (MMBtu/hr/unit, HHV)	834	0	0	0	0	895	0	0	0	0	920	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exhaust velocity (m/s)	17.39	17.27	16.25	13.76	10.87	18.44	18.08	17.87	14.66	10.86	18.72	18.26	14.67	10.96	18.01	17.08	14.03	13.03	18.70	18.49	15.17	13.55	20.15	16.31	14.61
Exhaust temperature (K)	358.71	361.48	359.82	360.93	359.82	358.15	355.37	355.37	354.26	354.26	359.82	355.37	354.26	354.26	372.59	370.37	367.59	366.48	366.48	365.93	363.15	362.59	373.15	368.71	367.59
NOx (g/s)	3.326	2.533	2.369	1.865	1.348	3.578	2.722	2.684	2.129	1.411	3.692	2.822	2.243	1.487	6.709	6.285	5.032	4.588	6.925	6.814	5.451	4.752	6.922	5.606	4.969
CO (g/s)	1.726	0.706	0.655	0.517	0.378	1.852	0.756	0.743	0.592	0.391	1.915	0.781	0.617	0.416	1.634	1.530	1.225	1.117	1.686	1.659	1.327	1.157	1.686	1.365	1.210
PM (g/s)	2.608	1.449	1.373	1.159	1.008	2.822	1.575	1.562	1.285	1.008	2.885	1.613	1.298	1.008	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780
SO2 (g/s)	0.630	0.479	0.454	0.365	0.265	0.680	0.517	0.517	0.416	0.277	0.706	0.542	0.428	0.290	0.491	0.454	0.365	0.340	0.504	0.491	0.403	0.353	0.504	0.403	0.365

AERMOD Impacts - turbine only (ug/m3 per g/s) - 150 ft. turbine stack height

		1	2	3	4	5	36	37	38	39	40	32	33	34	35	41	42	43	44	68	69	70	71	65	66	67
Unit	1-hour H1H	3.880	3.854	3.913	4.234	5.076	3.834	3.887	3.894	4.283	5.322	3.792	3.879	4.281	5.287	3.626	3.743	4.015	4.214	3.676	3.704	3.958	4.226	3.409	3.822	3.917
	1-hour H2H	3.759	3.676	3.893	4.161	5.003	3.623	3.784	3.813	4.199	5.293	3.520	3.757	4.197	5.254	3.225	3.412	3.982	4.188	3.288	3.338	3.935	4.170	2.915	3.590	3.913
	3-hour H1H	2.074	2.055	2.122	2.217	2.479	2.023	2.070	2.080	2.219	2.550	1.992	2.060	2.219	2.537	1.909	1.987	2.175	2.218	1.925	1.944	2.150	2.217	1.770	2.048	2.148
	3-hour H2H	1.773	1.768	1.837	2.040	2.394	1.756	1.771	1.774	2.047	2.485	1.728	1.768	2.046	2.471	1.650	1.721	1.936	2.041	1.657	1.676	1.886	2.039	1.598	1.767	1.884
	8-hour H1H	1.147	1.135	1.239	1.539	2.035	1.075	1.120	1.134	1.476	2.103	1.046	1.105	1.474	2.086	1.020	1.096	1.441	1.591	1.009	1.026	1.328	1.553	0.886	1.166	1.361
	8-hour H2H	1.015	1.007	1.101	1.343	1.776	0.951	0.996	1.005	1.308	1.859	0.929	0.983	1.306	1.838	0.883	0.958	1.249	1.374	0.885	0.897	1.174	1.350	0.781	1.028	1.187
	24-hour H1H	0.660	0.653	0.719	0.902	1.225	0.608	0.640	0.650	0.865	1.271	0.585	0.629	0.864	1.262	0.565	0.621	0.837	0.935	0.557	0.569	0.771	0.912	0.467	0.673	0.788
	24-hour H2H	0.458	0.453	0.502	0.660	0.948	0.422	0.447	0.453	0.638	1.001	0.409	0.441	0.636	0.990	0.384	0.427	0.595	0.681	0.384	0.392	0.550	0.665	0.321	0.463	0.558
	24-hour H6H	0.370	0.365	0.405	0.511	0.666	0.328	0.357	0.359	0.493	0.696	0.311	0.345	0.487	0.686	0.295	0.341	0.473	0.514	0.286	0.300	0.447	0.509	0.227	0.373	0.444
	Annual	0.035	0.035	0.039	0.049	0.067	0.033	0.035	0.036	0.048	0.072	0.031	0.035	0.048	0.071	0.029	0.032	0.043	0.049	0.029	0.030	0.041	0.049	0.025	0.034	0.041

AERMOD Scaled Impacts - turbine only (ug/m3) - 150 ft. turbine stack

Fuel		**Natural Gas**														**ULSD**										
Case #:	**Averaging Period**	**1**	**2**	**3**	**4**	**5**	**36**	**37**	**38**	**39**	**40**	**32**	**33**	**34**	**35**	**41**	**42**	**43**	**44**	**68**	**69**	**70**	**71**	**65**	**66**	**67**
NO2	1-hour H1H	9.40	7.06	6.98	6.07	5.17	9.82	7.71	7.67	7.00	5.68	9.94	7.93	7.37	5.94	17.04	16.74	15.48	14.94	17.85	17.76	16.42	15.47	16.15	15.48	14.87
	1-hour H8H	6.45	4.85	4.80	4.15	3.49	6.75	5.26	5.23	4.74	3.79	6.87	5.42	4.99	3.97	11.65	11.65	10.65	10.21	12.32	12.30	11.33	10.56	11.00	10.70	10.29
	Annual	0.12	0.09	0.09	0.09	0.09	0.12	0.10	0.10	0.10	0.10	0.12	0.10	0.11	0.11	0.19	0.20	0.22	0.22	0.20	0.20	0.22	0.23	0.17	0.19	0.20
CO	1-hour H1H	6.70	2.72	2.56	2.19	1.92	7.10	2.94	2.90	2.54	2.08	7.26	3.03	2.64	2.20	5.92	5.73	4.92	4.71	6.20	6.15	5.25	4.89	5.75	5.22	4.74
	1-hour H2H	6.49	2.59	2.55	2.15	1.89	6.71	2.86	2.83	2.49	2.07	6.74	2.93	2.59	2.18	5.27	5.22	4.88	4.68	5.54	5.54	5.22	4.83	4.91	4.90	4.74
	8-hour H1H	1.98	0.80	0.81	0.80	0.77	1.99	0.85	0.84	0.87	0.82	2.00	0.86	0.91	0.87	1.67	1.68	1.77	1.78	1.70	1.70	1.76	1.80	1.49	1.59	1.65
	8-hour H2H	1.75	0.71	0.72	0.69	0.67	1.76	0.75	0.75	0.77	0.73	1.78	0.77	0.81	0.76	1.44	1.47	1.53	1.54	1.49	1.49	1.56	1.56	1.32	1.40	1.44
PM10	24-hour H1H	1.72	0.95	0.99	1.05	1.24	1.72	1.01	1.02	1.11	1.28	1.69	1.01	1.12	1.27	2.14	2.35	3.16	3.54	2.11	2.15	2.92	3.45	1.77	2.54	2.98
	24-hour H2H	1.19	0.66	0.69	0.77	0.96	1.19	0.70	0.71	0.82	1.01	1.18	0.71	0.83	1.00	1.45	1.62	2.25	2.58	1.45	1.48	2.08	2.51	1.21	1.75	2.11
	24-hour H6H	0.96	0.53	0.56	0.59	0.67	0.93	0.56	0.56	0.63	0.70	0.90	0.56	0.63	0.69	1.12	1.29	1.79	1.94	1.08	1.13	1.69	1.92	0.86	1.41	1.68
	Annual	0.09	0.05	0.05	0.06	0.07	0.09	0.06	0.06	0.06	0.07	0.09	0.06	0.06	0.07	0.11	0.12	0.16	0.18	0.11	0.11	0.15	0.18	0.09	0.13	0.16
PM2.5	24-hour H1H	0.94	0.51	0.55	0.60	0.74	0.91	0.54	0.55	0.64	0.77	0.90	0.54	0.64	0.77	1.13	1.27	1.81	2.01	1.10	1.15	1.66	1.97	0.93	1.40	1.69
	24-hour H8H	0.44	0.24	0.25	0.27	0.32	0.44	0.26	0.26	0.29	0.34	0.43	0.26	0.30	0.34	0.53	0.57	0.78	0.88	0.53	0.54	0.72	0.87	0.46	0.63	0.72
	Annual	0.07	0.04	0.04	0.04	0.05	0.07	0.04	0.04	0.05	0.06	0.07	0.04	0.05	0.06	0.08	0.09	0.13	0.14	0.08	0.08	0.12	0.14	0.07	0.10	0.12
SO2	1-hour H1H	2.23	1.67	1.67	1.48	1.27	2.33	1.83	1.85	1.71	1.39	2.38	1.90	1.76	1.45	1.56	1.51	1.40	1.38	1.62	1.60	1.52	1.44	1.47	1.39	1.37
	1-hour H4H	1.86	1.39	1.39	1.24	1.08	1.93	1.53	1.54	1.42	1.18	1.96	1.59	1.46	1.22	1.30	1.26	1.17	1.16	1.35	1.32	1.26	1.20	1.24	1.16	1.14
	3-hour H1H	1.31	0.98	0.96	0.81	0.66	1.38	1.07	1.07	0.92	0.71	1.41	1.12	0.95	0.74	0.94	0.90	0.79	0.75	0.97	0.96	0.87	0.78	0.89	0.83	0.78
	3-hour H2H	1.12	0.85	0.83	0.75	0.63	1.19	0.91	0.92	0.85	0.69	1.22	0.96	0.88	0.72	0.81	0.78	0.71	0.69	0.84	0.82	0.76	0.72	0.81	0.71	0.69
	24-hour H1H	0.42	0.31	0.33	0.33	0.32	0.41	0.33	0.34	0.36	0.35	0.41	0.34	0.37	0.37	0.28	0.28	0.31	0.32	0.28	0.28	0.31	0.32	0.24	0.27	0.29
	24-hour H2H	0.29	0.22	0.23	0.24	0.25	0.29	0.23	0.23	0.27	0.28	0.29	0.24	0.27	0.29	0.19	0.19	0.22	0.23	0.19	0.19	0.22	0.23	0.16	0.19	0.20
	Annual	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01

NTE Killingly Energy Center

Combined Cycle Combustion Turbine - Start-up/Shutdown (SU/SD) Emissions Estimates

Fuel		Natural Gas				ULSD			
Case #:		Hot Start	Warm Start	Cold Start	Shutdown	Hot Start	Warm Start	Cold Start	Shutdown
xhaust velocity (m/s)		14.128	14.840	12.174	10.315	10.150	11.014	9.989	9.946
aust temperature (K)		352.444	353.556	351.889	353.000	403.556	404.111	403.556	401.333
NOx (g/s)		15.649	17.871	14.091	10.065	22.130	24.304	21.784	21.226
CO (g/s)		47.546	54.952	59.992	26.497	249.007	290.502	277.902	54.100
PM (g/s)		2.277	2.200	2.027	2.385	4.095	4.142	4.127	4.064
SO2 (g/s)		0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788

AERMOD SU/SD Impacts - turbine only (ug/m3 per g/s) - 150 ft. turbine stack height

Unit	1-hour H1H	4.404	4.280	4.984	5.587	4.288	4.045	4.333	4.374
	1-hour H2H	4.358	4.197	4.920	5.575	4.155	3.879	4.207	4.260
	3-hour H1H	2.238	2.217	2.377	2.690	2.214	2.167	2.226	2.253
	3-hour H2H	2.126	2.040	2.353	2.588	2.031	1.927	2.049	2.069
	8-hour H1H	1.569	1.460	1.890	2.223	1.774	1.613	1.803	1.829
	8-hour H2H	1.388	1.296	1.654	1.999	1.459	1.329	1.484	1.509
	24-hour H1H	0.925	0.854	1.134	1.361	1.044	0.939	1.065	1.083
	24-hour H2H	0.692	0.629	0.873	1.083	0.736	0.645	0.753	0.770
	24-hour H6H	0.526	0.488	0.620	0.746	0.547	0.495	0.552	0.569
	Annual	0.052	0.048	0.064	0.079	0.049	0.043	0.050	0.051

AERMOD SU/SD Scaled Impacts - turbine only (ug/m3) - 150 ft. turbine stack

NO2	1-hour H1H	53.29	58.61	53.09	42.48	70.73	72.95	70.40	69.43
	1-hour H8H	35.89	39.67	35.60	28.14	49.10	51.22	48.75	47.90
	Annual	0.82	0.86	0.91	0.79	1.08	1.05	1.09	1.08
CO	1-hour H1H	209.41	235.19	299.01	148.05	1067.76	1175.01	1204.06	236.66
	1-hour H2H	207.18	230.61	295.18	147.72	1034.70	1126.97	1169.08	230.47
	8-hour H1H	74.60	80.20	113.36	58.91	441.65	468.71	501.02	98.94
	8-hour H2H	66.01	71.20	99.23	52.97	363.33	386.11	412.34	81.62
PM10	24-hour H1H	2.11	1.88	2.30	3.25	4.27	3.89	4.40	4.40
	24-hour H2H	1.58	1.38	1.77	2.58	3.01	2.67	3.11	3.13
	24-hour H6H	1.20	1.07	1.26	1.78	2.24	2.05	2.28	2.31
	Annual	0.12	0.11	0.13	0.19	0.20	0.18	0.21	0.21
PM2.5	24-hour H1H	1.22	1.08	1.36	1.97	2.43	2.19	2.49	2.50
	24-hour H8H	0.55	0.49	0.61	0.89	0.99	0.90	1.02	1.03
	Annual	0.09	0.08	0.10	0.15	0.16	0.14	0.16	0.16
SO2	1-hour H1H	2.04	1.96	2.26	2.53	1.91	1.80	1.94	1.96
	1-hour H4H	1.71	1.63	1.91	2.14	1.62	1.51	1.64	1.67
	3-hour H1H	1.07	1.06	1.14	1.29	1.06	1.04	1.07	1.08
	3-hour H2H	1.02	0.98	1.13	1.24	0.97	0.92	0.98	0.99
	24-hour H1H	0.44	0.41	0.54	0.65	0.50	0.45	0.51	0.52
	24-hour H2H	0.33	0.30	0.42	0.52	0.35	0.31	0.36	0.37
	Annual	0.03	0.02	0.03	0.04	0.02	0.02	0.02	0.02

NTE Killingly Energy Center - Detailed Results Table

Pollutant	Averaging Period	Rank for SIL	Maximum Impact (SIL) (µg/m³)	Maximum Impact Receptor Location		Elevation (m)	Maximum Impact Date (YRMODDHR)	Worst Case Turbine Load Scenario	SIL (µg/m³)	NAAQS (µg/m³)	PSD (µg/m³)
				UTM-E (m)	UTM-N (m)						
NO2 (SS)	1-hour	H1H	21.07	263450.00	4637250.00	206.19	5-year average	Case 68	**7.5**	**188**	**NA**
	Annual	H1H	0.93	257831.20	4638543.30	98.00	2011	Case 71	**1**	**100**	**25**
NO2 (SU/SD)	1-hour	H1H	84.31	263450.00	4637300.00	204.37	5-year average	Oil Warm Start	**7.5**	**188**	**NA**
	Annual	H1H	0.93	257831.20	4638543.30	98.00	2011	Case 71, Oil Cold Start	**1**	**100**	**25**
CO	1-hour	H1H	1427	263450.00	4637200.00	207.60	10050424	Oil Cold Start	**2000**	**40,000**	**NA**
	8-hour	H1H	131	258050.00	4638300.00	113.64	14110216	Case 32, Oil Cold Start	**500**	**10,000**	**NA**
PM10	24-hour	H1H	3.96	258100.00	4638300.00	113.64	10122724	Case 44, Oil Shutdown	**5**	**150**	**30**
	Annual	H1H	0.35	258170.90	4638568.90	97.05	2013	Case 44, Oil Shutdown	**1**	**NA**	**17**
PM2.5	24-hour	H1H (5YA)	3.15	258188.30	4638567.40	95.87	5-year average	Case 44, Oil Shutdown	**1.2**	**35**	**9**
	Annual	H1H (5YA)	0.29	258170.90	4638568.90	97.05	5-year average	Case 44, Oil Shutdown	**0.3**	**12**	**4**
SO2	1-hour	H1H	2.92	263450.00	4637200.00	207.60	5-year average	Case 32, Gas Shutdown	**7.9**	**196**	**NA**
	3-hour	H1H	1.51	258205.70	4638565.90	94.42	11012121	Case 32, Gas Shutdown	**25**	**1300**	**512**
	24-hour	H1H	0.99	258188.30	4638567.40	95.87	11032824	Case 32, Gas Shutdown	**5**	**365**	**91**
	Annual	H1H	0.09	258170.90	4638568.90	97.05	2013	Case 32, Gas Shutdown	**1**	**80**	**20**

APPENDIX G-2 – SIEMENS TECHNOLOGY SELECTION MEMO

MEMO

To:	James Grillo, Connecticut Department of Energy and Environmental Protection (CTDEEP)
From:	Steven Babcock
Date:	July 14, 2016
Subject:	Killingly Energy Center

NTE Connecticut, LLC (NTE) submitted an application for a permit to construct and operate for the proposed Killingly Energy Center (KEC) located in Killingly, CT. The application proposed to install a Siemens Model SGT6-8000H, Mitsubishi M501GAC, or equivalent combustion turbine generator (CTG). NTE has since finalized the selection of the Siemens Model SGT6-8000H CTG for the KEC project. The emissions information provided in the application is based upon the performance and emissions data of the Siemens Model SGT6-8000H CTG and therefore, no changes to this information are required due to final turbine selection. However, since submittal of the application, Siemens has lowered its carbon monoxide (CO) emission rate guarantee for the KEC project during natural gas firing to 0.9 parts per million by volume dry corrected to 15% oxygen (ppmvdc) without duct firing and 1.7 ppmvdc with duct firing.

Attached to this memo is the following revised information to reflect the lower CO BACT emission rate limits for natural gas firing:

- Table G-5: Proposed LAER and BACT Emission Limits for the Combined Cycle CTG;
- Revised application forms
    - Att. E212 CTG & DB
    - Att. F
    - Att. G CT/DB pages 2 and 7 of 7
    - Att. G3
- Appendix A: Supporting Emission Calculations

Tetra Tech, Inc.
2 Lan Drive, Suite 210, Westford, MA 01886
Tel 978-212-3284 Fax 978-692-4592 tetratech.com

TABLE G-5: PROPOSED LAER AND BACT EMISSION LIMITS FOR THE COMBINED CYCLE CTG

Table G-5: Proposed LAER and BACT Emission Limits for the Combined Cycle CTG

Pollutant	Fuel	Emission Rate (lb/MMBtu)	Emission Rate (ppmvdc)	Control Technology
NO_x	Natural Gas	0.0075	2.0	DLN and SCR
	ULSD	0.0194	5.0	Water Injection and SCR
VOC	Natural Gas	0.0013 (w/o DF) 0.0026 (w/ DF)	1.0 (w/o DF) 2.0 (w/ DF)	Good combustion controls and an oxidation catalyst
	ULSD	0.0027	2.0	
CO	Natural Gas	0.0020 (w/o DF) 0.0038 (w/ DF)	0.9 (w/o DF) 1.7 (w/ DF)	Good combustion controls and an oxidation catalyst
	ULSD	0.0047	2.0	
$PM/PM_{10}/PM_{2.5}$	Natural Gas	0.0055 (w/o DF) 0.0059 (w/ DF)	12.8 lb/hr (w/o DF) 22.9 lb/hr (w/ DF)	Good combustion controls and low sulfur fuels
	ULSD	0.0155	30.0 lb/hr	
SO_2	Natural Gas	0.0015	N/A	Low sulfur fuels
	ULSD	0.0015	N/A	
H_2SO_4	Natural Gas	0.00056 (w/o DF) 0.00053 (w/ DF)	N/A	Low sulfur fuels
	ULSD	0.00054	N/A	
NH_3	Natural Gas	0.0027	2.0	SCR design and NH_3 injection control
	ULSD	0.0072	5.0	
GHG	Natural Gas	816 lb/MW-hr (w/o DF)[1]	7,273 Btu/kW-hr (w/o DF)[2]	High efficiency generation and low emitting fuels

[1] New and clean, full load @ ISO conditions, net energy basis.

[2] Full-load ISO conditions, net energy basis, annual.

REVISED APPLICATION FORMS

Attachment E212: Unit Emissions Supplemental Application Form

Applicant Name: NTE Connecticut, LLC
Unit No.: CT & DB

DEEP USE ONLY
App. No.:

Complete this form in accordance with the instructions (DEEP-NSR-INST-212) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete a separate form for *each* unit.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152.

Part I: Unit Emission Information

Pollutant	Potential Emissions at Maximum Capacity		Proposed Allowable Emissions		
	lb/hr	tpy	lb/hr	Other Units *(specify)*	tpy
Criteria Air Pollutants					
PM	30.0	131.4	30.0	See Attached	100.8
PM_{10}	30.0	131.4	30.0	Text and Tables	100.8
$PM_{2.5}$ Total (filterable + condensable)	30.0	131.4	30.0		100.8
SO_x	5.6	24.7	5.6		24.7
NO_x	54.9	240.6	54.9		133.9
CO	15.2	66.6	15.2		133.8
VOC	9.9	43.4	9.9		48.3
Pb	3.0E-03	1.3E-02	3.0E-03		1.8E-03
GHG	460,328	2.0E06	460,328		1,966,937
Hazardous or Other Air Pollutants					
See Appendix A					

Potential Emissions Calculation Basis: **Vendor Data**

Proposed Allowable Emissions Calculation Basis: **Vendor Data/operating restrictions in attached text**

Part II: Regulatory Standards

Enter the regulatory standard(s) and the proposed allowable emissions for each pollutant emitted by the unit using the same units (e.g., ppmvd, lb/MMBTU, lb/hour, lb/day, etc.). More than one regulatory standard will often apply to a unit for a particular pollutant, list all that apply. Enter the regulatory citation(s) for the standard(s).

NOTE: The applicant should be aware of any existing regulatory standard applicable to the unit and should not propose allowable emissions in excess of the regulatory standard(s).

Pollutant	Regulatory Standard(s) *(specify units)*	Proposed Allowable Emissions *(specify units)*	Regulatory Citation(s)
Criteria Air Pollutants			
PM			
PM_{10}			
$PM_{2.5}$ Total (filterable + condensable)			
SO_x	0.06 lb/MMBtu	0.0015 lb/MMBtu	40 CFR 60.4320(a)
NO_x	15 ppmvd @15% O2	2.0 ppmvdc (gas) 5.0 ppmvdc (ULSD)	40 CFR 60.4330(a)(2)
CO			
VOC			
Pb			
GHG			
Hazardous or Other Air Pollutants *(Standards other than RCSA §22a-174-29)*			

Part III: Attachments

Please check the attachment being submitted as verification that all applicable attachments have been submitted with this application form. When submitting such documents, please label the documents as indicated in this Part (e.g., Attachment E212-A, etc.) and be sure to include the applicant's name.

☒ Attachment E212-A: *Sample Calculations*- Submit sample calculations used to determine all emissions rates, excluding GHG. See Attachment E212-C for GHG emissions. **REQUIRED**

☒ Attachment E212-B: *RCSA section 22a-174-29 Hazardous Air Pollutants Compliance* – Submit a completed CTMASC spreadsheet**,** or equivalent, to demonstrate compliance with RCSA section 22a-174-29. **REQUIRED**

☒ Attachment E212-C: *Greenhouse Gas Emissions* – Submit a completed CO_2 Equivalents Calculator Spreadsheet, or equivalent, used to quantify Greenhouse Gas emissions, **REQUIRED**

Attachment F: Premises Information Form

Applicant Name: NTE Connecticut, LLC

DEEP USE ONLY
App. No.:

Complete this form in accordance with the instructions (DEEP-NSR-INST-217) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete Parts I through VI of this form, as applicable, for only the equipment which is located at the premises prior to the submittal of this application package. Unit(s) or modifications that are the subject of this application package are addressed in Part VII of this form.

Questions? Visit the Air Permitting web page or contact the Air Permitting Engineer of the Day at 860-424-4152

Note: This form is not required if you indicated in Part IV.8 of the *Permit Application for Stationary Sources of Air Pollution New Source Review Form (DEEP-NSR-APP-200) that* the premises is operating under the General Permit to Limit Potential to Emit.

Part I: Premises Information Summary

Answer each question unless directed to do otherwise. Complete the Part(s) indicated as well as Part VII.

Question	Check One	If Yes….
A. Is this a new premises? (i.e. no air pollution emitting equipment on site)	☒ Yes ☐ No	Skip Questions B through G and continue on to Part VII of this form.
B. Is the premises operating under a Title V permit?	☐ Yes ☐ No	Permit Number: Issue Date: Skip Questions C through G and continue on to Part VII of this form.
C. Is there any equipment operating under a New Source Review Permit (permit) or Air Registration (registration) at the premises?	☐ Yes ☐ No	Complete Part II of this form.
D. Are there any external combustion units, automotive refinishing operations, nonmetallic mineral processing equipment, emergency engines or surface coating operations operating under RCSA section 22a-174-3b at the premises?	☐ Yes ☐ No	Complete Part III of this form.
E. Are there any external combustion units, automotive refinishing operations, nonmetallic mineral processing equipment, emergency engines or surface coating operations operating under RCSA section 22a-174-3c at the premises?	☐ Yes ☐ No	Complete Part IV of this form.
F. Are there any emissions units operating at the premises that have potential emissions of any air pollutant below the permitting thresholds of RCSA section 22a-174-3a which have not been captured in Question E?	☐ Yes ☐ No	Complete Part V of this form.
G. Is the premises operating under a premises-wide annual limitation (other than GPLPE or RCSA section 22a-174-3c) for any air pollutant?	☐ Yes ☐ No	Complete Part VI of this form.

Part II: Permits and Registrations

Complete this part, if “Yes” was answered to Question C in Part I of this form. List each piece of equipment operating under a permit or registration located at this premises. Provide the potential emissions for each pollutant as limited by such permit or registration in tons per year for each unit. Calculate the total potential emissions from equipment operating under permits or registrations for the premises.

Permit / Registration Number	Equipment Description	Permit/Registration Issuance Date	Potential Emissions from Permit or Registration (tpy)								
			PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Totals											

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

Part III: Units Operating Under RCSA section 22a-174-3b

Complete this part, if “Yes” was answered to Question D in Part I of this form. Enter the following information for each unit operating under RCSA section 22a-174-3b. Such units may include external combustion units, automotive refinishing operations, nonmetallic mineral processing equipment, emergency engines or surface coating operations. Calculate the total potential emissions from the equipment as limited by RCSA section 22a-174-3b.

Equipment Type	Const. Date	Maximum Rated Capacity of Equipment	Potential Emissions as Limited by RCSA section 22a-174-3b (tpy)								
			PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Totals											

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

Emissions Calculation Basis: ____

Part IV: Units Operating Under RCSA section 22a-174-3c

Complete this part, if “Yes” was answered to Question E in Part I of this form. Check off the types of equipment that is operating at the premises under RCSA section 22a-174-3c. Check all that apply. Calculate the total potential emissions from the equipment limited by RCSA section 22a-174-3c for each pollutant.

Equipment Operating Under RCSA section 22a-174-3c (Check all that apply)		Fuels Used (Check all that apply)	Number of Fuels Used	Potential Emissions for Each Pollutant (tpy)	Total Potential Emissions for Each Pollutant (tpy)
External Combustion Unit	☐	☐ Gaseous Fuel ☐ Distillate Oil or a blend of distillate oil and biodiesel fuel ☐ Residual Oil or a blend of residual oil and biodiesel fuel (boiler only) ☐ Propane		**15**	
Emergency Engine	☐				
Nonmetallic Mineral Processing Equipment	☐	**N/A**	**N/A**	**15**	
Automotive Refinishing Operation	☐	**N/A**	**N/A**	**15**	
Surface Coating Operation	☐	**N/A**	**N/A**	**15**	
Totals for Each Pollutant (tpy)					

Potential emissions of any individual air pollutant for a stationary source operating under RCSA section 22a-174-3c is less than 15 tons per year unless otherwise determined by a permit or order. Please be aware that if different units are operating with the same fuel, the most stringent limitation for that fuel applies to the premises.

Part V: Other Equipment

Complete this part, if “Yes” was answered to Question F in Part I of this form. Only include units which have not been captured elsewhere on this form and have potential emissions between 5 and 15 tons per year of any individual pollutant. If it is determined that premises-wide annual emissions of a pollutant are within 90% of major source thresholds, include all units with potential emissions greater than one ton per year on this table. Calculate the total potential emissions.

Equipment Description	Const. Date	Maximum Rated Capacity of Equipment	Potential Emissions as Defined in RCSA section 22a-174-1(91) (tpy)								
			PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Totals											

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

Emissions Calculation Basis: ____

Part VI: Premises-Wide Annual Limitations

Complete this part, if “Yes” was answered to Question G in Part I of this form. List all premises-wide annual limitations applicable to this premises that appear in a permit or order. **Do not include limitations under RCSA section 22a-174-3c.**

Permit or Order Number	Pollutant Limited	Enforceable Premises-Wide Limitation (tpy)

Part VII: Premises Summary

Ozone Non-Attainment Status: ☒ **Serious** ☐ **Severe**

$PM_{2.5}$ Attainment Status: ☒ **Attainment** ☐ **Non-Attainment**

A. Current Premises Potential Emissions

List the applicable potential emissions totals from Parts II through VI, if required to complete those sections. Calculate the *Total Current Premises Potential Emissions* applying any applicable premise-wide limitations. A source that answered "Yes" to Question A or B in Part I of this form would only complete the last three rows of the table below.

