January 17, 2018

VIA EMAIL AND FIRST-CLASS MAIL

Ms. Melanie Bachman
Executive Director
Connecticut Siting Council
Ten Franklin Square
New Britain, CT. 06051

Re: DOCKET 192B – CPV Towantic LLC; CSC Decision and Order Section (g) – Final Noise Mitigation Measures and Plans to Demonstrate Compliance with DEEP Noise Standards.

Dear Ms. Bachman:

In accordance with Section (g) an Operational Noise Measurement Protocol plan has been prepared and submitted with this letter as required 120 days prior to the commencement of the field program. A final noise monitoring report will be submitted to the Council no later than 30 days after commercial operation.

Should you have any questions or require additional information, please feel free to contact me anytime.

Sincerely,

Colin M. Kelly
CPV Towantic, LLC
Asset Manager
(617) 480-8304
ckelly@cpv.com

cc: Dan Nugent
Franca DeRosa
CSC Mailing List

Towantic Energy Center Project

Facility Operation Far-Field Sound Test Protocol

October 18, 2017

Towantic Energy Center Project
Facility Operation Far-Field Sound Test Protocol

General

Gemma Power Systems, LLC (GPS) has designed and constructed the new CPV Towantic Energy Center in Oxford, CT. This 2x1 combined cycle natural gas-fired electrical generating facility is nominally rated at 805 MWe. Major equipment items at the facility include:

- Two (2) General Electric 7HA.01 combustion turbine generators (CTGs)
- Two (2) CMI Heat Recovery Steam Generators (HRSGs) with supplementary firing
- One (1) GE D602 Steam Turbine Generator (STG)
- Boiler Feed Pumps
- Fin Fan Coolers
- Air-Cooled Condenser
- Fuel Gas Compressors
- Generator Step-up Transformers
- Support Equipment

The references listed below identify the Far Field Noise Guarantees and associated Noise Receptor Locations for this project; pertinent sections from these references are presented the Appendix of this protocol.

The Owner or the Owner's representative shall be present for all far field noise testing at the Owner's discretion.

Purpose

The purpose of this protocol is to describe in detail the sound measurements that will be made to demonstrate compliance of the power facility with the Far Field Noise Guarantees.

Far Field Noise Guarantees

Sound levels produced by baseload operation of the Power Island Equipment Trains and Balance of Plant Systems will not exceed the values listed below in Table 1 for four far-field locations.

Table 1: Far Field Noise Limits

Noise Receptor ID	Noise Receptor Location/Description	A-Weighted Sound Level Guarantee (dBA)[2]
RES-N	Residential Land Boundary - North	51
RES-S	Residential Land Boundary - South	51
RES-E	Residential Land Boundary - East	51
PL-E	Industrial Property Line East of Site	70

Notes:
[1]Locations of the Noise Receptor Points are identified in Figure 1
[2]Plant sound only (i.e., excludes contribution of all non-plant ambient sounds)

Operating Survey

1. Confirm the siting of the four far field measurement locations shown in Figure 1 with the Project Representative.

2. Confirm with Project Representative that the plant is operating at a nominal 50F Baseload Unfired operating condition. If gas compression is not required, due to sufficient pipeline pressure, a single gas compressor will be placed in in recirculation mode. Sound levels will be measured with the new generation plant in normal operation at a load of 90% capacity or greater. Maintain contact during survey to reconfirm plant condition.

3. Perform field calibration of instruments before commencement of the operating measurements.

4. Measure the overall A-weighted L_{90} sound levels for a five-minute period at each far field location. Should additional time be deemed useful by the field team to capture representative sound data at a location, the team may extend the measurement period at that location. For informational purposes, measure the unweighted L_{90} one-third octave band sound pressure levels in the frequency bands centered from 25 Hz to 12,500 Hz, plus the associated L_1, L_{10}, L_{50}, and L_{eq} A-weighted sound levels and one-third octave band sound pressure levels for the same five (5) minute period at each location. A measurement may be paused when the sound level is unduly influenced by a short-term non-plant sound event (e.g., local truck traffic), however, a minimum of five (5) minutes of data will be collected at each location.

5. Microphone will be fitted with the manufacturer's recommended windscreen, tripod-mounted about five (5) feet above the ground, and where practical, removed from any large, vertical reflective surface. The meter will be set with the fast time constant. Local weather conditions, including wind speed and direction, temperature, cloud cover, and any precipitation will be noted. In addition, the field team will note sounds from the facility or other sources observed at each location.