Form Part	Part Description	Potential Emissions (tpy)								
		PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Part II	Total Potential Emissions as Limited by Permit or Registration									
Part III	Total Potential Emissions as Limited by RCSA section 22a-174-3b									
Part IV	Total Potential Emissions as Limited by RCSA section 22a-174-3c									
Part V	Total Potential Emissions from Other Sources									
Part VI	Applicable Premises-Wide Annual Limitations									
Total Current Premises Potential Emissions		0	0	0	0	0	0	0	0	0
Major Source Thresholds (severe/serious)		100	100	100	100	25/50	25/50	100	100	100,000
Existing Major Stationary Source?		☐	☐	☐	☐	☐	☐	☐	☐	☐

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

If any pollutant is checked above**,** this premises **is** an existing major stationary source.

If no pollutants are checked above, this premises **is not** an existing major stationary source.

Go on to Part VII.B.

B. Proposed Project Allowable Emissions

List the proposed allowable emissions from the proposed project for the equipment or modifications included in this application package from *Attachment E: Unit Emissions (DEEP-AIR-APP-212)*.

Totals	Pollutant Emissions (tpy)								
	PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Proposed Allowable Emissions	102.2	102.2	102.2	25.1	139.4	49.4	144.7	0.002	1,996,602
Major Source Thresholds (severe/serious)	**100**	**100**	**100**	**100**	**25/50**	**25/50**	**100**	**100**	**100,000**
Project Major Source?	☒	☒	☒	☐	☒	☐	☒	☐	☒

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

If any pollutant is checked above, the proposed project **is** major in and of itself.

If no pollutants are checked above, the project **is not** major in and of itself.

Go on to Part VII.C.

C. New Premises Total Emissions

List the *Current Premises Potential Emissions* and the *Proposed Allowable Emissions* values from Parts VII.A and B. Calculate the *New Premises Total Emissions*.

Totals	Pollutant Emissions (tpy)								
	PM	PM_{10}	$PM_{2.5}$*	SO_x	NO_x	VOC	CO	Pb	GHG
Total Current Premises Potential Emissions (Part VII.A)	0	0	0	0	0	0	0	0	0
Proposed Allowable Emissions (Part VII.B)	102.2	102.2	102.2	25.1	139.4	49.4	144.7	0.002	1,996,602
New Premises Total Emissions	102.2	102.2	102.2	25.1	139.4	49.4	144.7	0.002	1,996,602
Major Source Thresholds (severe/serious)	**100**	**100**	**100**	**100**	**25/50**	**25/50**	**100**	**100**	**100,000**
Premises Major Source After Project?	☒	☒	☒	☐	☒	☐	☒	☐	☒

* $PM_{2.5}$ should include filterable $PM_{2.5}$ plus condensable $PM_{2.5}$

If any pollutant is checked above, the premises **will be** considered a major stationary source after the approval of the proposed project.

If no pollutants are checked above, the premises **will not be** considered a major stationary source after the approval of the proposed project.

Go on to Part VII.D**.**

D. Form Requirements

Based on the results in Parts VII.A through VII.C of this form the following forms are required to be completed for each pollutant:

Premises Major Stationary Source?	Project Itself Major Stationary Source?	Premises After Project is Major Stationary Source?	Forms Required to Be Completed
Part VII.A	Part VII.B	Part VII.C	
Yes	Yes	--	• Attachment H: Major Modification Determination Form • Attachment I: Prevention of Significant Deterioration of Air Quality (PSD) Program Form • Attachment J: Non-Attainment Review Form (for NOx, VOC or $PM_{2.5}$ only)
Yes	No	--	• Attachment H: Major Modification Determination Form (This form will direct you to complete Attachments I or J, if required.)
No	Yes	--	• Attachment I: Prevention of Significant Deterioration of Air Quality (PSD) Program Form • Attachment J: Non-Attainment Review Form (for NOx, VOC or $PM_{2.5}$ only)
No	No	--	Attachments H, I and J are not required.
--	--	Yes	If not already operating under one, the applicant is required to apply for a Title V permit within 12 months of becoming a major stationary source or the applicant must limit premises potential emissions by obtaining an approval of registration to operate under the General Permit to Limit Potential to Emit (GPLPE).

Attachment G: Analysis of Best Available Control Technology (BACT)

(Complete this form for each pollutant for which BACT must be incorporated. Duplicate this form as necessary.)

Complete this form in accordance with the instructions (DEEP-NSR-INST-214) to ensure the proper handling of your application. Print or type unless otherwise noted.

Applicant Name: NTE Connecticut, LLC

Unit No.: CT/DB

Unit Description: Combined Cycle Combustion Turbine

Pollutant: CO

Part I. Identify All Control Technologies/ Options

List all available control systems that have practical potential for application to this type of unit.

To ensure a sufficiently broad and comprehensive search of control alternatives, references other than the RBLC data should be investigated and documented. These references include: DEEP BACT Database, EPA/State air quality permits, control equipment vendors, trade associations, international agencies or companies, technical papers or journals.

Source	Facility	Control Technology	Reference
Combined cycle CT	Several. See Attachment G1	Oxidation Catalyst	RBLC, CT DEEP BACT Database, permits

Part II. Rank All Control Options by Technical Feasibility and Control Effectiveness

List all Control Options considered in Part I and identify which options are technically feasible. First list the technically feasible control options in descending order of Overall Pollution Reduction Efficiency and then list the technically infeasible options. If a control option is determined to be technically infeasible, specify the reason in the Comments/Rationale column. DO NOT list the Post-BACT Emissions Rate, Emissions Reduction, and the Overall Pollution Reduction Efficiency (%) for technically infeasible control options. Technically infeasibility should be based on physical, chemical, and engineering principles that would preclude the successful use of the control option on the emissions unit under review. In addition, complete *Attachment G1: Background Search – Existing BACT determinations (DEEP-NSR-APP-214b)* to provide more detailed information regarding each of the technically feasible options listed below. (Duplicate this page as necessary)

Baseline Emissions Rate (tpy): 1,353

BACT Option	Technically Feasible? (Yes/No)	Allowable Emissions Rate	Emissions Reduction (tpy)	Overall Pollution Reduction Efficiency (%)	Comments/Rationale
Oxidation Catalyst	Yes	133.8	1,219	90	Top level of control. Reduction is for steady state operation excluding startup/shutdown emissions.

Part III. Economic Impacts/Cost Effectiveness

Is the proposed BACT the top control option ☒ **Yes** ☐ **No** **If Yes, go to Part IV**

Complete *Attachment G2: Cost/Economic Impact Analysis*, DEEP-NSR-APP-214c for each technically feasible BACT options listed in Part **II** for which economic impacts are to be considered before filling this Part.

Provide the following economic information for each of the BACT options with completed *Attachment G2: Cost/Economic Impact Analysis*, DEEP-NSR-APP-214c.

BACT Option	Total Annualized Cost (TAC, $/year)	Cost Effectiveness ($/ton)		Comments/Rationale
		Average	Incremental (optional)	

Part IV. Environmental Impact Analysis

Provide the following information regarding environmental impacts for each of the technically feasible BACT options listed in Part II. If the BACT option chosen is the top control option, the environmental impact analysis should be done for that option only.

BACT Option	Toxics Impact		Adverse Impact		Comments/Rationale
	Yes/No	amount/ton	Yes/No	amount/ton	
Oxidation Catalyst	No	N/A	Yes	0.012	Increased conversion of SO_2 to SO_3 from 5% to 30% resulting in increased H_2SO_4 emissions. H_2SO_4/ton reflects ratio of 83.3% of the H_2SO_4 emissions to CO reduction from baseline in Part II.

Part V. Energy Impact Analysis

Provide the following information regarding energy impacts for each of the technically feasible BACT options listed in Part II. If the BACT option chosen is the top control option, the energy impact analysis should be done for that option only.

Baseline (specify units): N/A

BACT Option	Incremental Increase Over Baseline (specify units)	Comments/Rationale
Oxidation Catalyst	0	Marginal increase in net heat rate estimated to be ___ Btu/kWh

Part VI. BACT Recommendation

BACT Option Recommended: Oxidation catalyst. CO emissions will be no greater than 2 ppmvd at 15%O2 during all operating conditions, including natural gas firing, with and without duct firing, and ULSD firing.

Justification: The selected controls are the top level of control.

Part VII. Additional Forms/Attachments

Indicate the number of each type of form included as part of this BACT analysis.

Number of Forms	Form Number	Form Name	Mandatory?
9	DEEP-NSR-APP-214b	Attachment G1: Background Search – Existing BACT Determinations	Yes
0	DEEP-NSR-APP-214c	Attachment G2: Cost/Economic Impact Analysis	Yes, for each economic consideration
1	DEEP-NSR-APP-214d	Attachment G3: Summary of Best Available Control Technology	Yes

Additional Attachments: 0

Attachment G3: Summary of Best Available Control Technology Reviews

Complete this form in accordance with the instructions (DEEP-NSR-INST-214) to ensure the proper handling of your application. Print or type unless otherwise noted.

List each emissions unit subject to the BACT requirements. For each emissions unit listed, indicate the Emissions Unit number and all pollutants that are subject to the BACT requirements. *Attachment G: Analysis of Best Available Control Technology* (DEEP-NSR-APP-214a) should be completed for each emissions unit-pollutant combination listed in this table.

		Pollutants Subject to BACT									
Unit Description	**Unit Number**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_X**	**CO**	**VOC**	**GHG**	**Other** (please specify)	
Combustion Turbine	CT	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4 & NH3
Duct Burner	DB	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4 & NH3
Auxliary Boiler	DB1	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Emergency Generator Engine	DB2	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Emergency Fire Pump Engine	AB	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Natural Gas Heater	GH	☒	☒	☒	☒	☒	☒	☒	☒	☒	H2SO4
Fugitive Emissions	FG	☐	☐	☐	☐	☐	☐	☐	☒	☐	H2SO4
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
Baseline Project Emissions Total in tons per year (tpy):		102.2	102.2	102.2	25.1	139.2	144.7	49.4	1,996,602	58.3	**Comments:**
Allowable Project Emissions Total in tons per year (tpy):		102.2	102.2	102.2	25.1	139.2	144.7	49.4	1,996,602	58.3	

APPENDIX A: SUPPORTING EMISSION CALCULATIONS

NTE Connecticut, LLC - Killingly Energy Center

Facility-Wide Potential Annual Emissions (TPY)

Pollutant	CTG & Duct Burners	Auxiliary Boiler	Natural Gas Heater	Emergency Generator	Fire Pump	Fugitive Emissions	Facility Total
NO_x	133.9	1.64	0.64	2.92	0.30	N/A	139.4
CO	133.8	7.14	1.94	1.60	0.26	N/A	144.7
VOC	48.3	0.78	0.18	0.15	0.02	N/A	49.4
SO_2	24.7	0.29	0.08	0.003	0.0005	N/A	25.1
PM	100.8	0.97	0.26	0.09	0.02	N/A	102.2
PM_{10}	100.8	0.97	0.26	0.09	0.02	N/A	102.2
$PM_{2.5}$	100.8	0.97	0.26	0.09	0.02	N/A	102.2
CO_2e	1,966,937	22,610	6,151	308	49	547	1,996,602
H_2SO_4	8.76	0.02	0.006	0.0002	0.00003	N/A	8.8
Lead (Pb)	1.8E-03	9.5E-05	2.6E-05	1.4E-06	2.3E-07	N/A	0.002
NH_3	49.5	N/A	N/A	N/A	N/A	N/A	49.5
Total HAPS	14.13	0.36	0.10	0.01	0.003	N/A	14.6

Potential To Emit Operating Scenario

The CTG will operate at full rated load for 8,760 hours per year.
Higher emission rates occur during gas firing with duct firing and ULSD firing without duct firing
Duct firing will be unlimited
ULSD firing will be limited to 720 hours per year per turbine without duct firing
Over the course of 8,760 operating hours, the average annual temperature will be 59°F
ULSD firing expected to occur during cold winter months
ULSD emission rate for 720 hrs/yr applied when the lb/hr rate is greater than the duct firing lb/hr rate
The potential to emit is the sum of the steady state potential to emit plus the net increase due to startup/shutdown operation

Operating Condition	Operating Load	Fuel	Ambient Temp. (°F)	Duct Firing	Maximum Annual Hours
Case #36	100%	Nat. Gas	59	On	8,760
Case #65	100%	ULSD	-10	Off	720
Total					**8,760**

Pollutant	Case #36	Case #69	8760 PTE	SU/SD	PTE
	lb/hr	lb/hr	tpy	tpy	tpy
NO_x	28.4	54.9	133.9	0.0	133.9
CO	14.7	13.4	64.4	69.4	133.8
VOC	9.9	7.7	43.4	4.9	48.3
$PM_{10}/PM_{2.5}$	22.4	30.0	100.8	0	100.8
SO_2	5.6	4.0	24.7	0	24.7
H_2SO_4	2.0	1.5	8.76	0	8.76
CO_2e	448,064	460,328	1,966,937	0	1,966,937
NH_3	10.5	20.3	49.5	0	49.5

NTE Connecticut, LLC - Killingly Energy Center
Siemens Model SGT6-8000H (or equivalent) Combined Cycle Combustion Turbine Emissions Estimates

Ambient Temperature (°F):			100					59					-10	
Case #:	**1**	**2**	**3**	**4**	**5**	**36**	**37**	**38**	**39**	**40**	**32**	**33**	**34**	**35**
Fuel	**Natural Gas**													
Number of GTs Operating														
GT Operating Load	100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%
Fuel Heating Value, Btu/lb (HHV)	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
Inlet Fogger State (On or Off)														
Ambient Relative Humidity, %	45	45	45	45	45	60	60	60	60	60	100	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,672	2,672	2,490	1,983	1,444	2,871	2,869	2,827	2,269	1,515	2,974	2,971	2,380	1,598
DB Heat Input (MMBtu/hr/unit, HHV)	834					895					920			
Net Power (kW)						532,724		433,008						
Gross Power (kW)						549,200		446,400						
Heat Rate (Btu/kW-hr, net, HHV)						7,069		6,529						
HRSG Stack Exhaust Gas														
Exhaust Flow, lb/hr	4,780,636	4,742,975	4,491,475	3,798,752	3,012,719	5,126,628	5,086,165	5,037,546	4,141,668	3,076,733	5,197,878	5,156,718	4,160,194	3,114,531
Stack Temperature, °F	186.0	191.0	188.0	190.0	188.0	185.0	180.0	180.0	178.0	178.0	188.0	180.0	178.0	178.0
Exhaust Flow, acfm	1,360,753	1,352,033	1,271,742	1,077,307	850,706	1,443,471	1,414,751	1,398,751	1,147,081	850,251	1,464,925	1,429,259	1,148,386	857,812
O_2, Vol. %	8.41	11.09	11.33	11.93	12.70	8.74	11.45	11.54	11.85	12.84	8.69	11.46	11.62	12.67
CO_2, Vol. %	5.61	4.34	4.28	4.00	3.64	5.66	4.38	4.36	4.22	3.75	5.80	4.49	4.42	3.92
H_2O, Vol. %	13.83	11.49	10.81	10.28	9.61	11.77	9.39	9.12	8.85	7.98	10.90	8.45	8.31	7.38
N_2, Vol. %	71.32	72.24	72.73	72.93	73.20	72.97	73.91	74.11	74.21	74.56	73.75	74.72	74.78	75.15
Ar, Vol. %	0.84	0.85	0.85	0.86	0.86	0.86	0.87	0.87	0.87	0.87	0.86	0.88	0.88	0.88
MW, lb/lb-mole	27.96	28.10	28.17	28.20	28.24	28.19	28.34	28.36	28.38	28.43	28.30	28.45	28.46	28.51
HRSG Stack Exhaust Gas Emissions														
NOx, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NOx, lb/MMBtu as NO2 (Siemens)	0.0075	0.0075	0.0076	0.0075	0.0074	0.0075	0.0075	0.0075	0.0074	0.0074	0.0075	0.0075	0.0075	0.0074
NOx, lb/MMBtu as NO2 (EPA Method 19)	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074	0.0074
NOx, lb/hr as NO2 (Siemens)	26.40	20.10	18.80	14.80	10.70	28.40	21.60	21.30	16.90	11.20	29.30	22.40	17.80	11.80
NOx, lb/hr as NO2 (Method 19)	25.83	19.69	18.35	14.62	10.64	27.75	21.14	20.83	16.72	11.16	28.69	21.90	17.53	11.78
VOC, ppmvd @ 15% O2 as CH4	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0
VOC ppm (Method 19)	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	2.0	1.0	1.0	1.0
VOC, lb/MMBtu (Siemens)	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013
VOC, lb/MMBtu as CH4 (EPA Method 19)	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013	0.0013	0.0026	0.0013	0.0013	0.0013
VOC, lb/hr as CH4 (Siemens)	9.20	3.60	3.30	2.60	1.90	9.90	3.80	3.80	3.00	2.00	10.30	3.90	3.10	2.10
VOC, lb/hr as CH4 (Method 19)	9.00	3.43	3.20	2.55	1.85	9.67	3.68	3.63	2.91	1.94	10.00	3.81	3.05	2.05
CO, ppmvd @ 15% O2	1.7	0.9	0.9	0.9	0.9	1.7	0.9	0.9	0.9	0.9	1.7	0.9	0.9	0.9
CO, lb/MMBtu (Siemens)	0.0039	0.0021	0.0021	0.0021	0.0021	0.0039	0.0021	0.0021	0.0021	0.0020	0.0039	0.0021	0.0021	0.0021
CO, lb/MMBtu (EPA Method 19)	0.0038	0.0020	0.0020	0.0020	0.0020	0.0038	0.0020	0.0020	0.0020	0.0020	0.0038	0.0020	0.0020	0.0020
CO, lb/hr (Siemens)	13.70	5.60	5.20	4.10	3.00	14.70	6.00	5.90	4.70	3.10	15.20	6.20	4.90	3.30
CO, lb/hr (Method 19)	13.37	5.39	5.03	4.00	2.91	14.36	5.79	5.71	4.58	3.06	14.85	6.00	4.80	3.23
SO2 ppm (Method 19)	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
SO2, lb/hr (Siemens)	5.00	3.80	3.60	2.90	2.10	5.40	4.10	4.10	3.30	2.20	5.60	4.30	3.40	2.30
SO2, lb/hr (calculated)	5.26	4.01	3.74	2.98	2.17	5.65	4.30	4.24	3.40	2.27	5.84	4.46	3.57	2.40
SO2, lb/MMBtu	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
H2SO4, lb/hr	1.80	1.40	1.30	1.10	0.80	2.00	1.50	1.50	1.20	0.80	2.00	1.60	1.30	0.90
H2SO4, lb/MMBtu	0.00051	0.00052	0.00052	0.00055	0.00055	0.00053	0.00052	0.00053	0.00053	0.00053	0.00051	0.00054	0.00055	0.00056
$PM/PM_{10}/PM_{2.5}$, lb/hr	20.70	11.50	10.90	9.20	8.00	22.40	12.50	12.40	10.20	8.00	22.90	12.80	10.30	8.00
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0059	0.0043	0.0044	0.0046	0.0055	0.0059	0.0044	0.0044	0.0045	0.0053	0.0059	0.0043	0.0043	0.0050
NH_3, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
NH_3, lb/MMBtu (EPA Method 19)	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027
NH_3, lb/hr (Siemens)	9.80	7.50	7.00	5.50	4.00	10.50	8.00	7.90	6.30	4.20	10.90	8.30	6.60	4.40
NH_3, lb/hr (Method 19)	9.55	7.28	6.78	5.40	3.93	10.25	7.81	7.70	6.18	4.13	10.60	8.09	6.48	4.35
CO_2, lb/hr (40 CFR 75, App. G, Eq. G-4)	416,712	317,605	295,959	235,752	171,635	447,609	341,057	336,047	269,653	180,065	462,871	353,170	282,827	189,969
CH_4, lb/hr (40 CFR 98, Subpart C, Table 2)	7.73	5.89	5.49	4.37	3.18	8.30	6.33	6.23	5.00	3.34	8.59	6.55	5.25	3.52
N_2O, lb/hr (40 CFR 98, Subpart C, Table 2)	0.77	0.59	0.55	0.44	0.32	0.83	0.63	0.62	0.50	0.33	0.86	0.66	0.52	0.35
CO_2e, lb/hr (CH4 GWP = 25, N2O GWP = 298)	417,136	317,927	296,260	235,991	171,810	448,064	341,403	336,388	269,927	180,248	463,341	353,529	283,114	190,162
CO_2e, lb/MMBtu	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0	119.0
CO_2e, lb/MW-hr (gross)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HCOH (lb/hr)	0.767	0.585	0.545	0.434	0.316	0.824	0.628	0.619	0.496	0.332	0.852	0.650	0.521	0.350

NTE Connecticut, LLC - Killingly Energy Cer
Siemens Model SGT6-8000H (or equivalent)

Ambient Temperature (°F):	100				59				-10		
Case #:	41	42	43	44	68	69	70	71	65	66	67
Fuel	ULSD										
Number of GTs Operating											
GT Operating Load	100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444
Evaporative Cooler Status (On or Off)	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	---	---	---	---	---	---	---	---	---	---	---
Inlet Fogger State (On or Off)											
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,740	2,567	2,055	1,874	2,828	2,783	2,226	1,941	2,827	2,289	2,029
DB Heat Input (MMBtu/hr/unit, HHV)											
Net Power (kW)											
Gross Power (kW)											
Heat Rate (Btu/kW-hr, net, HHV)											
HRSG Stack Exhaust Gas											
Exhaust Flow, lb/hr	4,833,827	4,620,398	3,833,176	3,574,417	5,155,459	5,106,515	4,228,784	3,791,268	5,500,484	4,510,924	4,056,678
Stack Temperature, °F	211.0	207.0	202.0	200.0	200.0	199.0	194.0	193.0	212.0	204.0	202.0
Exhaust Flow, acfm	1,409,478	1,336,669	1,098,107	1,020,083	1,463,706	1,446,835	1,187,159	1,060,412	1,577,200	1,276,412	1,143,842
O_2, Vol. %	11.50	11.77	12.24	12.48	12.25	12.34	12.78	13.08	13.13	13.35	13.52
CO_2, Vol. %	5.26	5.17	4.95	4.82	5.15	5.12	4.91	4.75	4.87	4.76	4.67
H_2O, Vol. %	10.88	10.18	9.40	9.08	8.08	7.81	7.13	6.72	5.71	5.32	5.13
N_2, Vol. %	71.52	72.03	72.56	72.76	73.66	73.86	74.32	74.57	75.41	75.68	75.79
Ar, Vol. %	0.84	0.85	0.85	0.85	0.86	0.87	0.87	0.87	0.88	0.89	0.89
MW, lb/lb-mole	28.33	28.39	28.45	28.48	28.62	28.65	28.70	28.73	28.85	28.88	28.89
HRSG Stack Exhaust Gas Emissions											
NOx, ppmvd @ 15% O2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NOx, lb/MMBtu as NO2 (Siemens)	0.0178	0.0178	0.0177	0.0176	0.0178	0.0178	0.0177	0.0176	0.0178	0.0176	0.0175
NOx, lb/MMBtu as NO2 (EPA Method 19)	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194	0.0194
NOx, lb/hr as NO2 (Siemens)	48.90	45.80	36.30	32.90	50.40	49.60	39.30	34.10	50.40	40.40	35.60
NOx, lb/hr as NO2 (Method 19)	53.25	49.88	39.93	36.42	54.96	54.08	43.26	37.72	54.9	44.49	39.44
VOC, ppmvd @ 15% O2 as CH4	2.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
VOC ppm (Method 19)	2.0	1.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0
VOC, lb/MMBtu (Siemens)	0.0026	0.0012	0.0025	0.0025	0.0013	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
VOC, lb/MMBtu as CH4 (EPA Method 19)	0.0027	0.0014	0.0027	0.0027	0.0014	0.0027	0.0027	0.0027	0.0027	0.0027	0.0027
VOC, lb/hr as CH4 (Siemens)	7.00	3.20	5.20	4.60	3.60	7.00	5.60	4.80	7.20	5.80	5.00
VOC, lb/hr as CH4 (Method 19)	7.42	3.48	5.57	5.08	3.83	7.54	6.03	5.26	7.66	6.20	5.50
CO, ppmvd @ 15% O2	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
CO, lb/MMBtu (Siemens)	0.0043	0.0044	0.0043	0.0043	0.0043	0.0043	0.0043	0.0043	0.0044	0.0043	0.0043
CO, lb/MMBtu (EPA Method 19)	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047	0.0047
CO, lb/hr (Siemens)	11.90	11.20	8.90	8.10	12.30	12.10	9.60	8.30	12.30	9.90	8.70
CO, lb/hr (Method 19)	12.97	12.15	9.72	8.87	13.38	13.17	10.53	9.18	13.38	10.83	9.60
SO2 ppm (Method 19)	0.17	0.16	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17
SO2, lb/hr (Siemens)	3.90	3.60	2.90	2.70	4.00	3.90	3.20	2.80	4.00	3.20	2.90
SO2, lb/hr (calculated)	4.11		3.08	2.81	4.24	4.17	3.34	2.91	4.24	3.43	3.04
SO2, lb/MMBtu	0.0015	0.0014	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015	0.0015
H2SO4, lb/hr	1.40	1.30	1.10	1.00	1.50	1.40	1.20	1.00	1.50	1.20	1.10
H2SO4, lb/MMBtu	0.00051	0.00051	0.00054	0.00053	0.00053	0.00050	0.00054	0.00052	0.00053	0.00052	0.00054
$PM/PM_{10}/PM_{2.5}$, lb/hr	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
$PM/PM_{10}/PM_{2.5}$, lb/MMBtu	0.0109	0.0117	0.0146	0.0160	0.0106	0.0108	0.0135	0.0155	0.0106	0.0131	0.0148
NH_3, ppmvd @ 15% O2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
NH_3, lb/MMBtu (EPA Method 19)	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072
NH_3, lb/hr (Siemens)	18.10	17.00	13.50	12.20	18.70	18.40	14.60	12.60	18.70	15.00	13.20
NH_3, lb/hr (Method 19)	19.68	18.43	14.76	13.46	20.31	19.99	15.99	13.94	20.30	16.44	14.57
CO_2, lb/hr (40 CFR 75, App. G, Eq. G-4)	444,638	416,510	333,445	304,077	458,908	451,561	361,231	314,929	458,746	371,494	329,315
CH_4, lb/hr (40 CFR 98, Subpart C, Table 2)	18.12	16.98	13.59	12.39	18.71	18.41	14.72	12.84	18.70	15.14	13.42
N_2O, lb/hr (40 CFR 98, Subpart C, Table 2)	3.62	3.40	2.72	2.48	3.74	3.68	2.94	2.57	3.74	3.03	2.68
CO_2e, lb/hr (CH4 GWP = 25, N2O GWP = 298)	446,171	417,946	334,595	305,125	460,491	453,118	362,477	316,015	460,328	372,775	330,450
CO_2e, lb/MMBtu	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8	162.8
CO_2e, lb/MW-hr (gross)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HCOH (lb/hr)	0.633	0.593	0.474	0.433	0.653	0.642	0.514	0.448	0.653	0.529	0.469

NTE Connecticut, LLC - Killingly Energy Center
Summary of Startup and Shutdown Emissions - Siemens Model SGT6-8000H (or equivalent)

Startup/Shutdown Operating Data

hot starts/unit/gas	208	number/yr	0.50	hrs/event	6	Avg. hrs downtime	6.50	hrs/event
warm starts/unit/gas	42	number/yr	0.58	hrs/event	16	Avg. hrs downtime	16.58	hrs/event
cold starts/unit/gas	0	number/yr	0.58	hrs/event	64	Avg. hrs downtime	64.58	hrs/event
shutdowns/unit/gas	250	number/yr	0.30	hrs/event	N/A	Avg. hrs downtime	N/A	hrs/event
hot starts/unit/ULSD	0	number/yr	0.53	hrs/event	6	Avg. hrs downtime	6.53	hrs/event
warm starts/unit/ULSD	10	number/yr	0.58	hrs/event	16	Avg. hrs downtime	16.58	hrs/event
cold starts/unit/ULSD	0	number/yr	0.58	hrs/event	64	Avg. hrs downtime	64.58	hrs/event
shutdowns/unit/ULSD	10	number/yr	0.30	hrs/event	N/A	Avg. hrs downtime	N/A	hrs/event

Startup/Shutdown Emissions Self-Correcting Analysis

		Natural Gas Start				ULSD Start			
		NOx	CO	VOC	PM	NOx	CO	VOC	PM
Emissions per cold start	lbs	100	470	40	6.8	150	2200	240	20.3
Emissions per warm start	lbs	130	430	40	8.1	170	2300	260	20.4
Emissions per hot start	lbs	110	370	40	6.9	150	1970	260	18.5
Emissions per shutdown	lbs	60	200	60	3.3	130	420	170	11.3
Shutdown/Cold start - duration (w/ downtime)	hrs	64.88	64.88	64.88	64.88	64.88	64.88	64.88	64.88
Shutdown/Warm start - duration (w/ downtime)	hrs	16.88	16.88	16.88	16.88	16.88	16.88	16.88	16.88
Shutdown/Hot start - duration (w/ downtime)	hrs	6.80	6.80	6.80	6.80	6.83	6.83	6.83	6.83
Shutdown/Cold start - avg hourly emissions[1]	lb/hr	2.47	10.33	1.54	0.15	4.32	40.38	6.32	0.49
Shutdown/Warm start - avg hourly emissions[1]	lb/hr	11.25	37.31	5.92	0.67	17.77	161.11	25.47	1.87
Shutdown/Hot start - avg hourly emissions[1]	lb/hr	25.00	83.82	14.71	1.49	40.98	349.76	62.93	4.35
Steady state average hourly (annual)[2]	lb/hr	28.40	14.70	9.90	22.40	54.94	13.38	7.66	30.00
Cold Start Net increase	lb/event	0.0	0.0	0.0	0.0	0.0	1752.0	0.0	0.0
Warm Start Net increase	lb/event	0.0	381.8	0.0	0.0	0.0	2494.1	300.7	0.0
Hot Start Net increase	lb/event	0.0	470.0	32.7	0.0	0.0	2298.6	377.7	0.0
Cold start - self correcting?	lb/hr	yes	yes	yes	yes	yes	no	yes	yes
Warm start - self correcting?	lb/hr	yes	no	yes	yes	yes	no	no	yes
Hot start - self correcting?	lb/hr	yes	no	no	yes	yes	no	no	yes

[1] Includes balance of the hour at the steady state annual average hourly rate

[2] Based upon average annual hourly emissions with 4,250 hr/yr gas with duct firing, 720 hr/yr oil firing and gas without duct firing balance of the year.

Startup/Shutdown Potential Emissions Increase (tpy/unit)

SUSD Type	Gas NOx	Gas CO	Gas VOC	Oil NOx	Oil CO	Oil VOC
Shutdown/Cold Start	-	-	-	-	0.00	-
Shutdown/Warm Start	-	8.02	-	-	12.47	1.50
Shutdown/Hot Start	-	48.88	3.40	-	0.00	0.00
TOTAL	**0.00**	**56.90**	**3.40**	**0.00**	**12.47**	**1.50**

Note: Maximum of hot start/warm start/transition used for worst case hot start

NTE Connecticut, LLC - Killingly Energy Center
Summary of Startup and Shutdown Emissions - Siemens Model SGT6-8000H (or equivalent)

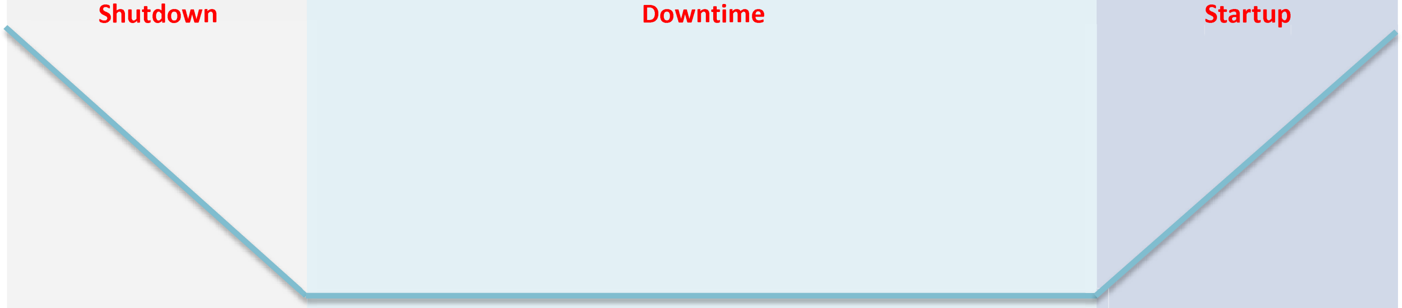
Startup/Shutdown Parameters (per turbine)

Type	Operating Condition	Exhaust Flow (ACFM)	Temp (°F)	Temp (°K)	NOx (lb/hr)	CO (lb/hr)	VOC (lb/hr)	PM (lb/hr)	Stack Diameter (ft)	Exit Velocity (m/s)
Hot Start - gas	Startup	1,105,782	175	352.4	124.2	377.4	45.0	18.1	22.5	14.13
Warm Start - gas	Startup	1,161,532	177	353.6	141.8	436.1	44.1	17.5	22.5	14.84
Cold Start - gas	Startup	952,830	174	351.9	111.8	476.1	44.1	16.1	22.5	12.17
Shutdown - gas	Shutdown	807,358	176	353.0	79.9	210.3	66.9	18.9	22.5	10.32
Hot Start - ULSD	Startup	794,409	267	403.6	175.6	1976.2	263.6	32.5	22.5	10.15
Warm Start - ULSD	Startup	862,055	268	404.1	192.9	2305.6	263.2	32.9	22.5	11.01
Cold Start - ULSD	Startup	781,795	267	403.6	172.9	2205.6	243.2	32.8	22.5	9.99
Shutdown - ULSD	Shutdown	778,466	263	401.3	168.5	429.4	175.4	32.3	22.5	9.95

Notes
1.) Data is from vendor estimates with 25% compliance margin applied
2.) Cold startup (SU) data are based on CTG shutdown (SD) >64 hours
3.) Warm SU data CTG SD between 16 and 64 hours
4.) Hot SU data CTG SD <16 hours, 6 hour average presumed based upon daily cycling of CTG
5.) ULSD starts presumed to be Warm starts

Example Calculation of Net Increase in Emissions Due To Shutdown and Startup Operation

Shutdown and Hot Startup Cycle For CO - Natural Gas Firing



	Shutdown	Downtime	Startup	SUSD Totals	
Duration (hrs)	0.30	6.00	0.50	**6.80**	**A**
Emissions (lbs)	200	0	370	**570.0**	**B**

Shutdown and Startup Cycle Emission Rate (lb/hr) =	83.82	**C** = B / A
Full Load Steady State Emission Rate (lb/hr) =	14.70	**D** (Case #36, full load on gas with duct firing at 59°F)
Net Increase in Emissions Due To Shutdown/Startup (lb/hr) =	69.12	**E** = C - D (avg over the shutdown/downtime/startup cycle)

If "E" is less than or equal to zero then there is no net increase in emissions over steady state from shutdown and startup operation.
If "E" is greater than zero, then there is a net increase in emissions over steady state from shutdown and startup operation.
If there is a net increase in emissions, then the impact on potential annual emissions from shutdown and startup must be quantifed.

Calculation of Impact on Potential Annual Emissions Due to a Net Increase in Emissions From Shutdown and Startup Operation

Net Increase in Emissions Due To Shutdown/Startup (lb/event) =	470.04	**F** = E x A
Number of Shutdown and Startup Cycles Per Year =	208	**G**
Net Increase in Annual Emissions (tpy) =	48.88	**H** = F x G / 2000

The net increase in emissions resulting from shutdown and startup operation is added to the steady state potential annual emissions to determine the total potential to emit from the CTG.

NTE Connecticut, LLC - Killingly Energy Center
Emissions From Ancillary Equipment

Pollutant	Auxiliary Boiler 84.0 MMBtu/hr	Natural Gas Heater 12.0 MMBtu/hr	Emergency Generator kW 1,380 (mechanical)	Fire Pump kW 227.5 (mechanical)
NO_x	7 ppmvd @ 3% O_2	10 ppmvd @ 3% O_2	6.40 g/kW-hr	4.0 g/kW-hr
	0.0085 lb/MMBtu	0.012 lb/MMBtu	1.55 lb/MMBtu	1.00 lb/MMBtu
	0.71 lb/hr	0.146 lb/hr	19.46 lb/hr	2.01 lb/hr
	1.64 TPY	0.64 TPY	2.92 TPY	0.30 TPY
CO	50 ppmvd @ 3% O_2	50 ppmvd @ 3% O_2	3.5 g/kW-hr	3.5 g/kW-hr
	0.037 lb/MMBtu	0.037 lb/MMBtu	0.85 lb/MMBtu	0.87 lb/MMBtu
	3.11 lb/hr	0.444 lb/hr	10.64 lb/hr	1.76 lb/hr
	7.14 TPY	1.94 TPY	1.60 TPY	0.263 TPY
VOC	9.6 ppmvd @ 3% O_2	8 ppmvd @ 3% O_2	0.32 g/kW-hr	0.20 g/kW-hr
	0.0041 lb/MMBtu	0.0034 lb/MMBtu	0.078 lb/MMBtu	0.050 lb/MMBtu
	0.34 lb/hr	0.04 lb/hr	0.97 lb/hr	0.100 lb/hr
	0.78 TPY	0.18 TPY	0.15 TPY	0.015 TPY
$PM_{10}/PM_{2.5}$	N/A ppmvd @ 3% O_2	N/A ppmvd @ 3% O_2	0.20 g/kW-hr	0.20 g/kW-hr
	0.005 lb/MMBtu	0.005 lb/MMBtu	0.048 lb/MMBtu	0.050 lb/MMBtu
	0.42 lb/hr	0.06 lb/hr	0.61 lb/hr	0.10 lb/hr
	0.97 TPY	0.26 TPY	0.091 TPY	0.015 TPY
SO_2	0.0015 lb/MMBtu	0.0015 lb/MMBtu	0.0015 lb/MMBtu	0.0015 lb/MMBtu
	0.13 lb/hr	0.0180 lb/hr	0.02 lb/hr	0.0030 lb/hr
	0.29 TPY	0.08 TPY	0.003 TPY	0.0005 TPY
H_2SO_4	0.00011 lb/MMBtu	0.00011 lb/MMBtu	0.00011 lb/MMBtu	0.00011 lb/MMBtu
	0.010 lb/hr	0.00138 lb/hr	0.0014 lb/hr	0.00023 lb/hr
	0.02 TPY	0.006 TPY	0.0002 TPY	0.00003 TPY
Pb	4.9E-07 lb/MMBtu	4.9E-07 lb/MMBtu	1.1E-06 lb/MMBtu	1.1E-06 lb/MMBtu
	4.1E-05 lb/hr	5.9E-06 lb/hr	1.3E-05 lb/hr	2.1E-06 lb/hr
	9.5E-05 TPY	2.6E-05 TPY	2.0E-06 TPY	3.2E-07 TPY
CO_2	116.9 lb/MMBtu	116.9 lb/MMBtu	163.1 lb/MMBtu	163.1 lb/MMBtu
	9,820 lb/hr	1,403 lb/hr	2,046 lb/hr	329 lb/hr
	22,587 TPY	6,145 TPY	307 TPY	49 TPY
CH_4	0.0022 lb/MMBtu	0.0022 lb/MMBtu	0.0066 lb/MMBtu	0.0066 lb/MMBtu
	0.1852 lb/hr	0.0265 lb/hr	0.083 lb/hr	0.013 lb/hr
	0.43 TPY	0.12 TPY	0.0124 TPY	0.0020 TPY
N_2O	0.00022 lb/MMBtu	0.0 lb/MMBtu	0.0013 lb/MMBtu	0.0013 lb/MMBtu
	0.0185 lb/hr	0.0026 lb/hr	1.7E-02 lb/hr	0.0027 lb/hr
	0.043 TPY	0.012 TPY	2.5E-03 TPY	4.0E-04 TPY
CO_2e	9,831 lb/hr	1,404 lb/hr	2,053 lb/hr	330 lb/hr
	22,610 TPY	6,151 TPY	308 TPY	49 TPY

NOTES:

Natural Gas SO2 emissions based upon a sulfur content of 0.5 gr/100 dscf

ULSD SO_2 emissions based upon a sulfur content of 15 ppmw

Aux Boiler and Gas Heater criteria pollutant emission factors from BACT analysis

Emergency Generator criteria pollutant emission factors based on Tier 2 emission standards in 40 CFR 89.

Fire Pump criteria pollutant emission factors based on post -2009 emission standards in 40 CFR 60 Subpart IIII.

H_2SO_4 emissions assume a 5% conversion of SO2 --> SO3 (on a molar basis)

Fuel specific CO_2, CH_4 and N_2O emission factors from 40 CFR 98, Subpart C

Pb emission factor for ULSD from "Survey of Ultra-Trace Metals in Gas Turbine Fuels"

Potential HAP Emissions (tpy)

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs & Duct Burners	Auxiliary Boiler	Nat. Gas Heater	Em. Generator	Fire Pump	
Organic Compounds						
Acetaldehyde	5.03E-01			4.74E-05	2.32E-04	5.03E-01
Acrolein	8.05E-02			1.48E-05	2.80E-05	8.05E-02
Benzene	1.46E-01	4.06E-04	1.10E-04	1.46E-03	2.82E-04	1.48E-01
1,3-Butadiene	4.96E-03				1.18E-05	4.97E-03
Dichlorobenzene	4.70E-03	2.32E-04	6.31E-05			5.00E-03
Ethylbenzene	4.02E-01					4.02E-01
Formaldehyde	3.05E+00	1.43E-02	3.89E-03	1.48E-04	3.57E-04	3.06E+00
Hexane	7.06E+00	3.48E-01	9.46E-02			7.50E+00
Propylene oxide	3.65E-01			7.24E-03	1.08E-03	3.73E-01
Toluene	1.65E+00	6.38E-04	1.73E-04	5.29E-04	1.24E-04	1.65E+00
Xylene	8.05E-01			3.63E-04	3.66E-04	8.06E-01
PAHs						
Acenaphthene	7.06E-06	3.48E-07	9.46E-08	8.81E-06	4.29E-07	1.67E-05
Acenaphthylene	7.06E-06	4.64E-07	1.26E-07	1.74E-05	1.53E-05	4.03E-05
Anthracene	9.41E-06	3.48E-07	9.46E-08	2.31E-06	5.65E-07	1.27E-05
Benzo(a)anthracene	7.06E-06	3.48E-07	9.46E-08	1.17E-06	5.08E-07	9.18E-06
Benzo(a)pyrene	4.70E-06	2.32E-07	6.31E-08	4.84E-07	5.68E-08	5.54E-06
Benzo(b)fluoranthene	7.06E-06	3.48E-07	9.46E-08	4.10E-07	3.00E-08	7.94E-06
Benzo(g,h,i)perylene	4.70E-06	2.32E-07	6.31E-08	1.05E-06	1.48E-07	6.19E-06
Benzo(k)fluoranthene	7.06E-06	3.48E-07	9.46E-08	2.09E-06	4.68E-08	9.63E-06
Chrysene	7.06E-06	3.48E-07	9.46E-08	2.88E-06	1.07E-07	1.05E-05
Dibenz(a,h)anthracene	4.70E-06	2.32E-07	6.31E-08	6.51E-07	1.76E-07	5.83E-06
7,12-Dimethylbenz(a) an	6.27E-05	3.09E-06	8.41E-07			6.67E-05
Fluoranthene	1.18E-05	5.60E-07	1.52E-07	7.58E-06	2.30E-06	2.24E-05
Fluorene	1.10E-05	5.22E-07	1.42E-07	2.41E-05	8.82E-06	4.45E-05
Indeno(1,2,3-cd)pyrene	7.06E-06	3.48E-07	9.46E-08	7.79E-07	1.13E-07	8.39E-06
3-Methylchloranthrene	7.06E-06	3.48E-07	9.46E-08			7.50E-06
2-Methylnaphthalene	9.41E-05	4.64E-06	1.26E-06			1.00E-04
Naphthalene	1.72E-02	1.20E-04	3.26E-05	2.45E-04	2.56E-05	1.76E-02
Phenanthrene	6.66E-05	3.28E-06	8.94E-07		8.89E-06	7.97E-05
Pyrene	1.96E-05	9.47E-07	2.58E-07	6.98E-06	1.44E-06	2.92E-05
TOTAL PAH	2.79E-02	1.31E-04	3.57E-05	3.99E-04	5.08E-05	2.85E-02
Metals						
Arsenic	7.84E-04	3.86E-05	1.05E-05	8.69E-08	1.40E-08	8.33E-04
Beryllium	4.33E-05	2.32E-06	6.31E-07			4.62E-05
Cadmium	4.31E-03	2.13E-04	5.78E-05	9.65E-09	1.55E-09	4.58E-03
Chromium	5.04E-03	2.70E-04	7.36E-05	2.33E-05	3.75E-06	5.41E-03
Chromium VI	9.07E-04	4.83E-05	1.31E-05	4.21E-06	6.77E-07	9.74E-04
Cobalt	3.21E-04	1.58E-05	4.31E-06			3.42E-04

Potential HAP Emissions (tpy)

HAP	Potential Annual Emissions (tpy)					TOTALS
	CTGs & Duct Burners	Auxiliary Boiler	Nat. Gas Heater	Em. Generator	Fire Pump	
Lead	1.77E-03	9.47E-05	2.58E-05	1.45E-06	2.32E-07	1.89E-03
Manganese	1.62E-03	7.15E-05	1.94E-05	5.31E-07	8.52E-08	1.71E-03
Mercury	9.80E-04	4.83E-05	1.31E-05	1.94E-08	3.11E-09	1.04E-03
Nickel	7.56E-03	4.06E-04	1.10E-04	2.78E-06	4.47E-07	8.08E-03
Selenium	9.54E-05	4.64E-06	1.26E-06	4.82E-07	7.74E-08	1.02E-04
Max. Single HAP						**7.50**
Total All HAPs	**1.41E+01**	**3.65E-01**	**9.92E-02**	**1.06E-02**	**2.60E-03**	**14.61**

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Potential HAP Emissions

HAP	CTG and Duct Burner HAP Emissions						
	CTG (gas)		CTG (ULSD)		Duct Burners		Potential To Emit
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	tpy
Organic Compounds							
Acetaldehyde	4.00E-05	1.15E-01					5.03E-01
Acrolein	6.40E-06	1.84E-02					8.05E-02
Benzene	1.20E-05	3.45E-02	5.50E-05	1.56E-01	2.10E-06	1.88E-03	1.46E-01
1,3-Butadiene	4.30E-07	1.23E-03	1.60E-05	4.52E-02			4.96E-03
Dichlorobenzene					1.20E-06	1.07E-03	4.70E-03
Ethylbenzene	3.20E-05	9.19E-02					4.02E-01
Formaldehyde	2.19E-04	6.28E-01	2.31E-04	6.53E-01	7.50E-05	6.71E-02	3.05E+00
Hexane					1.80E-03	1.61E+00	7.06E+00
Propylene oxide	2.90E-05	8.33E-02					3.65E-01
Toluene	1.30E-04	3.73E-01			3.40E-06	3.04E-03	1.65E+00
Xylene	6.40E-05	1.84E-01					8.05E-01
PAHs							
Acenaphthene					1.80E-09	1.61E-06	7.06E-06
Acenaphthylene					1.80E-09	1.61E-06	7.06E-06
Anthracene					2.40E-09	2.15E-06	9.41E-06
Benzo(a)anthracene					1.80E-09	1.61E-06	7.06E-06
Benzo(a)pyrene					1.20E-09	1.07E-06	4.70E-06
Benzo(b)fluoranthene					1.80E-09	1.61E-06	7.06E-06
Benzo(g,h,i)perylene					1.20E-09	1.07E-06	4.70E-06
Benzo(k)fluoranthene					1.80E-09	1.61E-06	7.06E-06
Chrysene					1.80E-09	1.61E-06	7.06E-06
Dibenz(a,h)anthracene					1.20E-09	1.07E-06	4.70E-06
7,12-Dimethylbenz(a) anthracene					1.60E-08	1.43E-05	6.27E-05
Fluoranthene					3.00E-09	2.69E-06	1.18E-05
Fluorene					2.80E-09	2.51E-06	1.10E-05
Indeno(1,2,3-cd)pyrene					1.80E-09	1.61E-06	7.06E-06
3-Methylchloranthrene					1.80E-09	1.61E-06	7.06E-06
2-Methylnaphthalene					2.40E-08	2.15E-05	9.41E-05
Naphthalene	1.30E-06	3.73E-03	3.50E-05	9.90E-02	6.10E-07	5.46E-04	1.72E-02
Phenanthrene					1.70E-08	1.52E-05	6.66E-05
Pyrene					5.00E-09	4.48E-06	1.96E-05
TOTAL PAH	2.20E-06	6.32E-03	4.00E-05	1.13E-01	6.98E-07	6.25E-04	2.79E-02
Metals							
Arsenic			4.60E-08	1.30E-04	2.00E-07	1.79E-04	0.0007841
Beryllium			3.10E-07	8.77E-04	1.20E-08	1.07E-05	4.329E-05
Cadmium			5.11E-09	1.44E-05	1.10E-06	9.85E-04	0.0043123
Chromium			1.24E-05	3.50E-02	1.40E-06	1.25E-03	0.0050412
Chromium VI			2.23E-06	6.30E-03	2.52E-07	2.26E-04	0.0009074
Cobalt					8.20E-08	7.34E-05	0.0003215

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Potential HAP Emissions

HAP	CTG and Duct Burner HAP Emissions						
	CTG (gas)		CTG (ULSD)		Duct Burners		Potential To Emit
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	tpy
Lead			1.05E-06	2.97E-03	4.90E-07	4.39E-04	0.0017681
Manganese			1.80E-07	5.10E-04	3.70E-07	3.31E-04	0.0016157
Mercury			1.02E-08	2.89E-05	2.50E-07	2.24E-04	0.0009801
Nickel			1.48E-06	4.17E-03	2.10E-06	1.88E-03	0.0075576
Selenium			2.55E-07	7.22E-04	2.40E-08	2.15E-05	9.535E-05
Max. Single HAP							
Total All HAPs	**5.36E-04**		**3.95E-04**		**1.89E-03**		**1.41E+01**

Notes:

1. Blank entry indicates no emission factor reported in the reference cited.
2. Organic HAP emission factors for CTGs are from Tables 3.1-3 and 3.1.4 of AP-42 except gas-firing for formaldehyde which is based on the NESHAP Subpart YYYY MACT floor limit of 91 ppb at 15% O2.
3. Emission factors for the HRSG and auxiliary boiler are from AP-42 Tables 1.4-3 and 1.4-4.
4. Emission factors for organics from the emergency diesel generator are from AP-42 Tables 3.4-3 and 3.4-4, for the fire pump from AP-42 Table 3.3-2.
5. Metal emission factors for ULSD firing are based on the paper "Survey of Ultra-Trace Metals in Gas Turbine Fuels", 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detected in any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit was used.
6. Hexavalent chrome is based on 18% of the total chrome emissions per EPA 453/R-98-004a.
7. No reduction by oxidation catalysts presumed for organic HAPs.
8. lb/hr values are at 59°F and do not represent maximum values at higher firing rates at colder temperatures.

NTE Connecticut, LLC - Killingly Energy Center
Ancillary Source Potential HAP Emissions (lb/hr)

HAP	Auxiliary Boiler		Natural Gas Heater		Em. Generator		Fire Pump	
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr
Organic Compounds								
Acetaldehyde					2.52E-05	3.16E-04	7.67E-04	1.55E-03
Acrolein					7.88E-06	9.88E-05	9.25E-05	1.86E-04
Benzene	2.10E-06	1.76E-04	2.10E-06	2.52E-05	7.76E-04	9.73E-03	9.33E-04	1.88E-03
1,3-Butadiene							3.91E-05	7.88E-05
Dichlorobenzene	1.20E-06	1.01E-04	1.20E-06	1.44E-05				
Ethylbenzene								
Formaldehyde	7.40E-05	6.22E-03	7.40E-05	8.88E-04	7.89E-05	9.90E-04	1.18E-03	2.38E-03
Hexane	1.80E-03	1.51E-01	1.80E-03	2.16E-02				
Propylene oxide					3.85E-03	4.83E-02	3.56E-03	7.17E-03
Toluene	3.30E-06	2.77E-04	3.30E-06	3.96E-05	2.81E-04	3.52E-03	4.09E-04	8.24E-04
Xylene					1.93E-04	2.42E-03	2.85E-04	2.44E-03
PAHs								
Acenaphthene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	4.68E-06	5.87E-05	1.42E-06	2.86E-06
Acenaphthylene	2.40E-09	2.02E-07	2.40E-09	2.88E-08	9.23E-06	1.16E-04	5.06E-05	1.02E-04
Anthracene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	1.23E-06	1.54E-05	1.87E-06	3.77E-06
Benzo(a)anthracene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	6.22E-07	7.80E-06	1.68E-06	3.38E-06
Benzo(a)pyrene	1.20E-09	1.01E-07	1.20E-09	1.44E-08	2.57E-07	3.22E-06	1.88E-07	3.79E-07
Benzo(b)fluoranthene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	2.18E-07	2.73E-06	9.91E-08	2.00E-07
Benzo(g,h,i)perylene	1.20E-09	1.01E-07	1.20E-09	1.44E-08	5.56E-07	6.97E-06	4.89E-07	9.85E-07
Benzo(k)fluoranthene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	1.11E-06	1.39E-05	1.55E-07	3.12E-07
Chrysene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	1.53E-06	1.92E-05	3.53E-07	7.11E-07
Dibenz(a,h)anthracene	1.20E-09	1.01E-07	1.20E-09	1.44E-08	3.46E-07	4.34E-06	5.83E-07	1.17E-06
7,12-Dimethylbenz(a) anthracene	1.60E-08	1.34E-06	1.60E-08	1.92E-07				
Fluoranthene	2.90E-09	2.44E-07	2.90E-09	3.48E-08	4.03E-06	5.06E-05	7.61E-06	1.53E-05
Fluorene	2.70E-09	2.27E-07	2.70E-09	3.24E-08	1.28E-05	1.61E-04	2.92E-05	5.88E-05
Indeno(1,2,3-cd)pyrene	1.80E-09	1.51E-07	1.80E-09	2.16E-08	4.14E-07	5.19E-06	3.75E-07	7.56E-07
3-Methylchloranthrene	1.80E-09	1.51E-07	1.80E-09	2.16E-08				
2-Methylnaphthalene	2.40E-08	2.02E-06	2.40E-08	2.88E-07				
Naphthalene	6.20E-07	5.21E-05	6.20E-07	7.44E-06	1.30E-04	1.63E-03	8.48E-05	1.71E-04
Phenanthrene	1.70E-08	1.43E-06	1.70E-08	2.04E-07			2.94E-05	5.92E-05
Pyrene	4.90E-09	4.12E-07	4.90E-09	5.88E-08	3.71E-06	4.65E-05	4.78E-06	9.63E-06
TOTAL PAH	6.80E-07	5.71E-05	6.80E-07	8.16E-06	2.12E-04	2.66E-03	1.68E-04	3.38E-04
Metals								
Arsenic	2.00E-07	1.68E-05	2.00E-07	2.40E-06	4.62E-08	5.80E-07	4.62E-08	9.31E-08
Beryllium	1.20E-08	1.01E-06	1.20E-08	1.44E-07				
Cadmium	1.10E-06	9.24E-05	1.10E-06	1.32E-05	5.13E-09	6.44E-08	5.13E-09	1.03E-08
Chromium	1.40E-06	1.18E-04	1.40E-06	1.68E-05	1.24E-05	1.56E-04	1.24E-05	2.50E-05
Chromium VI	2.50E-07	2.10E-05	2.50E-07	3.00E-06	2.24E-06	2.81E-05	2.24E-06	4.51E-06
Cobalt	8.20E-08	6.89E-06	8.20E-08	9.84E-07				
Lead	4.90E-07	4.12E-05	4.90E-07	5.88E-06	7.69E-07	9.65E-06	7.69E-07	1.55E-06
Manganese	3.70E-07	3.11E-05	3.70E-07	4.44E-06	2.82E-07	3.54E-06	2.82E-07	5.68E-07
Mercury	2.50E-07	2.10E-05	2.50E-07	3.00E-06	1.03E-08	1.29E-07	1.03E-08	2.08E-08
Nickel	2.10E-06	1.76E-04	2.10E-06	2.52E-05	1.48E-06	1.86E-05	1.48E-06	2.98E-06
Selenium	2.40E-08	2.02E-06	2.40E-08	2.88E-07	2.56E-07	3.21E-06	2.56E-07	5.16E-07
Max. Single HAP								
Total All HAPs	**1.89E-03**	**1.59E-01**	**1.89E-03**	**2.27E-02**	**5.61E-03**	**7.04E-02**	**7.66E-03**	**1.73E-02**

NTE Connecticut, LLC - Killingly Energy Center
CTG and Duct Burner Maximum Potential MASC Toxic Emissions

HAP	CTG and Duct Burner MASC Toxic Emissions						
	CTG (gas)		Duct Burners		CTG + Duct Burners	CTG (ULSD)	
	lb/MMBtu	lb/hr	lb/MMBtu	lb/hr	lb/hr	lb/MMBtu	lb/hr
Organic Compounds							
Acetaldehyde	4.00E-05	1.19E-01			1.19E-01		
Acrolein	6.40E-06	1.90E-02			1.90E-02		
Benzene	1.20E-05	3.57E-02	2.10E-06	1.93E-03	3.76E-02	5.50E-05	1.55E-01
Dichlorobenzene			1.20E-06	1.10E-03	1.10E-03		
Ethylbenzene	3.20E-05	9.52E-02			9.52E-02		
Formaldehyde	2.19E-04	6.51E-01	7.50E-05	6.90E-02	7.20E-01	2.31E-04	6.53E-01
Hexane			1.80E-03	1.66E+00	1.66E+00		
Toluene	1.30E-04	3.87E-01	3.40E-06	3.13E-03	3.90E-01		
Xylene	6.40E-05	1.90E-01			1.90E-01		
PAHs							
Naphthalene	1.30E-07	3.87E-04	6.10E-08	5.61E-05	4.43E-04	3.50E-06	9.89E-03
TOTAL PAH	2.20E-07	6.54E-04	6.98E-08	6.42E-05	7.19E-04	4.00E-06	1.13E-02
Metals							
Arsenic			2.00E-07	1.84E-04	1.84E-04	4.60E-08	1.30E-04
Cadmium			1.10E-06	1.01E-03	1.01E-03	5.11E-09	1.44E-05
Chromium			1.40E-06	1.29E-03	1.29E-03	1.24E-05	3.50E-02
Cobalt			8.20E-08	7.54E-05	7.54E-05		
Lead			4.90E-07	4.51E-04	4.51E-04	1.05E-06	2.97E-03
Manganese			3.70E-07	3.40E-04	3.40E-04	1.80E-07	5.10E-04
Mercury			2.50E-07	2.30E-04	2.30E-04	1.02E-08	2.89E-05
Nickel			2.10E-06	1.93E-03	1.93E-03	1.48E-06	4.17E-03
Selenium						2.55E-07	7.22E-04

Notes:
1. Only emission factors reported above their detection limited in AP-42 used in the analysis.
2. Organic HAP emission factors for CTGs are from Tables 3.1-3 and 3.1.4 of AP-42 except gas-firing for formaldehyde which is based on the NESHAP Subpart YYYY MACT floor limit of 91 ppb at 15% O2.
3. Emission factors for the HRSG and auxiliary boiler are from AP-42 Tables 1.4-3 and 1.4-4.
4. Emission factors for organics from the emergency diesel generator are from AP-42 Tables 3.4-3 and 3.4-4, for the fire pump from AP-42 Table 3.3-2.
5. Metal emission factors for ULSD firing are based on the paper “Survey of Ultra-Trace Metals in Gas Turbine Fuels”, 11th Annual International Petroleum Conference, Oct 12-15, 2004. Where trace metals were detected in any of 13 samples, the average result is used. Where no metals were detected in any of 13 samples, the detection limit was used.
6. Hexavalent chrome is based on 18% of the total chrome emissions per EPA 453/R-98-004a.
7. No reduction by oxidation catalysts presumed for organic HAPs except for PAHs where a 90% efficiency is taken into account for polycyclic compounds.
8. lb/hr values are at 59°F and do not represent maximum values at higher firing rates at colder temperatures.