6. If the measured level exceeds the project guarantee levels at a location due to the contribution of non-plant sounds, then additional measurements shall be conducted at an alternate location closer to the facility and/or at other times when the contributions of non-plant sounds are reduced. An alternative location shall be in the same direction from the facility as the far field measurement location, but closer to the facility. The operating noise at the far field measurement location shall then be calculated from the level observed at the alternative location by subtracting hemispherical divergence and atmospheric absorption as listed in column 4 of Table 5.1 of the "Electric Power Plant Environmental Noise Guide", 1984 Edition. Distances used in the adjustment for hemispherical divergence shall be from the center of the closest major facility noise source that is clearly audible at the alternative measurement location. As an alternative, measure the ambient sound level with the plant turned off and subtract this value from the above sound level with the plant in operation in order to calculate the sound level of the facility. At each measurement location the test team will observe and describe the non-plant ambient sound sources and will estimate their contribution to the measured total sound level.

7. Perform field calibration of instruments following the conclusion of the operating measurements.

Determination of Compliance

If the resultant overall A-weighted sound level (dBA)) does not exceed the "Far Field Noise Guarantees" in Table 1, then the Plant Generated Noise is deemed in compliance at that location.

Plant Operating Conditions

Sound levels will be measured with the power facility in normal baseload unfired operation at a load of 90% capacity or greater.

Weather Conditions

The community measurements will be performed during the normal operating time of the plant during times of acceptable weather conditions, including relatively calm winds (e.g., winds less than 10 mph) and no precipitation. Weather conditions, including air temperature, wind speed and direction, and cloud cover will be noted during the survey. Measurements will not be taken if there is significant freshly-fallen snow on the ground.

Instrumentation

All direct measurements will be made with a precision sound level meter that nominally meets the Type 1 provisions in ANSI S1.4-1983, ANSI S1.11-2004, and ANSI S1.43-1997; and/or meet the Class 1 provisions in IEC 61672-1: 2002 and IEC 61260: 1995. All sound measurement instrumentation will be identified as to manufacturer and model. Additional information, including instrument serial number and date of most recent laboratory calibration will be kept on file. All instrumentation shall have been calibrated in the lab within the previous 24 months with its calibration traceable to NIST. The instrumentation will also be calibrated in the field prior to and following the series of measurements and any test series shall be repeated if the before-and-after calibration level change exceeds ±1.0 dB.

Personnel

The survey will be performed by a qualified acoustical consultant or engineer who will employ methods that generally conform to the ASME PTC 36 standard and applicable ANSI and ASTM standards for the measurement of sound.

Schedule

The survey will be scheduled for a time with appropriate plant operating conditions, suitable weather conditions, and available instrumentation and personnel. The compliance measurements can be obtained during the day or night. If, in the judgment of the field team, high background ambient sound levels during a test period preclude useful measurements, the team may reschedule measurements to another time.

Reporting

A report that summarizes the pertinent results of the above operating survey will be prepared and submitted within two weeks from completion of the survey. The report should include the following information, at a minimum:

1. An introduction with a discussion of the background behind the measurement program.

2. A review of the test set-up information. This includes details regarding the test personnel, the meteorological conditions, the plant layout and measurement locations, and the test equipment.

3. An explanation of the measurement methodologies/techniques used to acquire the sound level data including observations and descriptions of the non-plant ambient sound sources and their estimated contribution to the measured total sound level.

4. A thorough presentation of the measured sound level data including explanatory and/or summary graphics, tables, or charts; per measurement location.

5. Calibration documentation performed on test instruments before, during, or after the testing.

6. A summary discussion relating the measured results to the generation project sound level guarantees.

References

Figure 1 - Aerial Photo of CPV Towantic Energy Center Site.

Figure 2 - Far-Field Sound Measurement Locations RES-N, RES-S, RES-E, and PL-E.
(from Exhibit A: Appendix Q – Noise Report for Project)

EPC Exhibit K: Guarantees and Performance Tests for CPV Towantic Energy Center Project.

Exhibit A: Appendix Q – Noise Report for CPV Towantic Energy Center Project.

Figure 1.
Aerial Photo of CPV Towantic Energy Center Site and
Far Field Noise Receptor Locations RES-N, RES-S, RES-E, and PL-E.