NTE Connecticut, LLC - Killingly Energy Center
Summary of Estimated Fugitive GHG Emissions

Circuit Breaker SF6 Emissions

SF6 Storage Capacity	111	lbs
SF6 Leak Rate	0.5%	per year
SF6 emissions	0.555	lbs/year
GHG emissions (CO2e)	**6.3**	**tons per year**

Natural Gas Handling Fugitive Emissions

Component Type	Component Count	Emission factor (scfh/component)[1]	CH4 Emissions (tpy)[2]	GHG Emissions (tpy)
Connector	10	1.69	3.08	77.04
Flanges, Regulator, Other	10	0.772	1.41	35.19
Control Valves	10	9.34	17.03	425.76
Orifice Meter	3	0.212	0.12	2.90
TOTALS			**21.64**	**540.9**

[1] Emission factors are from 40 CFR 98, Subpart W, Table W-7

[2] Conservatively assumes 100% CH4

NTE Connecticut, LLC - Killingly Energy Center
Summary of Baseline Emissions

SUMMARY OF BASELINE EMISSION RATES AND REDUCTIONS

Pollutant	Combustion Turbine				Auxiliary Boiler			
	Baseline Emission Rate (lb/MMBtu)[2]	Baseline (tpy)[3]	BACT (tpy)[4]	Reduction (tpy)	Baseline Emission Rate (lb/MMBtu)[5]	Baseline (tpy)[6]	BACT (tpy)[7]	Reduction (tpy)
NO_x	0.32	5278	133.9	5144	0.10	16.8	1.6	15.2
CO	0.082	1352.6	64.4	1288.2	0.084	14.1	7.1	7.0
VOC	0.0021	34.6	4.9	29.7	0.0055	0.92	0.78	0.1
GHGs[8]	119	2,866,710	1,966,937	899,773	N/A	N/A	N/A	N/A

[1] Emissions presented are on a per turbine basis

[2] From AP-42 Section 3.1 for uncontrolled natural gas fired combustion turbines except for GHGs

[3] Baseline calculated from gas firing at 59F of 2,827 MMBtu/hr (CT) and 895 MMBtu/hr (DB) for 8,760 hr/yr

[4] Proposed ton per year emissions excluding contribution from startup and shutdown emissions.

[5] From AP-42 Section 1.4 for uncontrolled natural gas fired boilers <100 MMBtu/hr.

[6] Based upon the rated heat input of the auxiliary boiler of 84 MMBtu/hr for 4,000 hr/yr

[7] Proposed ton per year emissions.

[8] Baseline based upon conventional steam generation with a heat rate of 10,000 Btu/kWh for 550MW firing gas

APPENDIX G-3 – AMBIENT AIR QUALITY ANALYSIS (ATTACHMENT L)

Ambient Air Quality Analysis
(Attachment L)

Killingly Energy Center

May 2016

Prepared for:

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TETRA TECH

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
ºF	degrees Fahrenheit
µg/m³	micrograms per cubic meter
ACC	air-cooled condenser
AERMOD	USEPA-approved steady-state air quality dispersion model
the Agencies	United States Forest Service, National Park Service, and United States Fish and Wildlife Service
the Application	Permit Application for Stationary Sources of Air Pollution – New Source Review for the Killingly Energy Center, April 2016
AQRV	Air Quality Related Value
ARM	Ambient Ratio Method
BPIP	Building Profile Input Program
Btu/lb	British thermal units per pound
CEMS	continuous emissions monitoring system
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
CTG	combustion turbine generator
DEEP	Connecticut Department of Energy and Environmental Protection
FLAG	Federal Land Managers' Air Quality Related Values Work Group
FLM	Federal Land Manager
g/s	grams per second
GEP	good engineering practice
GHG	greenhouse gases
H1H	highest first highest
H2H	highest second high
H8H	98^{th} percentile
H_2SO_4	sulfuric acid mist
HHV	higher heating value
HRSG	heat recovery steam generator
K	Kelvin
km	kilometers
kV	kilovolt
kW	kilowatt
MADEP	Massachusetts Department of Environmental Protection
MASC	maximum allowable stack concentration

Acronyms/Abbreviations	Definition
m/s	meters per second
MMBtu/hr	million British thermal units per hour
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NAD83	North American Datum of 1983
NH_3	ammonia
NNSR	Nonattainment New Source Review
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPS	National Park Service
NSR	New Source Review
NTE	NTE Connecticut, LLC
O_3	ozone
Pb	lead
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 micrometers or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 micrometers or less
ppm	parts per million
the Project	Killingly Energy Center, a nominal 550-MW natural gas-fired, combined cycle generating facility located in Killingly, CT
PSD	Prevention of Significant Deterioration
RIDEM	Rhode Island Department of Environmental Management
SCR	selective catalytic reduction
SER	Significant Emission Rate
SIA	Significant Impact Area
SILs	Significant Impact Levels
SO_2	sulfur dioxide
STG	steam turbine generator
SUSD	startup and shutdown
tpy	tons per year
ULSD	ultra-low sulfur distillate
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

Acronyms/Abbreviations	Definition
UTM	Universal Transverse Mercator
VISCREEN	USEPA-approved plume visibility model
VOC	volatile organic compounds
WCSS	worst-case steady-state

EXECUTIVE SUMMARY

The Killingly Energy Center is a proposed state-of-the-art combined cycle electric generating facility that has integrated emission control devices that will meet Best Available Control Technology and Lowest Achievable Emission Rate standards, as applicable. This report, which is an element of the Permit Application for Stationary Sources of Air Pollution/New Source Review submitted to the Connecticut Department of Energy and Environmental Protection on April 15, 2016, demonstrates that the Project is in compliance with all applicable ambient air quality standards and PSD increments.

In accordance with standard practice, this analysis has been conducted for the maximum potential-to-emit of the Project, a conservative aggregation of emissions associated with the highest-emitting operating scenarios for the Project under both steady-state operations for a range of loads and fuels, as well as for Project startup and shutdown. The maximum modeled case, therefore, considerably overstates the Project's actual impacts by combining assumptions for operating cases that would not occur simultaneously. Even with these conservative operating assumptions, compliance has been demonstrated.

The dispersion modeling conservatively incorporates meteorological conditions that reflect variations in wind direction and speed measured hourly over a 5-year period, in order to identify the maximum impacts under any meteorological condition over that time period. Although many other meteorological conditions occur for which impacts would be lower, the Project's compliance demonstration uses the highest impact applicable to each standard resulting from all conditions considered. The Project has demonstrated compliance with the National Ambient Air Quality Standards, levels established by the United States Environmental Protection Agency that are protective of the health of the most sensitive members of the populations. The Project has also demonstrated compliance with Prevention of Significant Deterioration increments, which indicates that existing air quality will not be significantly changed as a result of operation of the Project.

For the majority of parameters, modeled results – even with the required conservative assumptions – are below the Significant Impact Levels (screening levels established by the United States Environmental Protection Agency as to denote insignificant fractions of the National Ambient Air Quality Standards, below which a cumulative analysis is not warranted). For the two pollutants for which short-term predicted impacts exceed the Significant Impact Levels, additional modeling has been completed that evaluates the potential impacts of the Project in combination with measured existing ambient air quality background concentrations and modeled contributions from other nearby sources. This additional assessment demonstrates full compliance with all applicable ambient air quality standards.

The modeling analyses also demonstrate that maximum predicted impacts will not significantly impact sensitive vegetation or soils in the Project area. In addition, the Project will not have a significant impact on Prevention of Significant Determination Class I Area Air Quality Related Values or visibility, and will not significantly influence secondary growth in the area.

1.0 INTRODUCTION

NTE Connecticut, LLC (NTE) proposes to construct and operate the Killingly Energy Center (the Project), a nominal 550-megawatt (MW) combined cycle electric generating facility at a site located off Lake Road in the Town of Killingly, Windham County, Connecticut. The United States Geological Survey (USGS) map provided in Attachment D of the Permit Application for Stationary Sources of Air Pollution – New Source Review for the Killingly Energy Center (the Application), illustrates the general location of the Project. Construction of the proposed Project is scheduled to begin in the second quarter of 2017 and continue for a period of approximately three years. Commercial operation is expected to commence in 2020.

The proposed Project will include one combustion turbine generator (CTG), with a supplementary-fired heat recovery steam generator (HRSG), an auxiliary boiler, a natural gas-fired dew point heater, an emergency diesel generator, and an emergency fire pump diesel engine. The Project will be fired primarily with natural gas; the use of ultra-low sulfur distillate (ULSD) will be authorized for up to 720 hours per year as the backup fuel, although actual use is expected to be considerably less.

The purpose of this report is to meet the requirements of Attachment L of the Application, and present the air quality dispersion modeling analyses performed in support of the Prevention of Significant Deterioration (PSD) permit application to the Connecticut Department of Energy and Environmental Protection (DEEP) for criteria pollutants. The modeling analyses were conducted in accordance with the methodologies described in correspondence with the DEEP submitted on May 12, 2016. Information presented in this report also responds and is cross-referenced to the requirements of Attachments 215-C, 216-D, 216-E, 216-F, 216-G, and 216-H of the Application.

This report consists of four sections in addition to this introduction.

- Section 2 contains a Project description, including information regarding the Project's location and the expected air pollutant emissions, along with an applicability assessment relative to key permit-related regulations.
- Section 3 presents a detailed description of the modeling analyses undertaken to evaluate the air quality impacts of the proposed Project, including: model selection criteria; good engineering practice (GEP) stack height determination and building dimensions for model input; meteorological data; refined modeling analyses; and the ambient air quality compliance assessment, along with the modeling results.
- Section 4 discusses additional PSD analyses such as Class I Area Air Quality Related Values (AQRVs), visibility, growth, and impacts to vegetation and soils.
- Section 5 provides the references that were used in preparing this report.

The appendices include detailed source parameter data, a description of the Project's building layout and Building Profile Input Program (BPIP) analysis results, detailed AERMOD results data, background inventory source data, VISCREEN results, and detailed soils and vegetation analysis data.

The modeling analyses demonstrate that the air quality impacts resulting from maximum potential emissions from all of the Project's combustion sources, with consideration of measured existing ambient air quality background concentrations and modeled contributions from other nearby sources, will fully comply with all applicable ambient air quality standards. The modeling analyses also demonstrate compliance with PSD increments, thus ensuring that existing air quality levels will not be significantly degraded. Further, the modeling analyses demonstrate that maximum predicted impacts will not significantly impact sensitive vegetation or soils in the Project area. In addition, the Project will not have a significant impact on PSD Class I Area AQRVs or visibility, and will not significantly influence secondary growth in the area.

2.0 PROJECT DESCRIPTION

The equipment layout and exact location of the Project is illustrated in the Site Plan and USGS map provided in Attachments C and D of the Application, respectively.

2.1 SITE LOCATION

NTE proposes to construct and operate a nominal 550-MW combined cycle combustion turbine electric generating facility, known as the Killingly Energy Center, located off of Lake Road in the Town of Killingly, Connecticut. The proposed Project will be constructed on an approximately 70-acre site at a greenfield location. The site is located in Windham County, southeast of the Quinebaug River, west of Interstate 395 and Alexander Lake, and north of the Hartford Providence Turnpike. The exact location of the proposed Project and equipment can be found in Attachments C and D of the Application.

2.2 FACILITY DESCRIPTION

The proposed nominal 550-MW combined cycle electric generating facility will be in a “1-on-1” power block configuration with steam from the HRSG feeding a steam turbine generator (STG). The HRSG will be equipped with supplemental firing (duct burners) to provide additional generating capacity during periods of peak electrical demand. The Project is designed to run as a base-load plant, but will have the capability of operating at part load when necessary.

The Project will include a variety of power plant equipment including a CTG (a Siemens Model SGT6-8000H, Mitsubishi M501GAC, or equivalent); one STG; one HRSG with selective catalytic reduction (SCR) and oxidation catalyst emissions control equipment; generator step-up transformers; an electrical switchyard; ULSD storage tank; an ammonia (NH_3) storage tank; water tanks; and an air-cooled condenser (ACC). The Project will be fired primarily with natural gas, but will have the ability to run on back-up ULSD as necessary, for up to 720 hours per year. In addition, the Project will include other buildings for administrative and operating staff; warehousing of parts and consumables; and maintenance shops and equipment servicing.

The first stage in the generation process of a combined cycle power plant is the operation of the CTG. Thermal energy is produced in the CTG through the combustion of fuel (natural gas or ULSD), which is then converted into mechanical energy by a turbine that drives a generator. The exhaust gas temperature exiting the CTG is in excess of 1,000 degrees Fahrenheit (°F) and retains a significant amount of recoverable thermal energy. This thermal energy is recovered in the HRSG by generating steam that is sent to the STG to generate additional electrical energy. The generation of electricity using both a combustion turbine and steam turbine defines the combined cycle, which is the most efficient form of electrical generation using fossil fuels available.

The efficiency of the Project is further enhanced by using steam reheat systems as well as waste energy to heat feedwater in the HRSG through an additional economizer loop and also for fuel preheating. Once the steam leaves the STG, it is condensed back into water using an ACC, and this condensed water is returned to the HRSG to minimize water use. Additional steam, and consequently additional electricity, may be generated when required by the use of supplemental natural gas-fired burners (duct burners) within the HRSG. The CTG will also be equipped with inlet air evaporative cooling to increase output and efficiency during warmer ambient temperatures.

Emissions from the Project will be minimized through the use of natural gas as the primary fuel to be fired in the CTG and the sole fuel in the duct burners. ULSD (15 parts per million [ppm] sulfur) will be fired as a backup fuel in the CTG for up to 720 hours per year (although actual use is anticipated to be considerably less). The HRSG will be equipped with SCR to reduce emissions of nitrogen oxides (NO_x), and an oxidation catalyst to reduce emissions of carbon monoxide (CO) and volatile organic compounds (VOC). The SCR system will utilize 19% aqueous NH_3 as the reagent. A continuous emissions monitoring system (CEMS) will continuously sample, analyze, and record exhaust gas concentrations of NO_x, CO, and NH_3 from the 150-foot tall HRSG exhaust stack. The CEMS will be installed and operated in accordance with United States Environmental Protection Agency (USEPA) and DEEP requirements and will generate emissions data reports that will confirm compliance with permit requirements and send alarm signals to plant supervisory and control systems should emissions approach or exceed permitted limits.

Ancillary equipment at the proposed Project will include four additional fuel combustion emission units:

- One 84.0-million British thermal units per hour (MMBtu/hr) natural gas-fired auxiliary boiler equipped with ultra-low NO_x burners;
- One 12.0-MMBtu/hr natural gas-fired gas dew point heater;
- One 1,250-kilowatt (kW) emergency generator firing ULSD; and
- One 227.5-kW emergency fire pump engine firing ULSD.

To support the SCR systems, a 12,000-gallon aboveground storage tank will contain 19% aqueous NH_3. The tank will be located within a concrete containment structure along with the ammonia transfer pumps, valves, and piping. A 1 million-gallon aboveground storage tank located within a containment structure will store ULSD.

The Project will interconnect with the existing 345-kilovolt (kV) transmission line that crosses the smaller portion of the site south of Lake Road via a new switchyard. Natural gas will be delivered via a new connection to the existing pipeline located approximately 2 miles to the north of the site.

2.3 AMBIENT AIR QUALITY REGULATORY CRITERIA

The USEPA and the DEEP have promulgated regulations that establish ambient air quality standards and PSD increments. These standards and increments provide the basis for an evaluation of the potential impacts of the Project on ambient air quality.

2.3.1 National Ambient Air Quality Standards

The USEPA has developed National Ambient Air Quality Standards (NAAQS) for six air contaminants, known as criteria pollutants, for the protection of public health and welfare. These criteria pollutants are sulfur dioxide (SO_2), particulate matter,[1] nitrogen dioxide (NO_2), CO, ozone (O_3), and lead (Pb). The DEEP has also adopted these limits. The NAAQS have been developed for various durations of exposure. The NAAQS for short-term periods (24 hours or less) typically refer to pollutant levels that cannot be exceeded except for a limited number of cases per year. The NAAQS for long-term levels typically refer to pollutant levels that cannot be exceeded for exposures averaged over one year. As shown on Table L-1, the NAAQS include both “primary” and “secondary” standards. The primary standards are intended to protect human health and the secondary standards are intended to protect public welfare from any known or anticipated adverse effects associated with the presence of air pollutants.

[1] Particulate matter (PM) is characterized according to size. PM having an effective aerodynamic diameter of 10 microns or less is referred to as PM_{10}, or “respirable particulate.” PM having an effective aerodynamic diameter of 2.5 microns or less is referred to as $PM_{2.5}$, or “fine particulate.” $PM_{2.5}$ is a subset of PM_{10}. All particulate matter from the Project is conservatively assumed to be $PM_{2.5}$.

Table L-1. National Ambient Air Quality Standards

Pollutant	Averaging Period	NAAQS Primary Standard (μg/m³)	NAAQS Secondary Standard (μg/m³)
SO_2	Annual[a, j]	80	NA
	24-Hour[b, j]	365	NA
	3-Hour[b]	NA	1,300
	1-hour[i]	196	NA
PM_{10}	24-Hour[d]	150	150
$PM_{2.5}$	Annual[e]	12	15
	24-Hour[f]	35	35
CO	8-Hour[b]	10,000	NA
	1-Hour[b]	40,000	NA
O_3	8-Hour (2008 Standard)[g]	150	150
	8-Hour (1997 Standard)[g, h]	157	157
NO_2	Annual[a]	100	100
	1-hour[c]	188	NA
Pb	Rolling 3-month[a]	0.15	0.15

[a] Not to be exceeded.
[b] Not to be exceeded more than once per year.
[c] Compliance based on 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area.
[d] Not to be exceeded more than once per year on average over 3 years.
[e] Compliance based on 3-year average of weighted annual mean $PM_{2.5}$ concentrations at community-oriented monitors.
[f] Compliance based on 3-year average of 98th percentile of 24-hour concentrations at each population-oriented monitor within an area.
[g] Compliance based on 3-year average of fourth-highest daily maximum 8-hour average O_3 concentrations measured at each monitor within an area.
[h] The 1997 8-hour O_3 standard and associated implementation rules remain in place as the transition to the 2008 standard occurs.
[i] Compliance based on 3-year average of 99th percentile of the daily maximum 1-hour average at each monitor within an area.
[j] The 24-hour and annual average primary standards for SO_2 will remain in effect until one year after the effective date of the 1-hour SO_2 designations.

μg/m³ = micrograms per cubic meter

One of the basic goals of federal and state air pollution regulations is to ensure that ambient air quality, including the impact of background, existing sources, and new sources, is in compliance with ambient air quality standards. Toward this end, for each criteria pollutant, every area of the United States has been designated as one of the following categories: attainment, unclassifiable, or nonattainment, with respect to each NAAQS. In areas designated as attainment, the air quality is equal to or better than the NAAQS. These areas are under a mandate to maintain, i.e., prevent significant deterioration of, such air quality.

In areas designated as unclassifiable, there are limited air quality data, and those areas are treated as attainment areas for regulatory purposes.

In areas designated as nonattainment for a particular criteria pollutant, levels of that pollutant exceed the applicable NAAQS. These areas must take actions to improve air quality and attain the NAAQS within a certain period of time.

A proposed new major source of air pollution must undergo New Source Review (NSR). There are two NSR programs: one for sources being built in attainment/unclassifiable areas, and one for sources in nonattainment areas. The NSR program for sources in attainment/unclassifiable areas is known as the PSD program. The NSR program for sources being built in nonattainment areas is known as the Nonattainment New Source Review (NNSR) program. The Project site area is presently classified as "attainment" or "attainment/unclassifiable" (combined definition) for all pollutants except O_3. Windham County is a moderate nonattainment area for the 1997 O_3 standard and a marginal nonattainment area for the 2008 O_3 standard.

Major sources of the O_3 precursors, NO_x and VOC, are subject to the NNSR program, and the proposed Project is a major source of NO_x since annual potential emissions exceed 50 tons per year (tpy).

2.3.2 Prevention of Significant Deterioration Review

The PSD Program is a federally mandated review of new major sources of criteria pollutants designed to maintain the NAAQS and prevent degradation of air quality in attainment/unclassifiable areas. Review authority for the PSD program in Connecticut has been delgated by the USEPA to the DEEP for all pollutants.

For PSD purposes, a combined cycle electric generating facility is considered a major source if maximum permitted emissions of any one criteria pollutant are greater than 100 tpy. As shown in Table L-2, the Project will have potential emissions greater than 100 tpy for one or more attainment criteria pollutants. Therefore, the Project will be a major PSD source. For a major PSD source, PSD regulations also apply to each criteria pollutant that is emitted in excess of its defined Significant Emission Rate (SER). PSD regulations also apply to greenhouse gas (GHG) emissions from a major PSD source if potential emissions of GHG exceed the GHG SER of 75,000 tpy.

Table L-2 presents a PSD major source and SER threshold analysis for the Project. As shown in Table L-2, the Project is subject to PSD review for $PM/PM_{10}/PM_{2.5}$, NO_x, CO, VOC, sulfuric acid mist (H_2SO_4), and GHGs. Since there are no NAAQS for VOC or GHGs, a modeling analysis for those pollutants is not a PSD permit application requirement; therefore, they are not addressed in this modeling report. Rather, they are addressed in Attachment I of the Application. There is also no NAAQS for H_2SO_4, which is treated as an air toxic. As such, a maximum allowable stack concentration (MASC) analysis is included in Attachment E212- B of the Application. Therefore, it is not addressed further in this modeling report.

Table L-2. PSD Regulatory Threshold Evaluation

Pollutant	Project Annual **Potential** Emissions (tpy)	PSD Major Source Threshold (tpy)	PSD Significant Emission Rate (tpy)	PSD Review Applies
CO[a]	151.2	100	100	Yes
NO_x[a]	138.6	100	40	Yes
SO_2	25.0	100	40	No
PM	101.9	100	25	Yes
PM_{10}	101.9	100	15	Yes
$PM_{2.5}$	101.9	100	10	Yes
VOC[a]	49.2	100	40	Yes
Pb	0.002	100	0.6	No
H_2SO_4	8.8	100	7	Yes
GHGs (as CO_2e)	1,990,311[b]	N/A	75,000	Yes

[a] Includes incremental emissions due to startup and shutdown.
[b] Incudes 547 tpy of fugitive GHG emissions from circuit breakers and natural gas handling.
CO_2e = carbon dioxide equivalents

3.0 AIR QUALITY IMPACT ASSESSMENT

3.1 INTRODUCTION

The dispersion modeling analyses for the Project have been conducted in accordance with USEPA (2005) and DEEP (2009) guidance, as well as the detailed methodology description submitted by email to the DEEP on May 12, 2016.

As described in Section 2.3.2, the Project will be subject to PSD regulations for CO, NO_X, PM, PM_{10}, $PM_{2.5}$, VOC, GHG and H_2SO_4. Dispersion modeling has been conducted for CO, NO_2, PM, PM_{10}, and $PM_{2.5}$ to demonstrate compliance with the NAAQS and PSD increments; for completeness, SO_2 has also been modeled. Since potential emissions of Pb are less than 0.5% of its SER, ambient impacts were not evaluated. There are no ambient air quality standards for GHG or H_2SO_4.

Consistent with USEPA (2005) and DEEP (2009) guidance, the dispersion modeling for this Project has been conducted with the USEPA- and DEEP-recommended AERMOD dispersion model (USEPA 2004), in a manner that evaluates worst-case operating conditions in an effort to predict the highest impact for each pollutant and averaging period. Maximum predicted impacts from the worst-case scenarios are compared to the Significant Impact Levels (SILs). If maximum predicted impacts are below the corresponding SILs, then compliance is demonstrated and no additional analysis is necessary. However, if predicted impacts are greater than the SIL for one or more pollutants, a cumulative impact analysis must be conducted with other major emission sources of the pollutant(s) above its SIL in the area, as identified by the DEEP (with DEEP's Radius Search Tool and subsequent correspondence with DEEP) and the agencies for the two neighboring states, the Massachusetts Department of Environmental Protection (MADEP) and the Rhode Island Department of Environmental Management (RIDEM). The results of the cumulative modeling are compared to the NAAQS and to PSD increments. Table L-3 provides the SILs, NAAQS and PSD increments along with the modeling rank basis used for assessment of the various thresholds.

The $PM_{2.5}$ SILs were vacated on January 22, 2013 by the United States Court of Appeals for the District of Columbia Circuit (*Sierra Club v. USEPA*). However, as will be discussed in Section 3.8, existing ambient monitoring data representative of ambient background for the Project area indicate that there is sufficient margin between the ambient background levels and the NAAQS to allow use of the $PM_{2.5}$ SILs as a demonstration of compliance with the NAAQS. The SIL is only approximately 10% of this margin. Predicted Project impacts below the SILs would ensure protection of the NAAQS and, therefore, the $PM_{2.5}$ SILs are proposed to be used for this analysis.

All electronic modeling files have been provided to the DEEP.

Table L-3. SILs, NAAQS, and PSD Increments

Pollutant	Averaging Period	Rank for SIL Assessment	SIL (µg/m³)	NAAQS (µg/m³)	PSD Class II Increment (µg/m³)	Rank for NAAQS/PSD Assessment
NO_2	1-hour	H1H[1] (5-year Average)	7.5	188	NA	H8H (5-year Average)
	Annual	H1H	1	100	25	H1H
CO	1-hour	H1H	2,000	40,000	NA	H2H
	8-hour	H1H	500	10,000	NA	H2H
PM_{10}	24-hour	H1H	5	150	30	H6H
	Annual	H1H	1	NA	17	H1H
$PM_{2.5}$ (NAAQS))	24-hour	H1H (5-year Average)	1.2	35	NA	H8H (5-year Average)

Pollutant	Averaging Period	Rank for SIL Assessment	SIL (µg/m^3)	NAAQS (µg/m^3)	PSD Class II Increment (µg/m^3)	Rank for NAAQS/PSD Assessment
	Annual	H1H (5-year Average)	0.3	12	NA	H1H (5-year Average)
$PM_{2.5}$ (PSD)	24-hour	H1H (5-year Average)	1.2	NA	9	H2H
	Annual	H1H (5-year Average)	0.3	NA	4	H1H
SO_2	1-hour	H1H (5-year Average)	7.8	196	NA	H4H (5-year Average)
	3-hour	H1H	25	1,300	512	H2H
	24-hour	H1H	5	365	91	H2H
	Annual	H1H	1	80	20	H1H

[1] H1H = highest first highest, H2H = highest second highest, etc.

3.2 SOURCE DATA AND OPERATING SCENARIOS [ATTACHMENT 216-E]

The modeling analyses for the Project include the CTG/duct burners, the gas dew point heater, the emergency diesel generator, the fire pump diesel engine, and the auxiliary boiler. Air quality dispersion modeling has been conducted for a range of operating scenarios to capture worst-case potential impact concentrations from the CTG. Table L-4 summarizes stack characteristics for the HRSG stack and ancillary sources.

Table L-4. Stack Characteristics

Source	UTM* E (m)	UTM N (m)	Base Elevation (feet)	Stack Height (feet)	Stack Diameter (feet)
HRSG Stack	257865.32	4638682.97	315	150	22.0
Auxiliary Boiler	257878.32	4638701.01	315	90	4.0
Emergency Generator	257960.02	4638630.40	315	40	1.17
Fire Pump	257806.97	4638639.43	315	20	1.0
Gas Dew Point Heater	258149.52	4638593.34	326	20	1.0

*UTM = Universal Transverse Mercator

The CTG was modeled for the range of expected operating loads (full, mid, and low loads) over the range of expected ambient temperatures (-10°F, 59°F, 100°F). The operating scenarios include inlet air cooling and supplemental firing of the HRSG. The worst-case loads by pollutant and averaging period have then been used for Project-only modeling and, if necessary, cumulative modeling. Turbine transient startup and shutdown (SUSD) conditions have also been considered for short-term averaging period standards of 24 hours and less, and annual averages. Since startup conditions for these turbines generally last for less than 1 hour, the contribution of SUSD to predicted impacts are calculated as a weighted average with worst-case steady-state (WCSS) load impacts according to the following assumptions:

- 1-hour: Full SUSD impacts, no weighting
- 3-hour: 1/3 SUSD, 2/3 WCSS (conservatively assumes 1 start and shutdown per period)
- 8-hour: 2/8 SUSD, 6/8 WCSS (conservatively assume 2 starts and shutdowns per period)
- 24-hour: 4/24 SUSD, 20/24 WCSS (conservatively assumes 4 starts and shutdowns per period)
- Annual: 500/8,760 SUSD, 8,260/8,760 WCSS (conservatively assumes a maximum of 500 hours of SUSD operation)

The natural gas dew point heater will operate simultaneously with the CTG and the modeling analysis assesses their combined operation. The auxiliary boiler will typically operate to provide sealing steam to the STG during startups and it will not operate simultaneously with the CTG except for brief periods of overlap. The diesel generator and fire pump engines will each be limited to 300 hours per year or 500 hours per year combined (both engines); however, they will typically only be operated for testing one time per week for 1 hour or less. The auxiliary boiler has been evaluated for all averaging periods. The emergency engines were considered for all averaging periods with the exception of the 1-hour NO_2 and 1-hour SO_2 statistical-based standards. Consistent with recent USEPA guidance (USEPA 2011), the engines were excluded from the modeling for the 1-hour NO_2 and 1-hour SO_2 statistical-based standards, since they are "intermittent" based on the guidance. Emissions for the engines were normalized for periods longer than 1 hour to reflect typical test operations. Engine emission rates for the 3-hour, 8-hour, and 24-hour averaging periods have been scaled by 1/3, 1/8, and 1/24 hours, respectively.

Tables L-5 and L-6 provide emission rates and stack parameters that bracket the full range of normal operating loads for natural gas-fired and ULSD-fired conditions, respectively.

Table L-7 provides worst-case emission rates and stack parameters under startup conditions. The startup parameters are based on worst-case emissions and stack parameters considering the hot start, warm start, and cold startup conditions, as well as shutdown conditions.

Table L-8 provides the stack parameters for the gas dew point heater, emergency diesel generator, fire pump engine, and the auxiliary boiler.

The CTG was first modeled alone to determine worst-case load conditions for each pollutant and averaging period. The CTG under worst-case load conditions was then modeled in combination with the ancillary units to determine total Project impacts. Note that the auxiliary boiler will not operate simultaneously with the CTG except during brief periods when operation overlaps during CTG startup. The emergency generator and fire pump engines will operate for emergencies and for testing, which will normally consist of operation one time per week for up to 1 hour.

3.3 MODEL SELECTION

The USEPA-recommended AERMOD modeling system (USEPA 2004) has been used to conduct the dispersion modeling. The most current versions of the model have been used (AERMOD version 15181, AERMAP version 11103).

3.4 METEOROLOGICAL DATA

The modeling has been conducted using five years (2010-2014) of meteorological data processed and provided by the DEEP. The surface data are from the Windham Airport in Windham, Connecticut and the corresponding upper air data are from Albany, New York. The surface station is located approximately 25.7 kilometers (km) (16 miles) southwest of the Project site. It is representative of the Project site area because of its relatively close proximity and similar distance from the coastline with no significant intervening terrain. A windrose plot describing the wind speed and wind direction frequency distribution for these data is provided in Figure L-1.

3.5 LAND USE

A land use determination has been made following the classification technique suggested by Auer (Auer 1978) in accordance with USEPA/DEEP modeling guidance. The classification technique was conducted to determine the predominant land use (urban versus rural) in the area for the dispersion characteristics, by assessing land use categories within a 3-km radius of the proposed site. Figure L-2 provides an aerial view of the 3-km radius around the proposed Project site. Inspection of this aerial photo, other maps, and on-site inspection, indicates that the large majority of the area is characterized as rural. Therefore, rural dispersion coefficients have been used for the air quality modeling.

Table L-5. Load Scenarios and Emission Rates - Combined Cycle Combustion Turbine Firing Natural Gas

Parameter	Units	Natural Gas													
		100 °F					59°F					-10°F			
		1	2	3	4	5	36	37	38	39	40	32	33	34	35
GT Operating Load		100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%
Fuel Higher Heating Value (HHV)	Btu/lb	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150
Evaporative Cooler Status	On or Off	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	On or Off	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
Exhaust velocity	m/s	17.39	17.27	16.25	13.76	10.87	18.44	18.08	17.87	14.66	10.86	18.72	18.26	14.67	10.96
Exhaust temperature	K	358.7	361.5	359.8	360.9	359.8	358.2	355.4	355.4	354.3	354.3	359.8	355.4	354.3	354.3
NO_X	g/s	3.326	2.533	2.369	1.865	1.348	3.578	2.722	2.684	2.129	1.411	3.692	2.822	2.243	1.487
CO	g/s	2.029	1.550	1.449	1.134	0.819	2.180	1.663	1.638	1.298	0.857	2.255	1.726	1.361	0.907
PM	g/s	2.608	1.449	1.373	1.159	1.008	2.822	1.575	1.562	1.285	1.008	2.885	1.613	1.298	1.008
SO_2	g/s	0.630	0.479	0.454	0.365	0.265	0.680	0.517	0.517	0.416	0.277	0.706	0.542	0.428	0.290

Btu/lb = British thermal units per pound; g/s = grams per second; K = degrees Kelvin

Table L-6. Load Scenarios and Emission Rates - Combined Cycle Combustion Turbine Firing ULSD

Parameter	Units	ULSD										
		100°F				59°F				-10°F		
		41	42	43	44	68	69	70	71	65	66	67
GT Operating Load		100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, HHV	Btu/lb	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444
Evaporative Cooler Status	On or Off	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	On or Off	---	---	---	---	---	---	---	---	---	---	---
Exhaust velocity	m/s	18.01	17.08	14.03	13.03	18.70	18.49	15.17	13.55	20.15	16.31	14.61
Exhaust temperature	K	372.6	370.4	367.6	366.5	366.5	365.9	363.2	362.6	373.2	368.7	367.6
NO_X	g/s	6.709	6.285	5.032	4.588	6.925	6.814	5.451	4.752	6.922	5.606	4.969
CO	g/s	1.634	1.530	1.225	1.117	1.686	1.659	1.327	1.157	1.686	1.365	1.210
PM	g/s	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780
SO_2	g/s	0.491	0.454	0.365	0.340	0.504	0.491	0.403	0.353	0.504	0.403	0.365

Table L-7. Startup Condition Stack Parameters for Each Fuel

Parameter	Units	Startup / Shutdown							
		Natural Gas				ULSD			
		Hot Start	Warm Start	Cold Start	Shutdown	Hot Start	Warm Start	Cold Start	Shutdown
Exhaust velocity	m/s	14.13	14.84	12.17	10.32	10.15	11.01	9.99	9.95
Exhaust temperature	K	352.4	353.6	351.9	353.0	403.6	404.1	403.6	401.3
NO_X	g/s	15.649	17.871	14.091	10.065	22.130	24.304	21.784	21.226
CO	g/s	47.710	55.088	60.128	26.726	249.007	290.502	277.902	54.100
PM	g/s	2.277	2.200	2.027	2.385	4.095	4.142	4.127	4.064
SO_2	g/s	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788
m/s = meters per second									

Table L-8. Stack Parameters for Ancillary Equipment

Parameter	Time	Auxiliary Boiler	Emergency Generator	Fire Pump	Natural Gas Heater
Exhaust velocity (m/s)		8.29	31.19	7.12	17.46
Exhaust temperature (K)		422.0	722.0	789.3	394.3
NO_X (g/s)	1-hour	0.089	2.223	0.253	0.017
	Annual	0.041	0.076	0.0087	0.0075
CO (g/s)	1-hour	0.392	1.216	0.222	0.056
	8-hour	0392	0.152	0.028	0.056
PM (g/s)	1-hour	0.053	0.069	0.013	0.008
	24-hour	0.053	0.0029	0.0005	0.008
	Annual	0.024	0.0024	0.00048	0.0035
SO_2 (g/s)	1-hour	0.016	0.0025	0.00038	0.0023
	3-hour	0.016	0.00084	0.00013	0.0023
	24-hour	0.016	0.00011	0.00002	0.0023
	Annual	0.007	0.00009	0.00001	0.0011

3.6 GOOD ENGINEERING PRACTICE STACK HEIGHT ANALYSIS

A GEP stack height analysis has been performed based on the Project structures to determine the potential for building-induced aerodynamic downwash for the proposed stack. The analysis procedures described in USEPA's Guidelines for Determination of Good Engineering Practice Stack Height (USEPA 1985) and DEEP guidance (DEEP 2009) have been used.

The GEP formula height is based on the observed phenomena of disturbed atmospheric flow in the immediate vicinity of a structure resulting in higher ground-level concentrations at a closer proximity to the building than would otherwise occur. It identifies the minimum stack height at which significant aerodynamic downwash is avoided, and the maximum stack height[2] that can be used in modeling analyses. The GEP formula stack height, as defined in the 1985 guidelines, is calculated as follows:

[2] The maximum stack height a modeling analysis can take credit for is the greater of 65 meters or the GEP formula stack height.

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

Where:

- H_{GEP} is the calculated GEP formula height;
- H_{BLDG} is the height of the nearby structure; and
- L is the lesser dimension (height or projected width) of the nearby structure.

Both the height and width of the structure are determined from the frontal area of the structure projected onto the plane perpendicular to the direction of the wind. The GEP stack height is based on the plane projected from any structure that results in the greatest calculated height. For the purpose of the GEP analysis, nearby refers to the "sphere of influence" defined as 5 times L (the lesser dimension [height or projected width] of the nearby structure), downwind from the trailing edge of the structure.

In order to minimize visual impact, the HRSG stack height for the Project will be limited to 150 feet, which is less than the GEP height. Therefore, the USEPA's BPIP (Dated: 04274) version that is appropriate for use with the PRIME algorithms in AERMOD was used. The building dimensions and coordinates for each potentially influencing structure were input into the BPIPPRM program to determine direction-specific building data for input to AERMOD. The PRIME algorithms calculate the entire configuration of the structure's wake from the cavity immediately downwind of the structure to the far wake to evaluate downwash effects in the modeling. Schematic diagrams, which describe the site building configuration along with the BPIP input and output data, are provided in Appendix L-B.

3.7 RECEPTOR GRID AND AERMAP PROCESSING

Discrete receptors were placed at 25-meter intervals along the Project fence line. In addition, a nested Cartesian grid was extended out from the fence line at the following receptor intervals and distances:

- At 50-meter intervals from the fence line to 300 meters;
- At 100-meter intervals from the 300 meters to 2,000 meters;
- At 500-meter intervals from 2,000 to 5,000 meters;
- At 1,000-meter intervals from 5,000 to 10,000 meters; and
- At 2,000-meter intervals from 10,000 to 20,000 meters.

Terrain elevations at receptors were determined using BEE-Line Software's BEEST program and USGS digital terrain data. BEEST implements the AERMAP model, which includes processing routines that extract National Elevation Data at 10-meter spacing based on North American Datum of 1983 (NAD83). The four nearest data points surrounding each receptor have been used to determine receptor terrain elevations (by interpolation) for air quality model input.

For any cases where the maximum model concentrations were predicted beyond the dense (50-meter intervals) portion of the grid, supplemental receptors were placed around the initial maximum location (at a 50-meter grid spacing interval) to ensure higher concentrations were not overlooked.

3.8 AMBIENT BACKGROUND DATA [ATTACHMENT 216-D AND 216-F]

As previously stated, if AERMOD-predicted maximum-impact concentrations are greater than a SIL for any pollutant/averaging time, then multi-source modeling is required to be conducted for that pollutant/averaging time. In the multi-source modeling analysis, representative ambient air quality background concentrations are added to modeled concentrations from the cumulative modeling to compare against the NAAQS. Representative ambient air quality data and the selected background concentrations that were used in the compliance assessment are provided in Table L-9.

Table L-9. Ambient Air Quality Monitoring Data and Selected Background Concentrations*

Pollutant	Averaging Period	Rank	Background Concentration (µg/m^3)
CO	1-hour	2nd high	2185
	8-hour	2nd high	1495
NO_2	1-hour	98th percentile	79.0
	Annual	Mean	16.9
$PM_{2.5}$	24-hour	98th percentile	20
	Annual	Mean	7.4
PM_{10}	24-hour	2nd high	25
SO_2	1-hour	99th percentile	21.0
	3-hour	2nd high	23.6
	24-hour	2nd high	12.1
	Annual	Mean	2.0

*All monitoring data collected at McAuliffe Park, East Hartford, CT (ID# 09-009-1003).

DEEP monitoring data, as well as monitoring data from neighboring states, were reviewed to identify representative monitoring sites and determine ambient background concentrations for the Project area. The monitoring site selections considered proximately to the Project area, and similarity of the monitoring site environment to the relatively rural Project site area.

The ambient data for all pollutants comes from the McAuliffe Park monitor located in East Hartford. This monitoring site is suburban/residential in character and is located just 120 meters east of Route 5, 2.0 km east of I-91, and 2.5 km south of I-291. Therefore, the data from the monitoring site are conservatively representative of ambient background concentrations for the relatively rural Project area, with Interstate 395 located approximately 2.5 km east of the Project site. Therefore, for the purposes of this analysis, the ambient monitoring data presented in Table L-9 are considered representative of the Project area ambient background.

3.9 POTENTIAL SECONDARY $PM_{2.5}$ FORMATION ASSESSMENT

The analysis of $PM_{2.5}$ impacts is consistent with recent USEPA guidance on $PM_{2.5}$ permit modeling (USEPA 2013). Since the Project has an annual potential-to-emit of direct $PM_{2.5}$ and NO_x both greater than their respective SER thresholds, air quality impacts from both primary and secondary $PM_{2.5}$ emissions were assessed. Impacts of primary $PM_{2.5}$ emissions have been determined with dispersion modeling using AERMOD. The guidance indicates that the Project falls in the Case 3 Assessment category, where secondary $PM_{2.5}$ can be assessed by either a qualitative, hybrid qualitative/quantitative, or full quantitative approach.

Since no suitable existing photochemical modeling study has been identified to use for a hybrid $PM_{2.5}$ assessment, a qualitative assessment has been used to assess potential secondary $PM_{2.5}$ impacts for the Project. The qualitative approach is analogous to the example qualitative approach described in the recent draft $PM_{2.5}$ guidance. Specific details are summarized below:

- Model-predicted impacts indicate primary $PM_{2.5}$ impacts will be located very close to the Project (either at the facility fence line or within a few hundred meters of the fence line). Secondary $PM_{2.5}$ impacts are expected to be very low (negligible) in the vicinity of areas where model-predicted primary $PM_{2.5}$ impacts are highest, because there is not enough time for secondary chemical reactions to occur. Conversely, what limited secondary $PM_{2.5}$ emissions may form will occur several miles from the Project site and where the primary $PM_{2.5}$ impacts will be lowest. This makes it highly unlikely that maximum $PM_{2.5}$ primary and secondary impacts will occur at the same time and place.

- There will be a relatively small amount of $PM_{2.5}$ precursor emissions from the Project when compared to the existing source emissions in the region, especially for SO_2, where Project emissions are less than the SER threshold.
- The ambient background $PM_{2.5}$ monitoring data are quality assured and account for secondary $PM_{2.5}$ from regional emission sources. There is no indication that secondary formation of $PM_{2.5}$ from existing regional sources is causing or contributing to a violation of the NAAQS.
- RIDEM's Francis School monitor (USEPA AIRS monitor 44-007-1010) located in Providence, RI is the closest $PM_{2.5}$ monitor that also has speciation data available. These speciated $PM_{2.5}$ data were reviewed and it was determined that, over the last two-year period (2014-2015), the fraction of total nitrate to total $PM_{2.5}$ is just 9.8% on an average annual basis. Given that the proposed NO_x emissions for the Project are a small fraction of the NO_x emissions in the airshed, and that the ambient monitoring data show relatively small fractions of nitrates, secondary $PM_{2.5}$ formation from the proposed NO_x emissions would be expected to be considerably smaller than the monitored concentration of nitrates. The monitoring information supports the conclusion that the secondary $PM_{2.5}$ formation will be negligible and would not be expected to cause a NAAQS or PSD increment exceedance.

For the reasons stated above, emissions of $PM_{2.5}$ precursors from the Project, together with emissions of primary $PM_{2.5}$, will not cause or contribute to violations of the $PM_{2.5}$ NAAQS. Given this result, detailed quantification of secondary $PM_{2.5}$ is not necessary.

3.10 PROJECT MODELING ANALYSIS

The modeling analysis has been conducted using AERMOD along with the set of representative meteorological data as described in Section 3.4. The analysis was conducted to demonstrate compliance with the NAAQS and PSD increments. If maximum impacts from the Project's criteria pollutant emissions are predicted to exceed their associated SILs shown in Table L-3, a refined cumulative modeling analysis with additional major sources was conducted to determine compliance with the NAAQS and PSD increments. The full range of CTG operating conditions described in Table L-5 through Table L-7 was evaluated to determine worst-case loads (highest impact concentrations) for each pollutant and averaging period. Detailed results of this analysis are provided in Appendix L-C.

The CTG under worst-case load conditions was then modeled along with the other Project emissions sources (natural gas dew point heater, emergency generator and fire pump engines, and auxiliary boiler) to determine total Project impacts. Note that the auxiliary boiler will not operate simultaneously with the turbines, except for brief periods during startup. The case of a CTG in startup mode along with the auxiliary boiler operating has been assessed with modeling. Operation of the CTG simultaneously with the natural gas dew point heater, emergency generator, and fire pump engine has also been assessed. Normalized emission rates corresponding with short-term and annual operation, as shown in Table L-8, were used for the assessment of standards.

The NO_2 impact analysis is consistent with the approach outlined in the USEPA guidance on 1-hour NO_2 dispersion modeling, "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard" (USEPA 2011). The Tier 2 Ambient Ratio Method (ARM) factors of 0.8 for short-term concentrations and 0.75 for annual concentrations have been applied. Also consistent with the USEPA guidance, the emergency generator engine and emergency fire pump engine have been excluded from the statistical-based 1-hour NO_2 and 1-hour SO_2 analyses as "intermittent" sources. These units will be permitted to operate up to 300 hours per year per engine or up to 500 hours per year for both engines combined; however, absent emergencies, actual operations are expected to be less than 52 hours per year each since they will typically only be operated for testing one time per week for less than 1 hour. In addition, the SUSD conditions for the turbine will be limited to 500 hours per year, but actual SUSD operation is expected to be much less. Therefore, assessment of the 1-hour NO_2 NAAQS for transient turbine SUSD conditions consists of adding ambient background to the maximum predicted Project-only concentrations (98th percentile [H8H] of the daily maximum 1-hour concentration averaged over 5 years). No comparison with the SIL or cumulative modeling is conducted for 1-hour NO_2 for SUSD conditions, since these conditions are intermittent and do not occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations on which the 1-hour NO_2 standard is based.

The AERMOD results for the Project are summarized in Table L-10. Detailed results for the analyses are also provided in Appendix L-C. As shown in Table L-10, maximum predicted impact concentrations are less than SILs for all pollutants except 1-hour NO_2 and 24-hour $PM_{2.5}$. Compliance with NAAQS and PSD increments is demonstrated for pollutants with predicted impacts less than the SIL. Because of these results, no additional modeling for these pollutants is necessary.

Cumulative modeling has been conducted for pollutants with Project impacts that exceed their respective SILs (1-hour NO_2 and 24-hour $PM_{2.5}$) to demonstrate compliance with the 1-hour NO_2 NAAQS[3] and 24-hour $PM_{2.5}$ NAAQS and PSD increments, as described in Section 3.11.

[3] Note that there is no PSD increment for 1-hour NO_2, so no increment assessment is necessary for this pollutant/averaging period.

Table L-10. Maximum Predicted Impact Concentrations

Pollutant	Averaging Period	Rank Basis for SIL Assessment	Impact Concentration (µg/m³)	SIL (µg/m³)	Extent of SIA (km)	NAAQS (µg/m³)	PSD Class II Increment (µg/m³)
NO_2 (Normal Load)	1-hour	H1H (5-year Average)	21.07	7.5	20.2	188	NA
	Annual	H1H	0.92	1	NA	100	25
NO_2 (SUSD)	1-hour	H1H (5-year Average)	84.31	NA	NA	188	NA
	Annual	H1H	0.93	NA	NA	100	25
CO	1-hour	H1H	1,427	2,000	NA	40,000	NA
	8-hour	H1H	131	500	NA	10,000	NA
PM_{10}	24-hour	H1H	3.96	5	NA	150	30
	Annual	H1H	0.34	1	NA	NA	17
$PM_{2.5}$	24-hour	H1H (5-year Average)	3.15	1.2	8.05	35	9
	Annual	H1H (5-year Average)	0.29	0.3	NA	12	4
SO_2	1-hour	H1H (5-year Average)	2.92	7.8	NA	196	NA
	3-hour	H1H	1.51	25	NA	1300	512
	24-hour	H1H	0.99	5	NA	365	91
	Annual	H1H	0.09	1	NA	80	20

Notes:
Maximum highest first highest (H1H) concentrations are used for comparison with the SILs. Impact concentrations are based on maximum predicted across the range of 5 years modeled for all pollutants except $PM_{2.5}$ (both annual and 24-hour), NO_2 (1-hour only), and SO_2 (1-hour only), which are based on the maximum 5-year average H1H values. NO_2 concentrations assume NO_x to NO_2 conversion at 80% (short term) and 75% (annual). $PM_{2.5}$ SIL assessment relative to PSD increment compliance is based on H1H concentrations prediction over the range of 5 years modeled, rather than the 5-year average concentrations that are used for the NAAQS assessment.

SIA = Significant Impact Area, defined as a circle with a radius equal to the distance to the furthest receptor for which the maximum predicted impact exceeds the SIL.

3.11 CUMULATIVE IMPACT MODELING

As described in Section 3.10, maximum predicted impact concentrations for 1-hour NO_2 and 24-hour $PM_{2.5}$ exceed their respective SILs. Therefore, a cumulative modeling analysis including other regional emissions sources and existing ambient background concentrations has been conducted for these pollutants and averaging periods. The source inventory was based on the DEEP Radius Search Tool for 2008 Air Emissions Inventory Data, provided by DEEP. The Radius Search Tool was used to develop an inventory of sources located within 50 km of the Project site. DEEP guidance, based on distance and actual annual emissions levels, was used to select from the inventory the specific sources to be included in the cumulative modeling assessment. Consultation with MADEP and RIDEM also occurred to identify appropriate source information in those respective states.

Five background NO_X sources met the DEEP criteria for inclusion in the cumulative 1-hour NO_2 NAAQS analysis; two background sources of $PM_{2.5}$ met the criteria for inclusion in the cumulative 24-hour $PM_{2.5}$ NAAQS analysis; and one background source met the criteria for inclusion in the 24-hour $PM_{2.5}$ PSD increment assessment. As discussed in Section 3.10, there is no PSD increment for 1-hour NO_2.

The sources modeled cumulatively with the Project are as follows:

<u>NO_2 NAAQS Interactive Modeling Sources</u>

- Lake Road Generating Co., LLC, Killingly Connecticut; distance from Project = 2.0 km
  - Combustion Turbine #1 – Actual NO_x = 20.6 tpy
  - Combustion Turbine #2 – Actual NO_x = 30.0 tpy
  - Combustion Turbine #3 – Actual NO_x = 26.6 tpy
- Exeter Energy L.P., Sterling Connecticut; distance from Project = 18.7 km
  - Standard Kessl Inc./Blr #1, Actual NO_x = 45.8 tpy
  - Standard Kessl Inc./Blr #2, Actual NO_x = 50.8 tpy
- Wheelabrator Millbury, Inc., Millbury Massachusetts; distance from Project = 41.4 km
  - B&W Incinerator #1/#2 – Actual NO_x = 824 tpy
- Algonquin Gas Compressor Station, Burrillville, Rhode Island; distance from Project = 17.7 km - Existing and Proposed Expansion
  - Actual NO_x = 18.0 tpy
  - Proposed Emission Increases NO_x = 18.0 tpy
  - Three Clark TLA-8 Engines (existing)
  - Five Combustion Turbines (3 existing / 2 proposed)
- Invenergy Clean River Energy Center (proposed), Burrillville, Rhode Island; distance from Project = 17.7 km
  - Potential NO_x = 286.6 tpy, Potential $PM_{2.5}$ = 196.8 tpy
  - Two Combined Cycle Combustion Turbines (proposed)

<u>$PM_{2.5}$ Interactive Modeling Sources</u>

- Lake Road Generating Co., LLC, Killingly Connecticut; distance from Project = 2.0 km ($PM_{2.5}$ NAAQS only; constructed before PSD baseline date)
  - Combustion Turbine #1 – Actual $PM_{2.5}$ = 23.1 tpy
  - Combustion Turbine #2 – Actual $PM_{2.5}$ = 12.5 tpy
  - Combustion Turbine #3 – Actual $PM_{2.5}$ = 9 tpy
- Invenergy Clean River Energy Center (proposed), Burrillville, Rhode Island (Proposed Project); distance from Project = 17.7 km
  ($PM_{2.5}$ NAAQS and PSD)

- Distance from Project = 17.7 km
- Potential $PM_{2.5}$ = 196.8 tpy
- Two Combined Cycle Combustion Turbines (proposed)

Detailed emissions and stack parameter data for these sources are provided in Appendix L-D, along with details on the source inventory selection criteria.

Table L-11 presents the results of the NAAQS compliance assessment. This assessment includes the predicted cumulative impacts of the Project and background inventory sources plus representative ambient background concentrations for all receptors and time periods where the Project has a significant impact. As shown in Table L-11, the resulting total concentrations are less than the corresponding NAAQS concentrations for all pollutants. Detailed results of the modeling analysis are provided in Appendix L-C.

Table L-11. Cumulative NAAQS Compliance Assessment

Pollutant	Averaging Period	Cumulative Impact Concentration (μg/m³)	Ambient Background (μg/m³)	Total Impact Plus Background (μg/m³)	NAAQS (μg/m³)
NO_2 (Normal Load)	1-Hour	67.5	79	146.5	188
NO_2 (SUSD)	1-Hour	62.5	79	141.5	188
$PM_{2.5}$	24-hour	7.2	20	27.2	35

Notes:
- Total cumulative impact concentrations based on consideration of all receptors and time periods where the Project has a predicted significant impact concentration (based on 5-year average maximum H1H for 1-hour NO_2 and 24-hour $PM_{2.5}$).
- NO_2 concentrations conservatively assume 80% NO_X to NO_2 conversion.
- Assessment of the 1-hour NO_2 NAAQS for the transient turbine SUSD conditions consists of adding ambient background to Project-only concentrations.

3.12 PSD INCREMENT CONSUMPTION ANALYSIS

The PSD program requires a demonstration that the proposed Project, in combination with other PSD increment-consuming emission sources (as described in Section 3.11), will comply with the maximum allowable PSD increment. PSD increments prevent the air quality in areas that meet NAAQS from deteriorating to the level set by the NAAQS. The NAAQS is a maximum allowable concentration “ceiling.” A PSD increment, on the other hand, is the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant. The baseline concentration is defined for each pollutant and, in general, is the ambient concentration existing at the time that the first complete PSD permit application affecting the area is submitted.

A PSD increment analysis was conducted for 24-hour $PM_{2.5}$, which is the only pollutant/averaging time for which a PSD increment has been set and for which Project impacts exceed the respective SIL.

Table L-12 presents the results of the PSD increment compliance assessment for 24-hour $PM_{2.5}$. As shown, the cumulative impacts of the Project and the proposed Invenergy Clean River Energy Center (the only other PSD increment-consuming source in the area) are less than the available increment. Detailed results for the analysis are also provided in Appendix L-C.

Table L-12. Cumulative PSD Increment Compliance Assessment

Pollutant	Averaging Period	Total Increment Consumption[1] (µg/m³)	Maximum Allowable PSD Increment (µg/m³)
$PM_{2.5}$	24-hour	3.4	9
[1] Impact concentrations are conservatively based on the maximum highest second highest (H2H) concentration predicted across the range of modeled years.			

4.0 EVALUATION OF ADDITIONAL IMPACTS

In accordance with PSD regulations, additional impacts must be addressed for projects subject to PSD review. The additional PSD impact analyses involving air quality modeling are discussed in this section.

4.1 CLASS I AREA AIR QUALITY RELATED VALUES

The nearest PSD Class I Areas to the Project are as follows:

- Lye Brook National Wilderness Area, Vermont – located approximately 160 km from the Project.
- Presidential Range – Dry River National Wilderness Area, New Hampshire – located approximately 250 km from the Project.