Figure 2.
Far-Field Sound Measurement Locations RES-N, RES-S, RES-E, and PL-E.
(from Exhibit A: Appendix Q – Noise Report for Project)

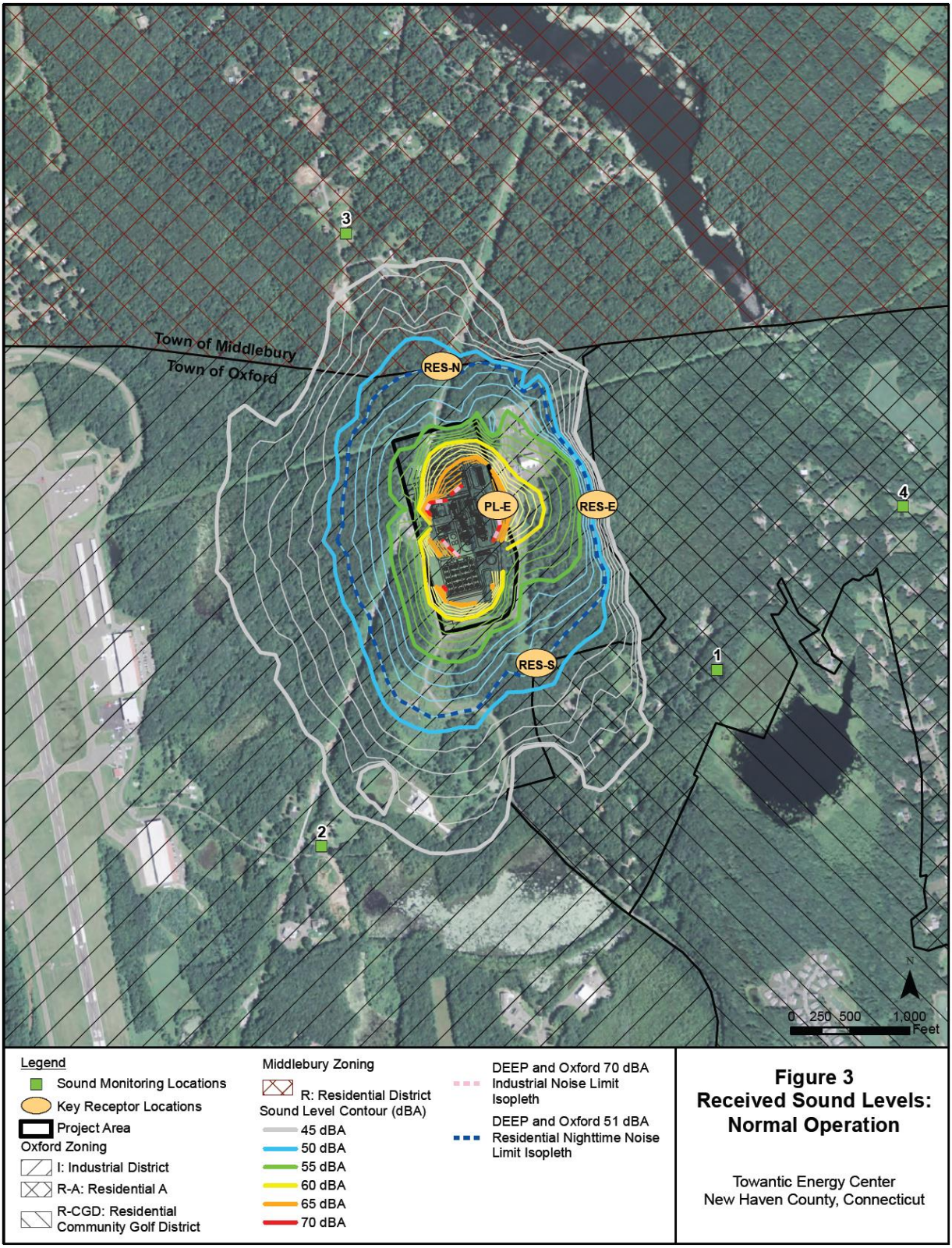


EXHIBIT K

Guarantees and Performance Tests

EXHIBIT K
GUARANTEES AND PERFORMANCE TESTS

I. PERFORMANCE GUARANTEES

A) Guaranteed Auxiliary Load for 50F Baseload Unfired operating condition and guaranteed incremental Auxiliary Load increase for the 90F Baseload Duct Fired operating condition above the greater of the guaranteed or measured Auxiliary Loads for the Baseload Unfired operating condition.