The Federal Land Managers' (FLM) Air Quality Related Values Work Group (FLAG) has implemented initial screening criteria to determine whether impacts to Class I Areas from sources greater than 50 km away would be considered negligible for all AQRVs, including visibility. The screening criteria are detailed in FLAG's October 2010 Phase I Report (United States Forest Service [USFS] et al. 2010). The FLAG Phase I Report was produced as a collaborative report by the FLMs in the USFS, National Park Service (NPS), and United States Fish and Wildlife Service (USFWS) (collectively "the Agencies"). The details of the screening criteria are given below.

> *…the Agencies will consider a source locating greater than 50 km from a Class I area to have negligible impacts with respect to Class I AQRVs if its total SO_2, NO_X, PM_{10}, and H_2SO_4 [sulfuric acid] annual emissions (in tons per year, based on 24-hour maximum allowable emissions), divided by the distance (in km) from the Class I area (Q/D) is 10 or less. The Agencies would not request any further Class I AQRV impact analyses from such sources* (USFS et al. 2010).

The combined annual potential-to-emit for SO_2, NO_x, PM_{10}, and H_2SO_4 for the Project (based on 24-hour maximum emissions), is approximately 397 tpy. The approximate distance to the Lye Brook National Wilderness Area, the closer of the two PSD Class I Areas, is 160 km. The resulting Q/D value of 2.5 is well below the screening level of 10. Therefore, no additional analysis of Class I Area impacts is required for the Project.

4.2 VISIBILITY [ATTACHMENT 216-G]

The Project will comply with the particulate matter and visible emissions requirements specified in Section 22a-174-18 of the Regulations of Connecticut State Agencies. Compliance with these regulations will address the intent of the PSD plume blight visibility requirements.

The VISCREEN model was used to assess potential visibility impacts at the closest Class I Area, the Lye Brook National Wilderness Area (160 km away). The Project's maximum potential emissions were used in the analysis. The results (provided in Appendix L-E) indicate that the visibility impairment related to the Project's plume will not exceed threshold criteria.

4.3 SOILS AND VEGETATION [ATTACHMENT 216-G]

The USEPA guidance document for soils and vegetation, *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (USEPA 1980), established a screening methodology for comparing air quality modeling impacts to "vegetation sensitivity thresholds." These methods were used to evaluate potential impacts on vegetation and soils.

4.3.1 Vegetation Assessment

As an indication of whether emissions from the Project will significantly impact the surrounding vegetation (i.e., cause acute or chronic exposure to each evaluated pollutant), the model predicted impact concentrations are compared against both a range of injury thresholds found in the guidance, as well as those established by the NAAQS secondary standards.

The dominant upland vegetative cover types for the portion of the Project site located north of Lake Road (where the Project is proposed) are maturing, second-growth deciduous-evergreen forest, evergreen (white pine dominated) forest, and pioneer, pole-sized evergreen dominated forest. The latter occurs in the areas closer to Lake Road, historically used for agriculture (e.g., pasture, fruit tree grove, hayfield, etc.). This portion of the Project site includes wetland areas that are dominated by both deciduous and evergreen cover types (red maple dominates the interior and white pine-hemlock dominates the margins), along with a significant ground cover of sedges and sphagnum mosses

The small portion of the Project site located south of Lake Road is mostly in post-agricultural deciduous woods and shrub tangles, on moderately to gently sloping land, with a mowed field on nearly level topography within its northernmost section. The majority of this portion of the site is upland, with limited wetland areas located along the parcel's eastern property boundary, mostly off-site and within the electric transmission line right-of-way. These wetlands are dominated by scrub-shrub and emergent (i.e., wet meadow) cover types.

The species prevalent in the area do not represent vegetation that would be expected to be more sensitive than those used by USEPA to establish the screening concentrations provided in Tables L-13 through L-16.

As an indication of whether emissions from the proposed Project will significantly impact (i.e., cause acute or chronic exposure to each evaluated pollutant) any surrounding vegetation with commercial or recreational value, the modeled emission concentrations are compared against both a range of injury thresholds found in the guidance and appropriate literature, as well as those established by the NAAQS secondary standards. Since the NAAQS secondary standards were set to protect public welfare, including protection against damage to crops and vegetation, comparing modeled emissions to these standards will provide some indication if potential impacts are likely to be significant. Tables L-13 through L-15 list the Project impact concentrations and compare them to the vegetation sensitivity thresholds and NAAQS secondary standards. All pollutant concentrations are well below the vegetation sensitivity thresholds.

Table L-13. Predicted Air Quality Impacts Compared to NO_2 Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts (μg/m^3)	Threshold for Impact to Vegetation (μg/m^3)	Applicability
1-hour	84.3	66,000[a]	Leaf Injury to plant
2-hour	84.3	1,130[b]	Affects to alfalfa
Annual	0.93	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 μg/m^3) which was found to depress the photosynthesis rate of alfalfa during a 2-hour exposure.

[c] "Secondary National Ambient Air Quality Standard (μg/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 L-14. Predicted Air Quality Impacts Compared to CO Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts (μg/m^3)	Threshold for Impact to Vegetation (μg/m^3)	Applicability
1-hour	1,427	40,000[a]	Protects all vegetation
8-hour	131	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 (μg/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.

[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 μg/m^3. Concentrations this low had no effects to various plant species. For many plant species, concentrations as high as 230,000 μg/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 μg/m^3. Also related to this family of plants, CO concentrations in the soil of 113,000 μg/m^3 were found to inhibit nitrogen fixation. It is clear that ambient CO concentrations as low as 10,000 μg/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 μg/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 μg/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 L-15. Predicted Air Quality Impacts Compared to SO_2 and PM_{10} Vegetation Impact Thresholds

Averaging Period	Maximum Project Impacts (µg/m^3)	Threshold for Impact to Vegetation (µg/m^3)	Applicability
SO_2			
1-hour SO_2	2.9	131[a]	Suggested worst-case limit
3-hour SO_2	1.5	390[b]	Protects SO_2 sensitive species
3-hour SO_2		1,300[c]	Protects all vegetation
24-hour SO_2	1.0	63[d]	Insignificant effect to wheat and barley
Annual SO_2	0.1	130[b]	Protects SO_2 sensitive species
PM_{10}			
24-hour PM_{10}	4.0	150[c]	Protects all vegetation
Annual PM_{10}	0.3	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 µg/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 µg/m^3. Similarly, a threshold of 130 µg/m^3 is suggested for chronic exposure.

c. Secondary National Ambient Air Quality Standard (µg/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. "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 µg/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 µg/m^3, using a worst-case deposition velocity of 2 centimeters per second.

4.3.2 Soil Assessment

The USEPA Screening Procedure also provides a method for assessing impacts on soils. This assessment evaluates trace element contamination of soils. Since plant and animal communities can be affected before noticeable accumulation occurs in the soils, the approach used here evaluates the way soil acts as an intermediary in the transfer of deposited trace elements to plants. For trace elements, the concentration deposited in the soil is calculated from the maximum-predicted annual ground-level concentrations conservatively assuming that all deposited material is soluble and available for uptake by plants. The amount of trace elements potentially taken up by plants is calculated using average plant-to-soil concentration ratios. The calculated soil and plant concentrations were then compared to screening concentration threshold criteria designed to assess potential adverse effects to soils and plants.

According to the United States Department of Agriculture Natural Resources Conservation Service Connecticut Soil Survey and field-verification, the portion of the Project site located north of Lake Road is dominated by glacial till-derived soils, with the exception of soils within and adjacent to an on-site forested swamp, where soils are derived from a glacial outwash deposit. Bedrock outcrops were observed within the Project site, but mostly along the ridgeline that dominates its sloping western section, where bedrock mining had taken place through the early 20th century.

Table L-16 presents the results of the potential soil and plant concentrations and compares them to the corresponding screening concentration criteria. Only pollutants that are potentially emitted from the Project and which have a screening concentration are presented. A calculated concentration in excess of either of the screening concentration criteria is an indication that a more detailed evaluation may be required. However, as shown in Table L-16, calculated concentrations as a result of operation of the Project are all well below the screening criteria. Detailed calculations are provided in Appendix L-F.

Table L-16. Soils Impact Screening Assessment

Pollutant	Maximum Project Deposited Soil Concentration (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Plant Tissue Concentration (ppmw)	Plant Screening Criteria (ppmw)	Percent of Plant Screening Criteria
Arsenic	2.14E-04	3	0.01%	2.99E-05	0.25	0.01%
Cadmium	1.17E-03	2.5	0.05%	1.26E-02	3	0.42%
Chromium	4.09E-02	8.4	0.49%	8.19E-04	1	0.08%
Lead	3.48E-03	1000	0.00%	1.57E-03	126	0.00%
Manganese	5.96E-04	2.5	0.02%	3.94E-05	400	0.00%
Mercury	2.67E-04	455	0.00%	1.34E-04	NA	NA
Nickel	4.88E-03	500	0.00%	2.20E-04	60	0.00%
Selenium	8.45E-04	13	0.01%	8.45E-04	100	0.00%
Note: Based on screening procedures described in Chapter 5 of the USEPA guidance document for soils and vegetation, *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (USEPA 1980).						

4.4 GROWTH [ATTACHMENT 216-H AND 215-C]

A growth analysis examines the potential emissions from secondary sources associated with the Project. While these activities are not directly involved in Project operation, the emissions involve those that can reasonably be expected to occur; for instance, industrial, commercial, and residential growth that will occur in the Project area due to the Project itself. Secondary emissions do not include any emissions that come directly from mobile sources, such as emissions from the tailpipe of any on-road motor vehicle or the propulsion of a train. They also do not include sources that do not impact the same general area as the source under review.

The Project is expected to have a construction workforce reflecting 250 to 350 jobs over the approximately three-year construction period. A significant portion of the regional construction force in the area of the site is currently available to build the Project. Although it is possible that a small percentage of the labor force will be from outside the commuting region, and may create a small new housing demand, it is expected that any new housing demand can be met with existing housing stock in the region. In addition, it is expected that no induced commercial or industrial construction in the area will be necessary to support the Project. The operations staff will consist of approximately 25 to 30 workers, and will not significantly influence growth in the area. Therefore, an evaluation of secondary emission sources associated with the Project is not warranted.

5.0 REFERENCES

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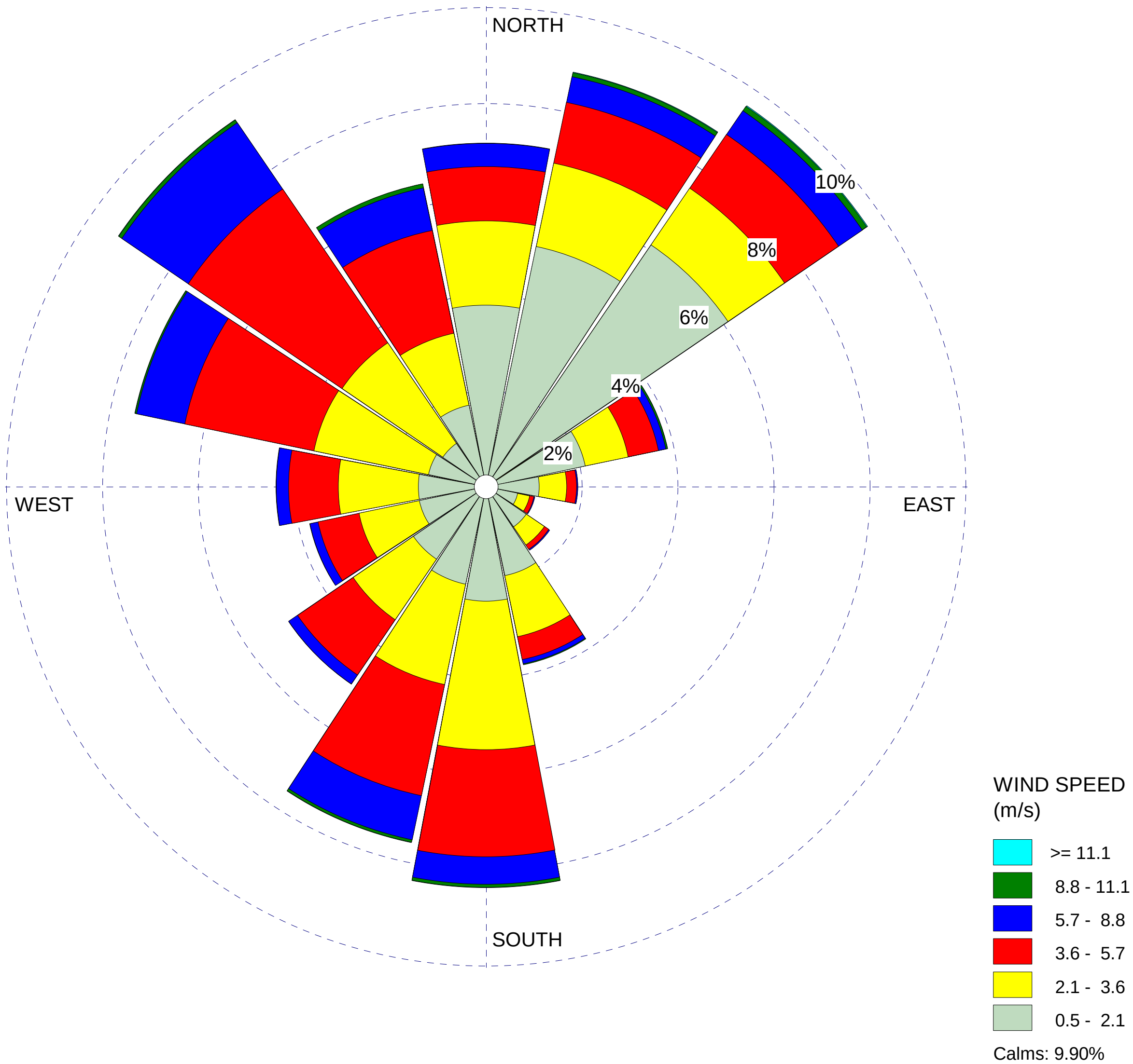
FIGURES

WIND ROSE PLOT:

Project: NTE Connecticut - Killingly Energy Center
Met: Windham CT Airport 2010-2014

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

Start Date: 1/1/2010 - 00:00
End Date: 12/31/2014 - 23:00

CALM WINDS:

9.90%

TOTAL COUNT:

43270 hrs.

Figure L-1:
Wind Rose Plot

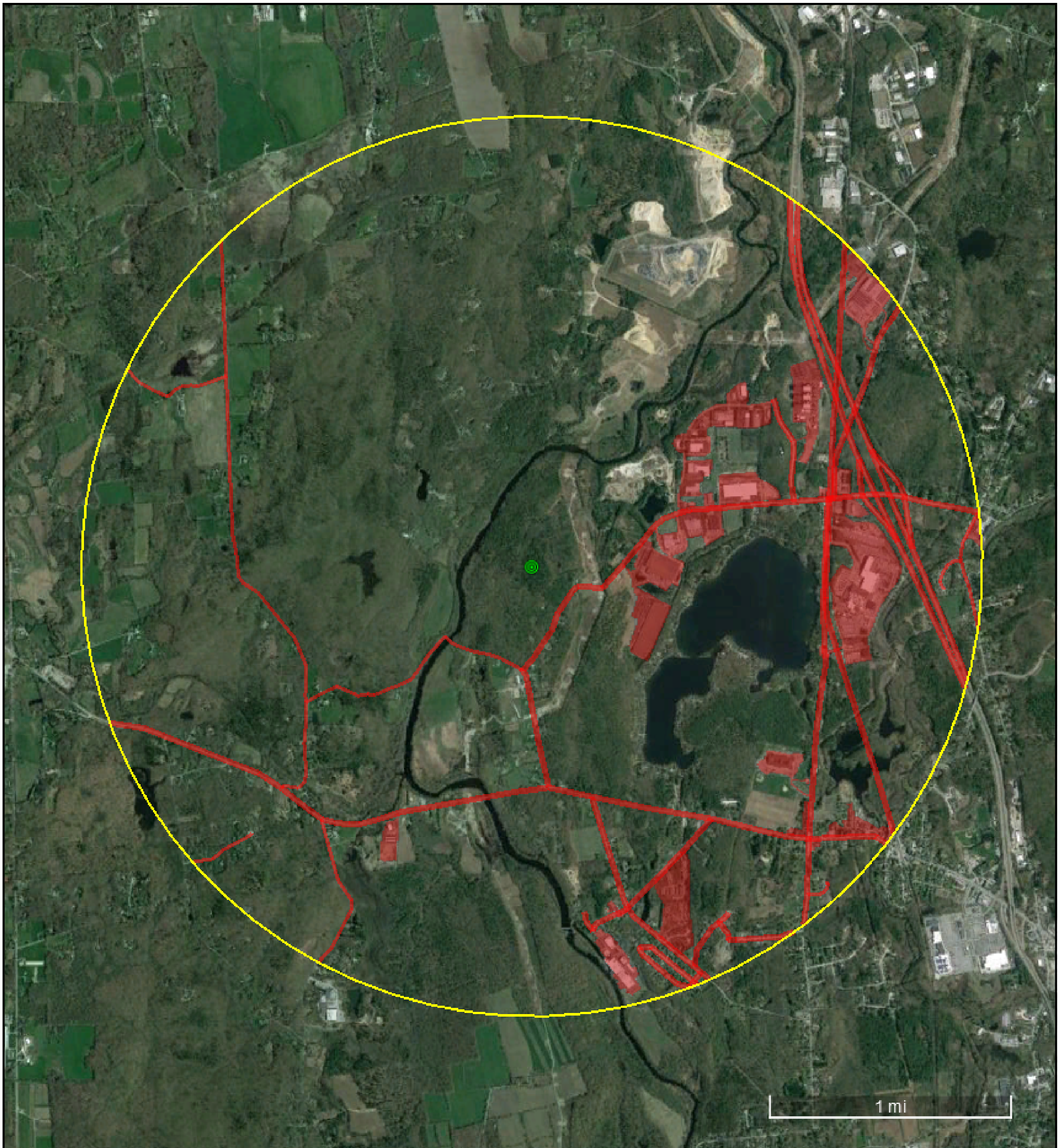
TETRA TECH

AVG. WIND SPEED:

2.71 m/s

PROJECT NO.:

WRPLOT View - Lakes Environmental Software



Legend

- Project site
- 3 km buffer
- Urban areas

N

TETRA TECH

Figure L- 2
Urban / Rural Determination Map

Killingly Energy Center
NTE Connecticut, LLC
Killingly, CT

APPENDIX L-A: DETAILED SOURCE PARAMETER DATA

Killingly Energy Center

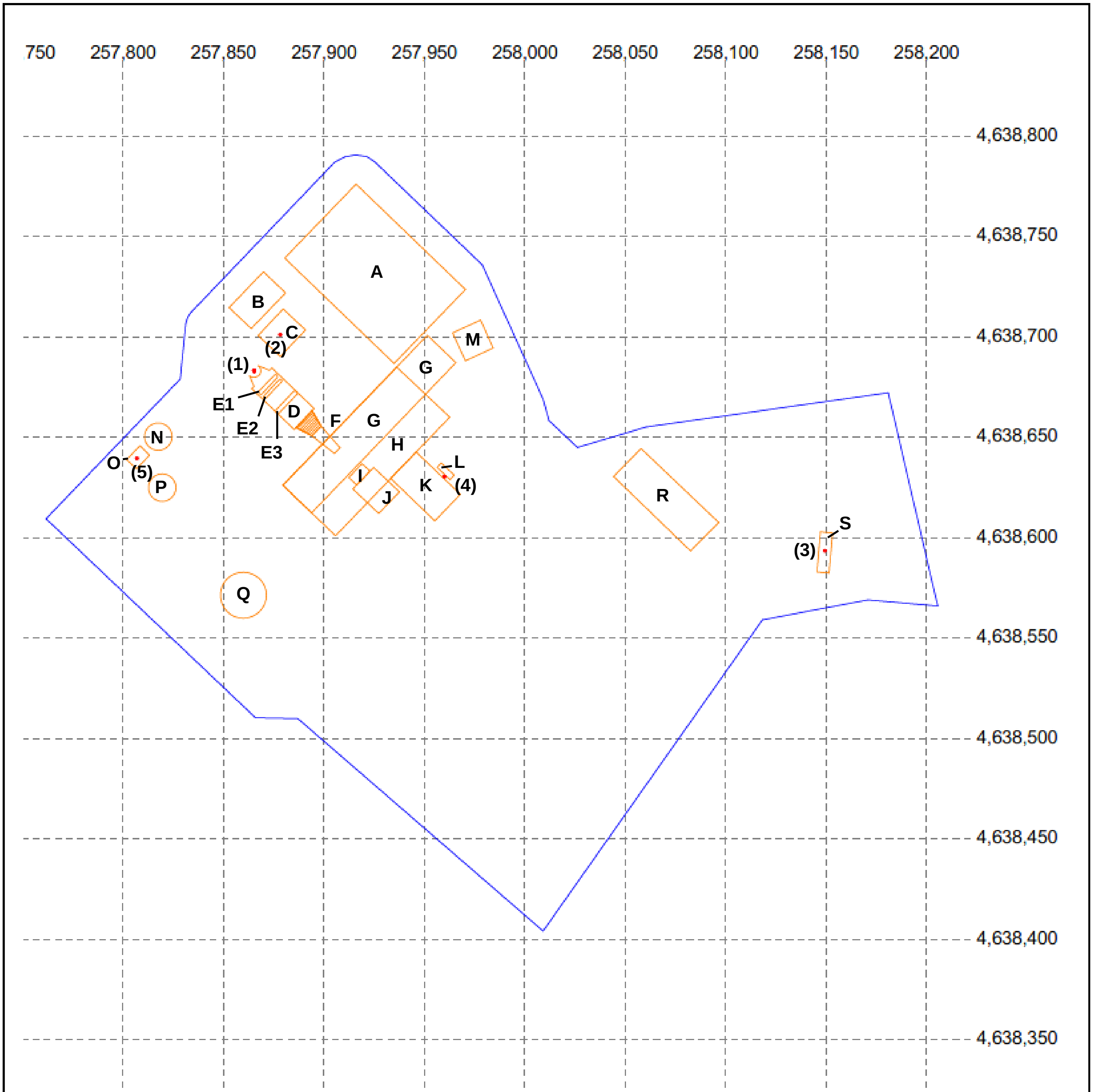
Combined Cycle Combustion Turbine and Ancillary Equipment Emissions Estimates

	Combustion Turbines													
Case #:	**1**	**2**	**3**	**4**	**5**	**36**	**37**	**38**	**39**	**40**	**32**	**33**	**34**	**35**
Fuel	Natural Gas													
Ambient Temperature (°F):	100	100	100	100	100	59	59	59	59	59	-10	-10	-10	-10
GT Operating Load	100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%
Fuel Heating Value, Btu/lb (HHV)	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150
Evaporative Cooler Status (On or Off)	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
Ambient Relative Humidity, %	45	45	45	45	45	60	60	60	60	60	100	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,672	2,672	2,490	1,983	1,444	2,871	2,869	2,827	2,269	1,515	2,974	2,971	2,380	1,598
DB Heat Input (MMBtu/hr/unit, HHV)	834	0	0	0	0	895	0	0	0	0	920	0	0	0
Exhaust velocity (m/s)	17.39	17.27	16.25	13.76	10.87	18.44	18.08	17.87	14.66	10.86	18.72	18.26	14.67	10.96
Exhaust temperature (K)	358.71	361.48	359.82	360.93	359.82	358.15	355.37	355.37	354.26	354.26	359.82	355.37	354.26	354.26
NOx (g/s)	3.326	2.533	2.369	1.865	1.348	3.578	2.722	2.684	2.129	1.411	3.692	2.822	2.243	1.487
CO (g/s)	2.029	1.550	1.449	1.134	0.819	2.180	1.663	1.638	1.298	0.857	2.255	1.726	1.361	0.907
PM (g/s)	2.608	1.449	1.373	1.159	1.008	2.822	1.575	1.562	1.285	1.008	2.885	1.613	1.298	1.008
SO2 (g/s)	0.630	0.479	0.454	0.365	0.265	0.680	0.517	0.517	0.416	0.277	0.706	0.542	0.428	0.290

	Combustion Turbines										
Case #:	**41**	**42**	**43**	**44**	**68**	**69**	**70**	**71**	**65**	**66**	**67**
Fuel	ULSD										
Ambient Temperature (°F):	100	100	100	100	59	59	59	59	-10	-10	-10
GT Operating Load	100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444
Evaporative Cooler Status (On or Off)	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status	---	---	---	---	---	---	---	---	---	---	---
Ambient Relative Humidity, %	45	45	45	45	60	60	60	60	100	100	100
Baromteric Pressure, psia	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)	2,740	2,567	2,055	1,874	2,828	2,783	2,226	1,941	2,827	2,289	2,029
DB Heat Input (MMBtu/hr/unit, HHV)	0	0	0	0	0	0	0	0	0	0	0
Exhaust velocity (m/s)	18.01	17.08	14.03	13.03	18.70	18.49	15.17	13.55	20.15	16.31	14.61
Exhaust temperature (K)	372.59	370.37	367.59	366.48	366.48	365.93	363.15	362.59	373.15	368.71	367.59
NOx (g/s)	6.709	6.285	5.032	4.588	6.925	6.814	5.451	4.752	6.922	5.606	4.969
CO (g/s)	1.634	1.530	1.225	1.117	1.686	1.659	1.327	1.157	1.686	1.365	1.210
PM (g/s)	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780
SO2 (g/s)	0.491	0.454	0.365	0.340	0.504	0.491	0.403	0.353	0.504	0.403	0.365

	Start-Up and Shutdown								Ancillary Equipment			
Case #:	**Hot Start**	**Warm Start**	**Cold Start**	**Shutdown**	**Hot Start**	**Warm Start**	**Cold Start**	**Shutdown**	**Auxiliary Boiler**	**Emergency Generator**	**FirePump**	**Gas Heater**
Fuel	Natural Gas				ULSD							
Exhaust velocity (m/s)	14.128	14.840	12.174	10.315	10.150	11.014	9.989	9.946	14.128	14.840	12.174	10.315
Exhaust temperature (K)	352.444	353.556	351.889	353.000	403.556	404.111	403.556	401.333	352.444	353.556	351.889	353.000
NOx (g/s)	15.649	17.871	14.091	10.065	22.130	24.304	21.784	21.226	15.649	17.871	14.091	10.065
CO (g/s)	47.710	55.088	60.128	26.726	249.007	290.502	277.902	54.100	47.710	55.088	60.128	26.726
PM (g/s)	2.277	2.200	2.027	2.385	4.095	4.142	4.127	4.064	2.277	2.200	2.027	2.385
SO2 (g/s)	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788

APPENDIX L-B: FACILITY LAYOUT DIAGRAMS AND BPIP DATA



Legend

	Building / Structure Name	Height (ft)			Height (ft)
A	Air Cooled Condenser	79	P	Service Water Storage Tank	40
B	Closed Cooling Water Fan Array	25	Q	Fuel Oil Tank	50
C	Auxiliary Boiler	40	R	Administration	25
D	Heat Recovery Steam Generator (HRSG)	95	S	Gas Heater Enclosure	10
E1	HRSG Drum 1	105			
E2	HRSG Drum 2	102	●	**Exhaust Stack**	**Height (ft)**
E3	HRSG Drum 3	104	1	HRSG	170
F	Turbine Exhaust Diffuser	32	2	Auxiliary Boiler	90
G	Turbine Building High Bay	91	3	Gas Heater	20
H	Turbine Building Low Bay	40	4	Emergency Generator	40
I	Air Inlet Filter Housing Duct	63	5	Fire Pump	20
J	Air Inlet Filter Housing	85			
K	Control/Maintenance Building	25		**Base Elevation**	
L	Emergency Generator	15		Main Power Block	315
M	Fuel Gas Compressor	20	R	Administration	320
N	Demineralized Water Storage Tank	35	S	Gas Heater Enclosure	326
O	Fire Pump Enclosure	15			

TETRA TECH

Figure L-B
Buildings, Structures and Stacks Input to AERMOD

Killingly Energy Center
NTE Connecticut, LLC
Killingly, CT

BPIP INPUT

```
'P'
'METERS'      1.0
'UTMY'        0
 22
'ACC'          1             96.012
 4            24.0792
257880.52     4638739.06
257916.02     4638775.97
257970.48     4638723.55
257934.98     4638686.65
'COOLFAN'      1             96.012
 4            7.62
257852.89     4638714.53
257870.01     4638732.32
257880.97     4638721.79
257863.85     4638704.
'AUXBLR'       1             96.012
 4            12.192
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257879.78906249              4638713.8419393
257890.82906249              4638703.4319393
257878.38906249              4638690.1019393
'FIREPUMP'     1             96.012
 4            4.572
257801.89843749              4638638.7995174
257808.43843749              4638645.6495174
257813.29843749              4638641.0095174
257806.75843749              4638634.1695174
'TURBLOW'      1             96.012
 4            12.192
257879.69     4638625.99
257936.38     4638684.88
257962.65     4638659.85
257905.83     4638600.85
'TURBHIGH'     1             96.012
 4            27.7368
257951.57     4638700.7
257965.82     4638687.07
257893.97     4638612.26
257879.69     4638626.
'CONTROL'      1             96.012
 4            7.62
257933.23     4638629.52
257946.05     4638642.56
257968.02     4638621.53
257955.31     4638608.32
'EMGEN'        1             96.012
 4            4.572
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257958.51921874              4638637.1023299
257964.91921874              4638630.9823299
257962.84921874              4638628.8123299
'GASCOMP'      1             96.012
 4            6.096
257964.19140624              4638701.9030330
257978.09140624              4638708.1930330
257984.38140624              4638694.2930330
257970.48140624              4638687.9930330
'AIRFILTR'     1             96.012
 4            25.908
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257924.82296874              4638634.8915487
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257927.33296874              4638611.9215487
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 14           28.956
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257865.31     4638675.19
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257865.87     4638679.75
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257868.21     4638681.41
257868.59     4638682.83
257868.33     4638684.31
257867.5      4638685.43
257873.08     4638683.28
257874.21     4638684.44
257895.35     4638664.15
257885.3      4638653.7
'CTDIFF1'      1            96.012
 4            9.7536
257894.12499999             4638650.6393611
257898.72499999             4638655.4593611
257908.18499999             4638644.6993611
257905.30499999             4638641.6893611
'CTDIFF2'      8            96.012
 4            12.1539
257886.20703124             4638654.7799861
257894.19703124             4638663.1099861
257898.70703124             4638655.4599861
257894.08703124             4638650.6399861
 4            14.5542
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257894.19703124             4638663.1099861
257898.14328124             4638656.4162361
257893.10203124             4638651.1574861
 4            16.9545
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257894.19703124             4638663.1099861
257897.57953124             4638657.3724861
257892.11703124             4638651.6749861
 4            19.3548
257886.20703124             4638654.7799861
257894.19703124             4638663.1099861
257897.01578124             4638658.3287361
257891.13203124             4638652.1924861
 4            21.7551
257886.20703124             4638654.7799861
257894.19703124             4638663.1099861
257896.45203124             4638659.2849861
257890.14703124             4638652.7099861
 4            24.1554
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257894.19703124             4638663.1099861
257895.88828124             4638660.2412361
257889.16203124             4638653.2274861
 4            26.5557
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257887.19203124             4638654.2624861
'AIRINTAK'     1            96.012
 4            19.2024
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257912.41812499             4638629.8012361
257919.01812499             4638636.7112361
257923.00812499             4638633.0512361
'DRUM1'        1            96.012
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257876.18594774             4638681.1263235
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257868.47594774            4638671.3463235
257867.93594774            4638671.6763235
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257885.37438524            4638672.9312453
257886.02438524            4638672.9812453
257886.58438524            4638672.6212453
257886.87438524            4638672.1112453
257886.86438524            4638671.5712453
257886.56438524            4638671.1212453
257878.13438524            4638662.2412453
257877.73438524            4638661.9612453
257877.03438524            4638661.9012453
257876.47438524            4638662.1812453
257876.18438524            4638662.7312453
257876.16438524            4638663.2812453
'DRUM2'        1           96.012
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257878.90860399            4638678.5703860
257879.17860399            4638678.1203860
257879.22860399            4638677.7403860
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257870.79860399            4638669.2403860
257870.26860399            4638669.5803860
257870.01860399            4638669.9903860
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 4           3.048
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258153.34    4638602.3
258151.53    4638582.25
258145.51    4638582.81
'ADMIN'        1           97.536
 4           7.62
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258096.65    4638607.46
258082.57    4638593.25
258044.27    4638630.36
'DEMINTNK'     1           96.
 32          10.668
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257822.53    4638655.05
257821.49    4638655.9
257820.3     4638656.53
257819.01    4638656.92
257817.68    4638657.06
257816.34    4638656.92
257815.05    4638656.53
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257812.83    4638655.05
257811.97    4638654.01
257811.34    4638652.82
257810.95    4638651.54
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257820.3	4638643.86	
257821.49	4638644.5	
257822.53	4638645.35	
257823.38	4638646.39	
257824.01	4638647.57	
257824.4	4638648.86	
'SVCTANK'	1	96.
32	12.192	
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257822.19	4638631.17	
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257812.84	4638623.5	
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257820.9	4638618.11	
257822.19	4638618.5	
257823.37	4638619.13	
257824.41	4638619.99	
257825.26	4638621.02	
257825.9	4638622.21	
257826.29	4638623.5	
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257871.22	4638573.46	
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257869.51	4638577.58	
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257855.63	4638581.79	
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257853.66	4638561.73	
257855.63	4638560.67	

257857.78	4638560.02				
257860.01	4638559.8				
257862.24	4638560.02				
257864.38	4638560.67				
257866.36	4638561.73				
257868.09	4638563.15				
257869.51	4638564.88				
257870.57	4638566.86				
257871.22	4638569.				
16					
'OIL_68_NO2 '		96.012	45.72	257865.32	4638682.97
'OIL_WST_NO2 '		96.012	45.72	257865.32	4638682.97
'OIL_44_PM '		96.012	45.72	257865.32	4638682.97
'OIL_SD_PM '		96.012	45.72	257865.32	4638682.97
'OIL_44_PMANN'		96.012	45.72	257865.32	4638682.97
'OIL_SD_PMANN'		96.012	45.72	257865.32	4638682.97
'GAS_32_SO2 '		96.012	45.72	257865.32	4638682.97
'GAS_SD_SO2 '		96.012	45.72	257865.32	4638682.97
'AUXBLR '		96.012	27.432	257878.32	4638701.01
'EGEN '		96.012	12.192	257960.02	4638630.4
'FIREPUMP '		96.012	6.096	257806.97	4638639.43
'GASHEATER '		99.3648	6.096	258149.52	4638593.34
'AUXBLR_PMANN'		96.012	27.432	257878.32	4638701.01
'EGEN_PMANN '		96.012	12.192	257960.02	4638630.4
'FIREPUMP_PMA'		96.012	6.096	257806.97	4638639.43
'GASHTR_PMANN'		99.3648	6.096	258149.52	4638593.34

BPIP OUTPUT

```
SO BUILDHGT OIL_68_NO2      28.96    28.96    28.96    28.96    28.96    28.96
SO BUILDHGT OIL_68_NO2      28.96    28.96    28.96    28.96    27.74    27.74
SO BUILDHGT OIL_68_NO2      27.74    27.74    27.74    27.74    28.96    28.96
SO BUILDHGT OIL_68_NO2      28.96    28.96    28.96    28.96    28.96    28.96
SO BUILDHGT OIL_68_NO2      28.96    28.96    28.96    28.96    27.74    27.74
SO BUILDHGT OIL_68_NO2      27.74    27.74    27.74    27.74    28.96    28.96
SO BUILDWID OIL_68_NO2      34.78    36.10    36.32    35.45    35.75    36.38
SO BUILDWID OIL_68_NO2      35.90    34.34    31.73    28.35   102.81   105.39
SO BUILDWID OIL_68_NO2     104.77   105.23   105.13   101.82    29.04    32.40
SO BUILDWID OIL_68_NO2      34.78    36.10    36.32    35.45    35.75    36.38
SO BUILDWID OIL_68_NO2      35.90    34.34    31.73    28.35   102.81   105.39
SO BUILDWID OIL_68_NO2     104.77   105.23   105.13   101.82    29.04    32.40
SO BUILDLEN OIL_68_NO2      28.35    25.09    21.08    16.42    17.52    22.05
SO BUILDLEN OIL_68_NO2      25.90    29.04    32.40    34.78    60.05    44.06
SO BUILDLEN OIL_68_NO2      26.72    30.72    47.79    63.41    34.34    31.73
SO BUILDLEN OIL_68_NO2      28.35    25.09    21.08    16.42    17.52    22.05
SO BUILDLEN OIL_68_NO2      25.90    29.04    32.40    34.78    60.05    44.06
SO BUILDLEN OIL_68_NO2      26.72    30.72    47.79    63.41    34.34    31.73
SO XBADJ    OIL_68_NO2     -25.36   -20.67   -15.36    -9.58    -6.61    -5.45
SO XBADJ    OIL_68_NO2      -4.12    -2.73    -2.37    -1.94    32.99    40.93
SO XBADJ    OIL_68_NO2      47.63    41.86    27.77    12.84    -2.04    -2.46
SO XBADJ    OIL_68_NO2      -2.99    -4.42    -5.72    -6.84   -10.91   -16.60
SO XBADJ    OIL_68_NO2     -21.78   -26.31   -30.03   -32.84   -93.04   -84.99
SO XBADJ    OIL_68_NO2     -74.35   -72.58   -75.56   -76.24   -32.29   -29.27
SO YBADJ    OIL_68_NO2     -15.45   -16.61   -17.25   -17.38   -17.39   -17.15
SO YBADJ    OIL_68_NO2     -16.39   -15.13   -13.40   -11.18    -5.24     5.78
SO YBADJ    OIL_68_NO2      16.64    27.01    36.52    44.93    11.79    13.83
SO YBADJ    OIL_68_NO2      15.45    16.61    17.25    17.38    17.39    17.15
SO YBADJ    OIL_68_NO2      16.39    15.13    13.40    11.18     5.24    -5.78
SO YBADJ    OIL_68_NO2     -16.64   -27.01   -36.52   -44.93   -11.79   -13.83
SO BUILDHGT OIL_WST_NO2     28.96    28.96    28.96    28.96    28.96    28.96
SO BUILDHGT OIL_WST_NO2     28.96    28.96    28.96    28.96    27.74    27.74
SO BUILDHGT OIL_WST_NO2     27.74    27.74    27.74    27.74    28.96    28.96
SO BUILDHGT OIL_WST_NO2     28.96    28.96    28.96    28.96    28.96    28.96
SO BUILDHGT OIL_WST_NO2     28.96    28.96    28.96    28.96    27.74    27.74
SO BUILDHGT OIL_WST_NO2     27.74    27.74    27.74    27.74    28.96    28.96
SO BUILDWID OIL_WST_NO2     34.78    36.10    36.32    35.45    35.75    36.38
SO BUILDWID OIL_WST_NO2     35.90    34.34    31.73    28.35   102.81   105.39
SO BUILDWID OIL_WST_NO2    104.77   105.23   105.13   101.82    29.04    32.40
SO BUILDWID OIL_WST_NO2     34.78    36.10    36.32    35.45    35.75    36.38
SO BUILDWID OIL_WST_NO2     35.90    34.34    31.73    28.35   102.81   105.39
SO BUILDWID OIL_WST_NO2    104.77   105.23   105.13   101.82    29.04    32.40
SO BUILDLEN OIL_WST_NO2     28.35    25.09    21.08    16.42    17.52    22.05
SO BUILDLEN OIL_WST_NO2     25.90    29.04    32.40    34.78    60.05    44.06
SO BUILDLEN OIL_WST_NO2     26.72    30.72    47.79    63.41    34.34    31.73
SO BUILDLEN OIL_WST_NO2     28.35    25.09    21.08    16.42    17.52    22.05
SO BUILDLEN OIL_WST_NO2     25.90    29.04    32.40    34.78    60.05    44.06
SO BUILDLEN OIL_WST_NO2     26.72    30.72    47.79    63.41    34.34    31.73
SO XBADJ    OIL_WST_NO2    -25.36   -20.67   -15.36    -9.58    -6.61    -5.45
SO XBADJ    OIL_WST_NO2     -4.12    -2.73    -2.37    -1.94    32.99    40.93
SO XBADJ    OIL_WST_NO2     47.63    41.86    27.77    12.84    -2.04    -2.46
SO XBADJ    OIL_WST_NO2     -2.99    -4.42    -5.72    -6.84   -10.91   -16.60
SO XBADJ    OIL_WST_NO2    -21.78   -26.31   -30.03   -32.84   -93.04   -84.99
SO XBADJ    OIL_WST_NO2    -74.35   -72.58   -75.56   -76.24   -32.29   -29.27
SO YBADJ    OIL_WST_NO2    -15.45   -16.61   -17.25   -17.38   -17.39   -17.15
SO YBADJ    OIL_WST_NO2    -16.39   -15.13   -13.40   -11.18    -5.24     5.78
SO YBADJ    OIL_WST_NO2     16.64    27.01    36.52    44.93    11.79    13.83
SO YBADJ    OIL_WST_NO2     15.45    16.61    17.25    17.38    17.39    17.15
SO YBADJ    OIL_WST_NO2     16.39    15.13    13.40    11.18     5.24    -5.78
SO YBADJ    OIL_WST_NO2    -16.64   -27.01   -36.52   -44.93   -11.79   -13.83
SO BUILDHGT AUXBLR          28.96    28.96    28.96    28.96    28.96    28.96
SO BUILDHGT AUXBLR          28.96    28.96    27.74    27.74    27.74    27.74
SO BUILDHGT AUXBLR          27.74    27.74    27.74    27.74    28.96    28.96
SO BUILDHGT AUXBLR          28.96    28.96    28.96    28.96    28.96    28.96
SO BUILDHGT AUXBLR          28.96    28.96    27.74    27.74    27.74    27.74
SO BUILDHGT AUXBLR          27.74    27.74    27.74    27.74    28.96    28.96
SO BUILDWID AUXBLR          34.78    36.10    36.32    35.45    35.75    36.38
SO BUILDWID AUXBLR          35.90    34.34    88.44    97.10   102.81   105.39
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SO BUILDWID AUXBLR        104.77   105.23   105.13   101.82    29.04    32.40
SO BUILDWID AUXBLR         34.78    36.10    36.32    35.45    35.75    36.38
SO BUILDWID AUXBLR         35.90    34.34    88.44    97.10   102.81   105.39
SO BUILDWID AUXBLR        104.77   105.23   105.13   101.82    29.04    32.40
SO BUILDLEN AUXBLR         28.35    25.09    21.08    16.42    17.52    22.05
SO BUILDLEN AUXBLR         25.90    29.04    86.13    74.22    60.05    44.06
SO BUILDLEN AUXBLR         26.72    30.72    47.79    63.41    34.34    31.73
SO BUILDLEN AUXBLR         28.35    25.09    21.08    16.42    17.52    22.05
SO BUILDLEN AUXBLR         25.90    29.04    86.13    74.22    60.05    44.06
SO BUILDLEN AUXBLR         26.72    30.72    47.79    63.41    34.34    31.73
SO XBADJ    AUXBLR        -45.38   -42.07   -37.48   -31.75   -28.17   -25.73
SO XBADJ    AUXBLR        -22.51   -18.67     1.37    14.37    26.94    38.69
SO XBADJ    AUXBLR         49.26    47.32    36.89    25.34    13.46    15.58
SO XBADJ    AUXBLR         17.03    16.98    16.41    15.34    10.65     3.68
SO XBADJ    AUXBLR         -3.40   -10.37   -87.50   -88.59   -86.99   -82.75
SO XBADJ    AUXBLR        -75.99   -78.05   -84.68   -88.75   -47.80   -47.31
SO YBADJ    AUXBLR         -5.78   -10.56   -15.02   -19.02   -22.85   -26.27
SO YBADJ    AUXBLR        -28.89   -30.63   -44.53   -36.13   -26.64   -16.34
SO YBADJ    AUXBLR         -5.54     5.45    16.24    26.54    -4.15     0.83
SO YBADJ    AUXBLR          5.78    10.56    15.02    19.02    22.85    26.27
SO YBADJ    AUXBLR         28.89    30.63    44.53    36.13    26.64    16.34
SO YBADJ    AUXBLR          5.54    -5.45   -16.24   -26.54     4.15    -0.83
SO BUILDHGT GASHEATER       3.05     3.05     3.05     3.05     3.05     3.05
SO BUILDHGT GASHEATER       3.05     3.05     3.05     3.05     3.05     3.05
SO BUILDHGT GASHEATER       3.05     3.05     3.05     3.05     3.05     3.05
SO BUILDHGT GASHEATER       3.05     3.05     3.05     3.05     3.05     3.05
SO BUILDHGT GASHEATER       3.05     3.05     3.05     3.05     3.05     3.05
SO BUILDHGT GASHEATER       3.05     3.05     3.05     3.05     3.05     3.05
SO BUILDWID GASHEATER       7.78    11.06    14.00    16.52    18.53    19.99
SO BUILDWID GASHEATER      20.83    21.05    20.62    20.55    20.99    20.79
SO BUILDWID GASHEATER      19.96    18.53    16.53    14.02    11.10     7.83
SO BUILDWID GASHEATER       7.78    11.06    14.00    16.52    18.53    19.99
SO BUILDWID GASHEATER      20.83    21.05    20.62    20.55    20.99    20.79
SO BUILDWID GASHEATER      19.96    18.53    16.53    14.02    11.10     7.83
SO BUILDLEN GASHEATER      20.55    20.99    20.79    19.96    18.53    16.53
SO BUILDLEN GASHEATER      14.02    11.10     7.83     7.78    11.06    14.00
SO BUILDLEN GASHEATER      16.52    18.53    19.99    20.83    21.05    20.62
SO BUILDLEN GASHEATER      20.55    20.99    20.79    19.96    18.53    16.53
SO BUILDLEN GASHEATER      14.02    11.10     7.83     7.78    11.06    14.00
SO BUILDLEN GASHEATER      16.52    18.53    19.99    20.83    21.05    20.62
SO XBADJ    GASHEATER     -11.07   -11.27   -11.12   -10.64    -9.84    -8.74
SO XBADJ    GASHEATER      -7.37    -5.78    -4.01    -3.87    -5.37    -6.71
SO XBADJ    GASHEATER      -7.85    -8.75    -9.38    -9.72    -9.78    -9.53
SO XBADJ    GASHEATER      -9.49    -9.73    -9.67    -9.32    -8.69    -7.79
SO XBADJ    GASHEATER      -6.65    -5.32    -3.82    -3.91    -5.68    -7.29
SO XBADJ    GASHEATER      -8.67    -9.79   -10.61   -11.11   -11.27   -11.09
SO YBADJ    GASHEATER      -0.02    -0.15    -0.29    -0.41    -0.52    -0.62
SO YBADJ    GASHEATER      -0.69    -0.75    -0.78    -0.79    -0.77    -0.73
SO YBADJ    GASHEATER      -0.66    -0.58    -0.47    -0.36    -0.23    -0.09
SO YBADJ    GASHEATER       0.02     0.15     0.29     0.41     0.52     0.62
SO YBADJ    GASHEATER       0.69     0.75     0.78     0.79     0.77     0.73
SO YBADJ    GASHEATER       0.66     0.58     0.47     0.36     0.23     0.09
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APPENDIX L-C: DETAILED AERMOD RESULTS SUMMARY

Killingly Energy Center

Combined Cycle Combustion Turbine Emissions Estimates

Ambient Temperature (°F):				100					59					-10					100					59					-10	
Case #:		**1**	**2**	**3**	**4**	**5**	**36**	**37**	**38**	**39**	**40**	**32**	**33**	**34**	**35**	**41**	**42**	**43**	**44**	**68**	**69**	**70**	**71**	**65**	**66**	**67**
Fuel		**Natural Gas**														**ULSD**										
Number of GTs Operating																										
GT Operating Load		100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%	100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%
Fuel Heating Value, Btu/lb (HHV)		22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	22,150	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444	20,444
Evaporative Cooler Status (On or Off)		ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
Duct Burner Status		ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	---	---	---	---	---	---	---	---	---	---	---
Ambient Relative Humidity, %		45	45	45	45	45	60	60	60	60	60	100	100	100	100	45	45	45	45	60	60	60	60	100	100	100
Barometric Pressure, psia		14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52	14.52
GT Heat Input (MMBtu/hr/unit, HHV)		2,672	2,672	2,490	1,983	1,444	2,871	2,869	2,827	2,269	1,515	2,974	2,971	2,380	1,598	2,740	2,567	2,055	1,874	2,828	2,783	2,226	1,941	2,827	2,289	2,029
DB Heat Input (MMBtu/hr/unit, HHV)		834	0	0	0	0	895	0	0	0	0	920	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exhaust velocity (m/s)		17.39	17.27	16.25	13.76	10.87	18.44	18.08	17.87	14.66	10.86	18.72	18.26	14.67	10.96	18.01	17.08	14.03	13.03	18.70	18.49	15.17	13.55	20.15	16.31	14.61
Exhaust temperature (K)		358.71	361.48	359.82	360.93	359.82	358.15	355.37	355.37	354.26	354.26	359.82	355.37	354.26	354.26	372.59	370.37	367.59	366.48	366.48	365.93	363.15	362.59	373.15	368.71	367.59
NOx (g/s)		3.326	2.533	2.369	1.865	1.348	3.578	2.722	2.684	2.129	1.411	3.692	2.822	2.243	1.487	6.709	6.285	5.032	4.588	6.925	6.814	5.451	4.752	6.922	5.606	4.969
CO (g/s)		2.029	1.550	1.449	1.134	0.819	2.180	1.663	1.638	1.298	0.857	2.255	1.726	1.361	0.907	1.634	1.530	1.225	1.117	1.686	1.659	1.327	1.157	1.686	1.365	1.210
PM (g/s)		2.608	1.449	1.373	1.159	1.008	2.822	1.575	1.562	1.285	1.008	2.885	1.613	1.298	1.008	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780	3.780
SO2 (g/s)		0.630	0.479	0.454	0.365	0.265	0.680	0.517	0.517	0.416	0.277	0.706	0.542	0.428	0.290	0.491	0.454	0.365	0.340	0.504	0.491	0.403	0.353	0.504	0.403	0.365

AERMOD Impacts - turbine only (ug/m3 per g/s) - 150 ft. turbine stack height

		1	2	3	4	5	36	37	38	39	40	32	33	34	35	41	42	43	44	68	69	70	71	65	66	67
Unit	1-hour H1H	3.880	3.854	3.913	4.234	5.076	3.834	3.887	3.894	4.283	5.322	3.792	3.879	4.281	5.287	3.626	3.743	4.015	4.214	3.676	3.704	3.958	4.226	3.409	3.822	3.917
	1-hour H2H	3.759	3.676	3.893	4.161	5.003	3.623	3.784	3.813	4.199	5.293	3.520	3.757	4.197	5.254	3.225	3.412	3.982	4.188	3.288	3.338	3.935	4.170	2.915	3.590	3.913
	3-hour H1H	2.074	2.055	2.122	2.217	2.479	2.023	2.070	2.080	2.219	2.550	1.992	2.060	2.219	2.537	1.909	1.987	2.175	2.218	1.925	1.944	2.150	2.217	1.770	2.048	2.148
	3-hour H2H	1.773	1.768	1.837	2.040	2.394	1.756	1.771	1.774	2.047	2.485	1.728	1.768	2.046	2.471	1.650	1.721	1.936	2.041	1.657	1.676	1.886	2.039	1.598	1.767	1.884
	8-hour H1H	1.147	1.135	1.239	1.539	2.035	1.075	1.120	1.134	1.476	2.103	1.046	1.105	1.474	2.086	1.020	1.096	1.441	1.591	1.009	1.026	1.328	1.553	0.886	1.166	1.361
	8-hour H2H	1.015	1.007	1.101	1.343	1.776	0.951	0.996	1.005	1.308	1.859	0.929	0.983	1.306	1.838	0.883	0.958	1.249	1.374	0.885	0.897	1.174	1.350	0.781	1.028	1.187
	24-hour H1H	0.660	0.653	0.719	0.902	1.225	0.608	0.640	0.650	0.865	1.271	0.585	0.629	0.864	1.262	0.565	0.621	0.837	0.935	0.557	0.569	0.771	0.912	0.467	0.673	0.788
	24-hour H2H	0.458	0.453	0.502	0.660	0.948	0.422	0.447	0.453	0.638	1.001	0.409	0.441	0.636	0.990	0.384	0.427	0.595	0.681	0.384	0.392	0.550	0.665	0.321	0.463	0.558
	24-hour H6H	0.370	0.365	0.405	0.511	0.666	0.328	0.357	0.359	0.493	0.696	0.311	0.345	0.487	0.686	0.295	0.341	0.473	0.514	0.286	0.300	0.447	0.509	0.227	0.373	0.444
	Annual	0.035	0.035	0.039	0.049	0.067	0.033	0.035	0.036	0.048	0.072	0.031	0.035	0.048	0.071	0.029	0.032	0.043	0.049	0.029	0.030	0.041	0.049	0.025	0.034	0.041

AERMOD Scaled Impacts - turbine only (ug/m3) - 150 ft. turbine stack

Fuel		**Natural Gas**														**ULSD**										
Case #:	**Averaging Period**	**1**	**2**	**3**	**4**	**5**	**36**	**37**	**38**	**39**	**40**	**32**	**33**	**34**	**35**	**41**	**42**	**43**	**44**	**68**	**69**	**70**	**71**	**65**	**66**	**67**
NO2	1-hour H1H	9.40	7.06	6.98	6.07	5.17	9.82	7.71	7.67	7.00	5.68	9.94	7.93	7.37	5.94	17.04	16.74	15.48	14.94	17.85	17.76	16.42	15.47	16.15	15.48	14.87
	1-hour H8H	6.45	4.85	4.80	4.15	3.49	6.75	5.26	5.23	4.74	3.79	6.87	5.42	4.99	3.97	11.65	11.65	10.65	10.21	12.32	12.30	11.33	10.56	11.00	10.70	10.29
	Annual	0.12	0.09	0.09	0.09	0.09	0.12	0.10	0.10	0.10	0.10	0.12	0.10	0.11	0.11	0.19	0.20	0.22	0.22	0.20	0.20	0.22	0.23	0.17	0.19	0.20
CO	1-hour H1H	7.87	5.97	5.67	4.80	4.16	8.36	6.46	6.38	5.56	4.56	8.55	6.70	5.83	4.80	5.92	5.73	4.92	4.71	6.20	6.15	5.25	4.89	5.75	5.22	4.74
	1-hour H2H	7.63	5.70	5.64	4.72	4.10	7.90	6.29	6.25	5.45	4.53	7.94	6.48	5.71	4.77	5.27	5.22	4.88	4.68	5.54	5.54	5.22	4.83	4.91	4.90	4.74
	8-hour H1H	2.33	1.76	1.80	1.75	1.67	2.34	1.86	1.86	1.92	1.80	2.36	1.91	2.01	1.89	1.67	1.68	1.77	1.78	1.70	1.70	1.76	1.80	1.49	1.59	1.65
	8-hour H2H	2.06	1.56	1.60	1.52	1.45	2.07	1.66	1.65	1.70	1.59	2.10	1.70	1.78	1.67	1.44	1.47	1.53	1.54	1.49	1.49	1.56	1.56	1.32	1.40	1.44
PM10	24-hour H1H	1.72	0.95	0.99	1.05	1.24	1.72	1.01	1.02	1.11	1.28	1.69	1.01	1.12	1.27	2.14	2.35	3.16	3.54	2.11	2.15	2.92	3.45	1.77	2.54	2.98
	24-hour H2H	1.19	0.66	0.69	0.77	0.96	1.19	0.70	0.71	0.82	1.01	1.18	0.71	0.83	1.00	1.45	1.62	2.25	2.58	1.45	1.48	2.08	2.51	1.21	1.75	2.11
	24-hour H6H	0.96	0.53	0.56	0.59	0.67	0.93	0.56	0.56	0.63	0.70	0.90	0.56	0.63	0.69	1.12	1.29	1.79	1.94	1.08	1.13	1.69	1.92	0.86	1.41	1.68
	Annual	0.09	0.05	0.05	0.06	0.07	0.09	0.06	0.06	0.06	0.07	0.09	0.06	0.06	0.07	0.11	0.12	0.16	0.18	0.11	0.11	0.15	0.18	0.09	0.13	0.16
PM2.5	24-hour H1H	0.94	0.51	0.55	0.60	0.74	0.91	0.54	0.55	0.64	0.77	0.90	0.54	0.64	0.77	1.13	1.27	1.81	2.01	1.10	1.15	1.66	1.97	0.93	1.40	1.69
	24-hour H8H	0.44	0.24	0.25	0.27	0.32	0.44	0.26	0.26	0.29	0.34	0.43	0.26	0.30	0.34	0.53	0.57	0.78	0.88	0.53	0.54	0.72	0.87	0.46	0.63	0.72
	Annual	0.07	0.04	0.04	0.04	0.05	0.07	0.04	0.04	0.05	0.06	0.07	0.04	0.05	0.06	0.08	0.09	0.13	0.14	0.08	0.08	0.12	0.14	0.07	0.10	0.12
SO2	1-hour H1H	2.23	1.67	1.67	1.48	1.27	2.33	1.83	1.85	1.71	1.39	2.38	1.90	1.76	1.45	1.56	1.51	1.40	1.38	1.62	1.60	1.52	1.44	1.47	1.39	1.37
	1-hour H4H	1.86	1.39	1.39	1.24	1.08	1.93	1.53	1.54	1.42	1.18	1.96	1.59	1.46	1.22	1.30	1.26	1.17	1.16	1.35	1.32	1.26	1.20	1.24	1.16	1.14
	3-hour H1H	1.31	0.98	0.96	0.81	0.66	1.38	1.07	1.07	0.92	0.71	1.41	1.12	0.95	0.74	0.94	0.90	0.79	0.75	0.97	0.96	0.87	0.78	0.89	0.83	0.78
	3-hour H2H	1.12	0.85	0.83	0.75	0.63	1.19	0.91	0.92	0.85	0.69	1.22	0.96	0.88	0.72	0.81	0.78	0.71	0.69	0.84	0.82	0.76	0.72	0.81	0.71	0.69
	24-hour H1H	0.42	0.31	0.33	0.33	0.32	0.41	0.33	0.34	0.36	0.35	0.41	0.34	0.37	0.37	0.28	0.28	0.31	0.32	0.28	0.28	0.31	0.32	0.24	0.27	0.29
	24-hour H2H	0.29	0.22	0.23	0.24	0.25	0.29	0.23	0.23	0.27	0.28	0.29	0.24	0.27	0.29	0.19	0.19	0.22	0.23	0.19	0.19	0.22	0.23	0.16	0.19	0.20
	Annual	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01

Killingly Energy Center
Combined Cycle Combustion Turbine - Start-up/Shutdown (SU/SD) Emissions Estimates

Fuel		Natural Gas				ULSD			
Case #:		**Hot Start**	**Warm Start**	**Cold Start**	**Shutdown**	**Hot Start**	**Warm Start**	**Cold Start**	**Shutdown**
Exhaust velocity (m/s)		14.128	14.840	12.174	10.315	10.150	11.014	9.989	9.946
Exhaust temperature (K)		352.444	353.556	351.889	353.000	403.556	404.111	403.556	401.333
NOx (g/s)		15.649	17.871	14.091	10.065	22.130	24.304	21.784	21.226
CO (g/s)		47.710	55.088	60.128	26.726	249.007	290.502	277.902	54.100
PM (g/s)		2.277	2.200	2.027	2.385	4.095	4.142	4.127	4.064
SO2 (g/s)		0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788	0.4788

AERMOD SU/SD Impacts - turbine only (ug/m3 per g/s) - 150 ft. turbine stack height

Unit	1-hour H1H	4.404	4.280	4.984	5.587	4.288	4.045	4.333	4.374
	1-hour H2H	4.358	4.197	4.920	5.575	4.155	3.879	4.207	4.260
	3-hour H1H	2.238	2.217	2.377	2.690	2.214	2.167	2.226	2.253
	3-hour H2H	2.126	2.040	2.353	2.588	2.031	1.927	2.049	2.069
	8-hour H1H	1.569	1.460	1.890	2.223	1.774	1.613	1.803	1.829
	8-hour H2H	1.388	1.296	1.654	1.999	1.459	1.329	1.484	1.509
	24-hour H1H	0.925	0.854	1.134	1.361	1.044	0.939	1.065	1.083
	24-hour H2H	0.692	0.629	0.873	1.083	0.736	0.645	0.753	0.770
	24-hour H6H	0.526	0.488	0.620	0.746	0.547	0.495	0.552	0.569
	Annual	0.052	0.048	0.064	0.079	0.049	0.043	0.050	0.051

AERMOD SU/SD Scaled Impacts - turbine only (ug/m3) - 150 ft. turbine stack

NO2	1-hour H1H	53.29	58.61	53.09	42.48	70.73	72.95	70.40	69.43
	1-hour H8H	35.89	39.67	35.60	28.14	49.10	51.22	48.75	47.90
	Annual	0.82	0.86	0.91	0.79	1.08	1.05	1.09	1.08
CO	1-hour H1H	210.13	235.77	299.69	149.33	1067.76	1175.01	1204.06	236.66
	1-hour H2H	207.90	231.18	295.85	149.00	1034.70	1126.97	1169.08	230.47
	8-hour H1H	74.86	80.40	113.61	59.42	441.65	468.71	501.02	98.94
	8-hour H2H	66.24	71.37	99.46	53.43	363.33	386.11	412.34	81.62
PM10	24-hour H1H	2.11	1.88	2.30	3.25	4.27	3.89	4.40	4.40
	24-hour H2H	1.58	1.38	1.77	2.58	3.01	2.67	3.11	3.13
	24-hour H6H	1.20	1.07	1.26	1.78	2.24	2.05	2.28	2.31
	Annual	0.12	0.11	0.13	0.19	0.20	0.18	0.21	0.21
PM2.5	24-hour H1H	1.22	1.08	1.36	1.97	2.43	2.19	2.49	2.50
	24-hour H8H	0.55	0.49	0.61	0.89	0.99	0.90	1.02	1.03
	Annual	0.09	0.08	0.10	0.15	0.16	0.14	0.16	0.16
SO2	1-hour H1H	2.04	1.96	2.26	2.53	1.91	1.80	1.94	1.96
	1-hour H4H	1.71	1.63	1.91	2.14	1.62	1.51	1.64	1.67
	3-hour H1H	1.07	1.06	1.14	1.29	1.06	1.04	1.07	1.08
	3-hour H2H	1.02	0.98	1.13	1.24	0.97	0.92	0.98	0.99
	24-hour H1H	0.44	0.41	0.54	0.65	0.50	0.45	0.51	0.52
	24-hour H2H	0.33	0.30	0.42	0.52	0.35	0.31	0.36	0.37
	Annual	0.03	0.02	0.03	0.04	0.02	0.02	0.02	0.02

Killingly Energy Center - Detailed Results Table

Pollutant	Averaging Period	Rank for SIL	Project Maximum Impact (SIL) (µg/m³)	Maximum Impact Receptor Location		Elevation (m)	Maximum Impact Date (YRMODDHR)	Worst Case Turbine Load Scenario	SIL (µg/m³)	NAAQS (µg/m³)	PSD (µg/m³)
				UTM-E (m)	UTM-N (m)						
NO2 (SS)	1-hour	H1H	21.07	263450.00	4637250.00	206.19	5-year average	Case 68	**7.5**	**188**	**NA**
	Annual	H1H	0.92	257831.20	4638543.30	98.00	2011	Case 71	**1**	**100**	**25**
NO2 (SU/SD)	1-hour	H1H	84.31	263450.00	4637300.00	204.37	5-year average	Oil Warm Start	**7.5**	**188**	**NA**
	Annual	H1H	0.93	257831.20	4638543.30	98.00	2011	Case 71, Oil Cold Start	**1**	**100**	**25**
CO	1-hour	H1H	1427	263450.00	4637200.00	207.60	10050424	Oil Cold Start	**2000**	**40,000**	**NA**
	8-hour	H1H	131	258050.00	4638300.00	113.64	14110216	Case 32, Oil Cold Start	**500**	**10,000**	**NA**
PM10	24-hour	H1H	3.96	258100.00	4638300.00	113.64	10122724	Case 44, Oil Shutdown	**5**	**150**	**30**
	Annual	H1H	0.34	258170.90	4638568.90	97.05	2013	Case 44, Oil Shutdown	**1**	**NA**	**17**
PM2.5	24-hour	H1H (5YA)	3.15	258188.30	4638567.40	95.87	5-year average	Case 44, Oil Shutdown	**1.2**	**35**	**9**
	Annual	H1H (5YA)	0.29	258170.90	4638568.90	97.05	5-year average	Case 44, Oil Shutdown	**0.3**	**12**	**4**
SO2	1-hour	H1H	2.92	263450.00	4637200.00	207.60	5-year average	Case 32, Gas Shutdown	**7.9**	**196**	**NA**
	3-hour	H1H	1.51	258205.70	4638565.90	94.42	11012121	Case 32, Gas Shutdown	**25**	**1300**	**512**
	24-hour	H1H	0.99	258188.30	4638567.40	95.87	11032824	Case 32, Gas Shutdown	**5**	**365**	**91**
	Annual	H1H	0.09	258170.90	4638568.90	97.05	2013	Case 32, Gas Shutdown	**1**	**80**	**20**

Killingly Energy Center - Cumulative Impacts

Pollutant	Averaging Period	Rank for NAAQS Assessment	Cumulative Maximum Impact (NAAQS) (µg/m³)	Ambient Background (µg/m³)	Cumulative Impact + Ambient Background (µg/m³)	Maximum Impact Receptor Location		Elevation (m)	Maximum Impact Date (YRMODDHR)	NAAQS (µg/m³)	PSD (µg/m³)
						UTM-E (m)	UTM-N (m)				
NO2 (Steady-State)	1-hour	H8H (5YA)	67.51	79.0	146.5	268000.00	4640000.00	227.46	5-year average	**188**	**NA**
NO2 (Start-up/Shutdown)	1-hour	H8H (5YA)	62.52	79.0	141.5	263450.00	4637250.00	206.19	5-year average	**188**	**NA**
PM2.5 (NAAQS)	24-hour	H8H (5YA)	7.21	20.0	27.2	266000.00	4638000.00	213.43	5-year average	**35**	**NA**
PM2.5 (PSD)	24-hour	H8H (5YA)	3.35	NA	NA	258188.30	4638568.00	95.87	10012924	**NA**	**9**

Note: Cumulative Impacts reported for all pollutants and averaging periods for which the Project has a significant impact

APPENDIX L-D: BACKGROUND INVENTORY SOURCE DATA

Killingly Energy Center – Background Source Inventory for Cumulative Modeling Assessment

As described Section 3.11, the proposed Project has significant predicted impact concentrations for 1-hour NO_2 and 24-hour $PM_{2.5}$. The predicted significant impact area (SIA) is 20.2 kilometers (km) for NO_2 and 8.1 km for $PM_{2.5}$. Therefore, cumulative modeling with other regional sources has been conducted. CTDEEP guidance, based on distance and actual annual emissions levels, was used to determine the final set of inventory sources for the cumulative modeling assessment. The CTDEEP guidance criteria for background source selection is summarized below:

- For NAAQS modeling:
  - All stacks with actual emissions of >15 tons per year (tpy) of a given pollutant that fall within the radius of significance of the subject source for the pollutant;
  - All stacks with actual emissions of ≥ 50 tpy that fall within 20 km of the subject source; and
  - All stacks with actual emissions of ≥ 500 tpy that fall within 50 km of the subject source.

  All sources retrieved above should be modeled at their allowable emission rate for all short term averaging times. Source can be modeled at their actual emission rates for annual average modeling.

- For PSD increment tracking:
  - All sources affecting the PSD increment (defined in RCSA sections 22a-174-3a(k)(5) and 22a-174-3a(k)-174-2a(k)(6)) that fall within the radius of significance of the subject source for the applicable pollutant;
  - All sources affecting PSD increment with actual stack emissions of ≥ 50 tpy that fall within 20 km of the subject source; and
  - All sources affecting PSD increment with actual stack emissions of ≥ 500 tpy that fall within 50 km of the subject source.

For Connecticut, the source inventory was based on the CTDEEP Radius Search Tool for 2008 Air Emissions Inventory Data, provided by CTDEEP. The Radius Search Tool was used to determine the potential inventory of sources located within 50 km of the Project. For the neighboring states of Massachusetts and Rhode Island, emissions inventory data provided by MADEP and RIDEM.

Five background NO_X sources met the CTDEEP criteria for inclusion in the cumulative NO_2 NAAQS analysis, and two background sources of $PM_{2.5}$ met the criteria for inclusion in the cumulative modeling assessment for NAAQS. The PSD baseline trigger date for $PM_{2.5}$ is October 20, 2010. Therefore, sources that commence construction after that date could potentially consume increment. In addition to the proposed project, two new sources proposed nearby in Rhode Island were considered (the Algonquin Gas Compressor Station Expansion project and the Clean River Energy Center project, both in Burrillville, RI). As shown below, only the proposed Invenergy facility meets the CTDEEP criteria to be included in the $PM_{2.5}$ PSD Increment analysis (the Algonquin PM emissions are less than 50 tpy). Note that there is no PSD increment for 1-hour NO_2.

The sources modeled cumulatively with the Project are as follows:

<u>NO2 NAAQS Modeling</u>

- Lake Road Generating Co., LLC, Killingly Connecticut - Distance from Project = 2.0 km
    - Combustion Turbine #1, Actual NO_x = 20.6 tpy
    - Combustion Turbine #2, Actual NO_x = 30.0 tpy
    - Combustion Turbine #3, Actual NO_x = 26.6 tpy
- Exeter Energy L.P., Sterling Connecticut - Distance from Project = 18.7 km
    - Standard Kessl Inc./Blr #1, Actual NO_x = 45.8 tpy
    - Standard Kessl Inc./Blr #2, Actual NO_x = 50.8 tpy
- Wheelabrator Millbury, Inc., Millbury Massachusetts - Distance from Project = 41.4 km
    - B&W Incinerator #1 / #2, Actual NO_x = 824 tpy
- Algonquin Gas Compressor Station, Burrillville, Rhode Island - Distance from Project = 17.7 km - Existing and Proposed Expansion
    - Actual NO_x = 18.0 tpy
    - Proposed Emission Increases NO_x = 18.0 tpy
    - Three Clark TLA-8 Engines (existing)
    - Five Combustion Turbines (3 existing / 1 proposed)
- Invenergy Clean River Energy Center, Burrillville, Rhode Island – (Proposed Project) Distance from Project = 17.7 km
    - Potential NO_x = 286.6 tpy, Potential $PM_{2.5}$ = 196.8 tpy
    - Two Combined Cycle Combustion Turbines

<u>PM2.5 Modeling</u>

- Lake Road Generating Co., LLC, Killingly Connecticut - Distance from Project = 2.0 km ($PM_{2.5}$ NAAQS only, constructed before PSD baseline date)
    - Combustion Turbine #1, Actual $PM_{2.5}$ = 23.1 tpy
    - Combustion Turbine #2, Actual $PM_{2.5}$ = 12.5 tpy
    - Combustion Turbine #3, Actual $PM_{2.5}$ = 9 tpy
- Invenergy Clean River Energy Center, Burrillville, Rhode Island (Proposed Project)- Distance from Project = 17.7 km Proposed ($PM_{2.5}$ NAAQS and PSD)
    - Distance from Project = 17.7 km,
    - Potential PM2.5 = 196.8 tpy
    - Two Combined Cycle Combustion Turbines

One additional source, the Griswold Rubber Co., located 16.9 km from the Project, was identified by the DEEP Radius Search Tool as potentially needing to be included in the cumulative NO_2 NAAQS analysis with actual NO_X emissions listed as 30.5 tpy. However, potential NO_X emissions for this source were listed as only 4.4. tpy. Follow up with the CTDEEP (Jared Millay) confirmed that the facility currently operates under a General Permit to Limit Potential to Emit (GPLPE) permit that limits potential NO_X emissions to 4.4 tpy. Therefore, this source was excluded from the analysis

Detailed emissions and stack parameter data for these sources are provided in the table below.

Killingly Energy Center - Modeled Source Parameters for the Background Inventory Sources

Facility	Source ID	UTM Easting	UTM Northing	Base Elevation	Stack Height	Temperature	Exit Velocity	Stack Diameter	Emission Rate (g/s)	
		m	m	ft	ft	K	m/s	ft	1-HR NO2	24-HR PM2.5
Lake Road Generating Co., LLC	Turbine 1	259783.06	4639806.86	315	165	364.26	15.86	18.00	6.590	10.823
	Turbine 2	259780.09	4639748.48	315	165	364.26	15.86	18.00	6.590	10.823
	Turbine 3	259776.91	4639690.27	315	165	364.26	15.86	18.00	6.590	10.823
Exeter Energy L.P.	Boiler 1, 2	265300.91	4621670.51	565	196	355.37	8.12	8.00	5.541	NA
Wheelabrator Millbury, Inc.	Incinerator 1, 2	271605.14	4677996.46	496	365	429.10	23.08	10.00	26.770	NA
Algonquin/Spectra Gas Compressor Station	RICE 1	271650.08	4649864.07	572.51	54.46	725.00	25.00	2.49	3.830	NA
	RICE 2	271658.76	4649868.72	572.51	54.46	725.00	25.00	2.49	3.830	NA
	RICE 3	271667.48	4649873.47	572.51	54.46	725.00	25.00	2.49	3.830	NA
	Turbine 1 (existing)	271675.10	4649877.80	572.51	54.46	723.00	59.50	3.28	0.730	NA
	Turbine 2 (existing)	271683.30	4649882.60	572.51	54.46	723.00	59.50	3.28	0.730	NA
	Turbine 3 (existing)	271613.80	4649863.10	572.51	55.12	755.00	15.78	9.02	0.590	NA
	Turbine 4 (proposed)	271577.60	4649843.00	572.51	55.12	755.00	15.78	9.02	0.590	NA
	Turbine 5 (proposed)	271669.29	4649858.42	572.51	60.37	763.00	70.72	6.89	0.380	NA
Invenergy Clean River Energy Center	Turbine 1 (NO2)	271725.83	4649606.72	570.01	200.00	366.50	17.71	22.01	6.170	NA
	Turbine 2 (NO2)	271818.60	4649661.23	570.01	200.00	366.50	17.71	22.01	6.170	NA
	Turbine 1 (PM2.5)	271725.83	4649606.72	570.01	200.00	395.90	15.43	22.01	NA	8.520
	Turbine 2 (PM2.5)	271818.60	4649661.23	570.01	200.00	395.90	15.43	22.01	NA	8.520

APPENDIX L-E: VISCREEN ANALYSIS

Visual Effects Screening Analysis for
Source: Killingly Energy Center
Class I Area: Lye Brook NWA

*** Level-1 Screening ***

Input Emissions for

Particulates	32.90	LB /HR
NOx (as NO2)	192.90	LB /HR
Primary NO2	0.00	LB /HR
Soot	0.00	LB /HR
Primary SO4	0.00	LB /HR

**** Default Particle Characteristics Assumed

Transport Scenario Specifications:

Background Ozone:	0.04	ppm
Background Visual Range:	40.00	km
Source-Observer Distance:	160.00	km
Min. Source-Class I Distance:	160.00	km
Max. Source-Class I Distance:	170.00	km
Plume-Source-Observer Angle:	11.25	degrees

Stability: 6
Wind Speed: 1.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	84.	160.0	84.	2.00	0.023	0.05	0.000
SKY	140.	84.	160.0	84.	2.00	0.006	0.05	0.000
TERRAIN	10.	84.	160.0	84.	2.00	0.002	0.05	0.000
TERRAIN	140.	84.	160.0	84.	2.00	0.000	0.05	0.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	75.	154.9	94.	2.00	0.024	0.05	0.000
SKY	140.	75.	154.9	94.	2.00	0.006	0.05	0.000
TERRAIN	10.	65.	149.3	104.	2.00	0.002	0.05	0.000
TERRAIN	140.	65.	149.3	104.	2.00	0.001	0.05	0.000

APPENDIX L-F: DETAILED CALCULATIONS FOR IMPACTS TO SOILS

Killingly Energy Center
Soils Screening Assessment

Run Case	1	2	3	4	5	36	37	38	39	40	32	33	34	35	41	42	43	44	68	69	70	71	65	66	67	
	Natural Gas														ULSD											
Ambient Temperature (deg F)	100	100	100	100	100	59	59	59	59	59	-10	-10	-10	-10	100	100	100	100	59	59	59	59	-10	-10	-10	
Relative Humidity (%)	45	45	45	45	45	60	60	60	60	60	100	100	100	100	45	45	45	45	60	60	60	60	100	100	100	
Site Elevation (feet)	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	315	
CTG Load	100%	100%	100%	75%	45%	100%	100%	100%	75%	40%	100%	100%	75%	40%	100%	100%	75%	65%	100%	100%	75%	60%	100%	75%	60%	
Evaporative Cooler Status	ON	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	
Duct Firing Status	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	---	---	---	---	---	---	---	---	---	---	---	
Fuel Type	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	OIL	OIL	OIL	OIL	OIL	OIL	OIL	OIL	OIL	OIL	OIL	
Modeling Inputs	**1**	**2**	**3**	**4**	**5**	**36**	**37**	**38**	**39**	**40**	**32**	**33**	**34**	**35**	**41**	**42**	**43**	**44**	**68**	**69**	**70**	**71**	**65**	**66**	**67**	
	Natural Gas														ULSD											
Temp (K)	358.71	361.48	359.82	360.93	359.82	358.15	355.37	355.37	354.26	354.26	359.82	355.37	354.26	354.26	372.59	370.37	367.59	366.48	366.48	365.93	363.15	362.59	373.15	368.71	367.59	
Exhaust Velocity (m/s)	17.39	17.27	16.25	13.76	10.87	18.44	18.08	17.87	14.66	10.86	18.72	18.26	14.67	10.96	18.01	17.08	14.03	13.03	18.70	18.49	15.17	13.55	20.15	16.31	14.61	
EMISSION RATES (g/s)																										
Ammonia																										
Arsenic	2.10E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.26E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.32E-05	0.00E+00	0.00E+00	0.00E+00	1.59E-05	1.49E-05	1.19E-05	1.09E-05	1.64E-05	1.61E-05	1.29E-05	1.12E-05	1.64E-05	1.33E-05	1.18E-05	
Beryllium	1.26E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-06	0.00E+00	0.00E+00	0.00E+00	1.07E-04	1.00E-04	8.03E-05	7.32E-05	1.10E-04	1.09E-04	8.69E-05	7.58E-05	1.10E-04	8.94E-05	7.93E-05	
Boron																										
Cadmium	1.16E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.24E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-04	0.00E+00	0.00E+00	0.00E+00	1.76E-06	1.65E-06	1.32E-06	1.21E-06	1.82E-06	1.79E-06	1.43E-06	1.25E-06	1.82E-06	1.47E-06	1.31E-06	
Chromium	1.47E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.58E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E-04	0.00E+00	0.00E+00	0.00E+00	4.27E-03	4.00E-03	3.21E-03	2.92E-03	4.41E-03	4.34E-03	3.47E-03	3.03E-03	4.41E-03	3.57E-03	3.17E-03	
Cobalt	8.62E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.25E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Copper																										
Fluoride																										
Formaldehyde	8.16E-02	7.37E-02	6.87E-02	5.47E-02	3.98E-02	8.76E-02	7.91E-02	7.80E-02	6.26E-02	4.18E-02	9.07E-02	8.19E-02	6.56E-02	4.41E-02	7.97E-02	7.47E-02	5.98E-02	5.45E-02	8.23E-02	8.09E-02	6.48E-02	5.65E-02	8.22E-02	6.66E-02	5.90E-02	
H2SO4	2.27E-01	1.76E-01	1.64E-01	1.39E-01	1.01E-01	2.52E-01	1.89E-01	1.89E-01	1.51E-01	1.01E-01	2.52E-01	2.02E-01	1.64E-01	1.13E-01	1.76E-01	1.64E-01	1.39E-01	1.26E-01	1.89E-01	1.76E-01	1.51E-01	1.26E-01	1.89E-01	1.51E-01	1.39E-01	
Lead	5.15E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.53E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.68E-05	0.00E+00	0.00E+00	0.00E+00	3.63E-04	3.40E-04	2.72E-04	2.48E-04	3.75E-04	3.69E-04	2.95E-04	2.57E-04	3.75E-04	3.03E-04	2.69E-04	
Manganese	3.89E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.29E-05	0.00E+00	0.00E+00	0.00E+00	6.22E-05	5.83E-05	4.67E-05	4.26E-05	6.42E-05	6.32E-05	5.06E-05	4.41E-05	6.42E-05	5.20E-05	4.61E-05	
Mercury	2.63E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.82E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-05	0.00E+00	0.00E+00	0.00E+00	3.53E-06	3.30E-06	2.64E-06	2.41E-06	3.64E-06	3.58E-06	2.87E-06	2.50E-06	3.64E-06	2.95E-06	2.61E-06	
Nickel	2.21E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.37E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.43E-04	0.00E+00	0.00E+00	0.00E+00	5.10E-04	4.77E-04	3.82E-04	3.49E-04	5.26E-04	5.18E-04	4.14E-04	3.61E-04	5.26E-04	4.26E-04	3.77E-04	
Selenium	2.52E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.78E-06	0.00E+00	0.00E+00	0.00E+00	8.82E-05	8.26E-05	6.61E-05	6.03E-05	9.10E-05	8.95E-05	7.16E-05	6.24E-05	9.10E-05	7.37E-05	6.53E-05	
Toluene	4.41E-02	4.38E-02	4.08E-02	3.25E-02	2.37E-02	4.74E-02	4.70E-02	4.63E-02	3.72E-02	2.48E-02	4.91E-02	4.87E-02	3.90E-02	2.62E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Vanadium																										
Xylene	2.15E-02	2.15E-02	2.01E-02	1.60E-02	1.16E-02	2.32E-02	2.31E-02	2.28E-02	1.83E-02	1.22E-02	2.40E-02	2.40E-02	1.92E-02	1.29E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
Zinc																										
MODELING RESULTS																										
AERMOD Unit Impacts (ug/m3 per g/s)																										
Annual	0.035	0.035	0.039	0.049	0.067	0.033	0.035	0.036	0.048	0.072	0.031	0.035	0.048	0.071	0.029	0.032	0.043	0.049	0.029	0.030	0.041	0.049	0.025	0.034	0.041	
SCALED IMPACTS (ug/m3)																										**MAX**
Ammonia																										0.000
Arsenic	7.45E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.40E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.30E-07	0.00E+00	0.00E+00	0.00E+00	4.57E-07	4.71E-07	5.17E-07	5.30E-07	4.79E-07	4.82E-07	5.28E-07	5.47E-07	4.06E-07	4.56E-07	4.83E-07	7.45E-07
Beryllium	4.47E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.44E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.38E-08	0.00E+00	0.00E+00	0.00E+00	3.08E-06	3.17E-06	3.48E-06	3.58E-06	3.23E-06	3.25E-06	3.56E-06	3.69E-06	2.74E-06	3.07E-06	3.25E-06	3.58E-06
Boron																										
Cadmium	4.10E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.07E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.01E-06	0.00E+00	0.00E+00	0.00E+00	5.08E-08	5.23E-08	5.74E-08	5.89E-08	5.32E-08	5.35E-08	5.87E-08	6.07E-08	4.51E-08	5.07E-08	5.36E-08	4.10E-06
Chromium	5.22E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.18E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.11E-06	0.00E+00	0.00E+00	0.00E+00	1.23E-04	1.27E-04	1.39E-04	1.43E-04	1.29E-04	1.30E-04	1.42E-04	1.47E-04	1.09E-04	1.23E-04	1.30E-04	1.43E-04
Cobalt	3.06E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.04E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.99E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.06E-07
Copper																										0.00E+00
Fluoride																										
Formaldehyde	2.89E-03	2.55E-03	2.65E-03	2.66E-03	2.68E-03	2.88E-03	2.77E-03	2.78E-03	3.03E-03	3.02E-03	2.85E-03	2.83E-03	3.17E-03	3.15E-03	2.30E-03	2.36E-03	2.59E-03	2.66E-03	2.40E-03	2.42E-03	2.65E-03	2.74E-03	2.04E-03	2.29E-03	2.42E-03	0.003
H2SO4	8.04E-03	6.10E-03	6.33E-03	6.74E-03	6.79E-03	8.27E-03	6.62E-03	6.73E-03	7.32E-03	7.28E-03	7.93E-03	6.96E-03	7.92E-03	8.10E-03	5.08E-03	5.19E-03	6.02E-03	6.16E-03	5.52E-03	5.27E-03	6.19E-03	6.13E-03	4.69E-03	5.20E-03	5.69E-03	0.008
Lead	1.83E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.81E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.79E-06	0.00E+00	0.00E+00	0.00E+00	1.05E-05	1.08E-05	1.18E-05	1.21E-05	1.10E-05	1.10E-05	1.21E-05	1.25E-05	9.29E-06	1.04E-05	1.10E-05	1.21E-05
Manganese	1.38E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.37E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E-06	0.00E+00	0.00E+00	0.00E+00	1.79E-06	1.85E-06	2.03E-06	2.08E-06	1.88E-06	1.89E-06	2.07E-06	2.14E-06	1.59E-06	1.79E-06	1.89E-06	2.08E-06
Mercury	9.32E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.25E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.12E-07	0.00E+00	0.00E+00	0.00E+00	1.02E-07	1.05E-07	1.15E-07	1.18E-07	1.06E-07	1.07E-07	1.17E-07	1.21E-07	9.03E-08	1.01E-07	1.07E-07	9.32E-07
Nickel	7.82E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.77E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.66E-06	0.00E+00	0.00E+00	0.00E+00	1.47E-05	1.51E-05	1.66E-05	1.70E-05	1.54E-05	1.55E-05	1.70E-05	1.75E-05	1.30E-05	1.46E-05	1.55E-05	1.70E-05
Selenium	8.94E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.88E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.75E-08	0.00E+00	0.00E+00	0.00E+00	2.54E-06	2.61E-06	2.87E-06	2.95E-06	2.66E-06	2.68E-06	2.93E-06	3.04E-06	2.26E-06	2.53E-06	2.68E-06	2.95E-06
Toluene	1.56E-03	1.51E-03	1.58E-03	1.58E-03	1.59E-03	1.56E-03	1.65E-03	1.65E-03	1.80E-03	1.79E-03	1.55E-03	1.68E-03	1.88E-03	1.87E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.002
Vanadium																										0.00E+00
Xylenes	7.64E-04	7.45E-04	7.76E-04	7.77E-04	7.85E-04	7.60E-04	8.11E-04	8.12E-04	8.85E-04	8.83E-04	7.55E-04	8.27E-04	9.27E-04	9.20E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.001
Zinc																										0.00E+00

Killingly Energy Center - Soils Impact Screening Assessment

Trace Element	Annual Conc (ug/m3)	Maximum Project Deposited Soil Concentration (ppmw)	Soil Screening Criteria (ppmw)	Percent of Soil Screening Criteria	Avg. Soil Conc (ppmw)	Percent Increase
Arsenic	7.45E-07	2.14E-04	3	0.01%	6	0.0%
Beryllium	3.58E-06	1.03E-03	NA	NA	6	0.0%
Boron	0.00E+00	NA	0.5	NA	10	NA
Cadmium	4.10E-06	1.17E-03	2.5	0.05%	0.06	2.0%
Chromium	1.43E-04	4.09E-02	8.4	0.49%	100	0.0%
Cobalt	3.06E-07	8.76E-05	NA	NA	8	0.0%
Copper	0.00E+00	NA	40	NA	20	NA
Fluoride	0.00E+00	NA	400	NA	200	NA
Lead	1.21E-05	3.48E-03	1000	0.00%	10	0.0%
Manganese	2.08E-06	5.96E-04	2.5	0.02%	850	0.0%
Mercury	9.32E-07	2.67E-04	455	0.00%	0.1	0.3%
Nickel	1.70E-05	4.88E-03	500	0.00%	40	0.0%
Selenium	2.95E-06	8.45E-04	13	0.01%	0.5	0.2%