B) Guaranteed piping pressure drops for the 50F Baseload Unfired and 90F Baseload Duct Fired operating condition.

C) ACC Vacuum Guarantee for the 50F Baseload Unfired and 90F Baseload Duct Fired operating condition.

D) Guaranteed Contractor Emission Limits for the Contractor furnished equipment (auxiliary boiler, standby diesel generator, and diesel fire pump). Contractor's responsibility for emissions guarantees shall be limited to those pieces of equipment listed above.

E) Reliability Guaranty: the Facility shall pass a Reliability Test.

F) Guaranteed Noise Limits shall be defined as follows. Contractor shall procure equipment with near field noise guarantees as stated in Section II.E. of this Exhibit and design the Plant with noise attenuation features as listed in Section II.E.4. of this Exhibit. Far field noise limits are listed in Section II.E and far field noise guarantees are described in Section V.F and Section V.G.

II. GUARANTEED VALUES

The guaranteed values assume, as a minimum condition, that the Equipment Contractor's Minimum Performance Guarantees as defined in Appendix T to Exhibit A are being achieved. Contractor guarantees the balance of plant (BOP) equipment will not impair the Equipment Contractor from achieving its Minimum Performance Guarantees. If Equipment Contractor fails to achieve Minimum Performance Guarantees yet Contractor meets the requirements for Substantial Completion, Contractor shall be granted Substantial Completion; however, Contractor will work with Owner and Equipment Contractor to achieve the Minimum Performance Guarantees.

A) Auxiliary Load. Contractor's Guaranteed Auxiliary Load (including calculated transformer losses as described in Section V.A), excluding the Equipment Contractor's auxiliary loads, shall be less than or equal to 16,680 kW for the Facility based on the 50F Baseload Unfired operating condition as per GE heat balance Case-1 CCA 19957 Rev 5. The incremental increase in auxiliary power for the 90F Baseload Duct Fired operating condition, as per GE heat balance Case-2 CCA 19958 Rev 5, shall be less

than or equal to 3,000kW for the Facility based on the higher of either the measured or guaranteed Auxiliary Load for the 50F Baseload Unfired operating condition. The Contractor's Guaranteed Auxiliary Load will be determined by subtracting the Equipment Contractor's auxiliary loads as described in Section V.A below. The test will be conducted per the agreed test procedure for purposes of measuring the Guaranteed Auxiliary Load with the required BOP equipment operating and will be corrected to the Design Conditions.

B) HP, Reheat and LP Steam Piping Pressure Drops and ACC Vacuum. Contractor's Guaranteed HP, Reheat and LP Steam Piping Pressure Drops and ACC Vacuum Guarantee are shown in the table below. Test results shall be corrected to Design Conditions. Contractor's guarantees for piping pressure drop shall be from the identified terminal points and shall exclude equipment supplied by the Equipment Contractor. Contractor's guarantees for ACC Vacuum shall be measured at the steam turbine exhaust.

Guaranteed Steam Piping Pressure Drop Summary			
System	**GE HB Terminal Point**	**Unfired Heat Balance GE Case [1]**	**Fired Heat Balance GE Case [2]**
HP Steam	S1 to S2	79 psi	94 psi
Cold and Hot Reheat Steam Combined	S3 to S17 (CRH) and S6 to S7 (HRH) combined	20 psi	24 psi
LP Steam	S8 to S9	8 psi	5 psi

Guaranteed ACC Vacuum		
	Unfired Heat Balance GE Case [1]	**Fired Heat Balance GE Case [2]**
ACC Vacuum (S10) (backpressure at ST exhaust interface)	1.054 psia	2.759 psia

C) Guaranteed Emission Limits for the BOP equipment in Contractor's scope (Auxiliary Boiler, Standby Diesel Generator and Diesel Fire Pump), contingent upon fuel gas supplied in accordance with constituents listed in Exhibit A Appendix F, are as follows:

Pollutant	Auxiliary Boiler (Max Heat Input: 92.4MMBtu)*	Standby Diesel Generator	Diesel Fire Pump
NOx (lb/hr)	0.79	19.84	2.65
NOx (ppmvd @ 3% O_2)	7	N/A	N/A
CO (lb/hr)	3.42	2.14	0.64
CO (ppmvd @ 3% O_2)	50	N/A	N/A
VOC (lb/hr)	0.38	0.53	0.07
PM_{10} (lb/hr)	0.65	0.15	0.1
$PM_{2.5}$ (lb/hr)	0.65	0.15	0.1

** These emissions will be demonstrated between 80% and 100% load.*

D) Reliability Guaranty: Contractor guarantees that the Facility will operate for seventy-two (72) hours at loads between Minimum Emissions Compliance Load (MECL) and base load defined as both combustion turbines operating at 100% load.

E) Guaranteed Noise Limits

Near Field Noise: The Contractor shall procure BOP equipment with a near field noise guarantee of 85 dBA (A-weighted sound pressure level) or less at a distance of 3 feet and at a height of 5 feet above grade or foundation level with the exception of the equipment identified in Section II.E.4 below.

Far Field Noise Limits: With the Facility operating in the Baseload Unfired operating condition, the far field A-weighted sound levels shall not exceed those limits listed in the table below.

Item No.	Receptor Location/Description	A-weighted Guarantee Value (dBA)
RES-N, S, E	Residential Land Boundary North, South, and East of site	51
PL- E	Industrial Property Line East of site	70

1) Refer to Exhibit A Appendix Q for further clarification on the location of the noise receptors.

2) The Contractor provides noise guarantees, as defined in this Exhibit K, for far field noise limits based on the information provided in the Tetra Tech Noise Study in Appendix Q of Exhibit A. The study contains the sound levels used for the modeling in general, and specifically for the Owner-Supplied Equipment. Those Owner-furnished values form the basis of the guaranteed values listed above and the modeling inputs used in the detailed analysis of near-field and far-field noise impacts.

3) Sound levels will be measured per standard methods; a testing protocol will be developed and agreed upon by Owner and Contractor prior to compliance demonstration.

4) The Contractor shall procure equipment and design the Plant components to mitigate noise with the following measures:

   a. Provide and install Acoustic Enclosures with an STC 35 rating for the boiler feedwater pumps.

   b. Procure the ACC with requirement to meet a far field noise level of 52 dBA at 400 ft.

   c. Procure generator step-up transformers (GSUs) with a low noise NEMA rating of 73dBA sound pressure level.

   d. Procure the fin fan cooler with a sound pressure level of 85dBA or less at a distance of 3 feet and a height of 5 feet above grade or foundation level.

   e. Procure gas compressors with a sound pressure level of 95dBA each (expected 91dBA*) or less at a distance of 3.3 feet and a height of 5 feet above grade or foundation level. The following criteria shall apply:

      1. The noise is average of six points around the compressor skids;

      2. The noise during the transient condition is excluded., e.g. unload and recycle operation, unusual operation, PSV blowing.

**Note: Kobelco estimates, based on a calculation, a sound pressure level of 91dBA equates to a sound power level of 99dBA (not guaranteed).*

III. DESIGN CONDITIONS

Site Elevation:	830 ft
Ambient Temperature:	50 deg. F Unfired and 90 deg. F Duct Fired

Relative Humidity:	60%
Fuel Gas Pressure at Site Boundary:	480 psig

The Facility is operating in Baseload Unfired and Baseload Duct Fired in accordance with GE Heat Balance No. Case 1, CCA-19957-NG Rev 5 and Case 2, CCA-19958-NG Rev 5, respectively.

IV. SUBSTANTIAL COMPLETION AND FINAL COMPLETION

A) Required for Substantial Completion

1) The Auxiliary Load will be measured to compare the actual value to the Guaranteed Auxiliary Load (one hour test).
2) HP, Reheat and LP Steam System Piping Pressure Drop Tests.
3) ACC Vacuum test.
4) Equipment Contractor Output Test (one hour test).
5) Equipment Contractor Heat Rate Test (one hour test to be run in conjunction with Output Test and Auxiliary Load Test)
6) Reliability Test conducted and successfully passed.
7) Emissions Tests conducted and successfully passed.
8) Noise Survey (as defined below) conducted.

B) Required for Final Completion

Contractor has met the guaranteed performance criteria in Section II.A and II.B of this Exhibit K or has paid the applicable Performance Damages.

Contractor has completed Compliance Noise Tests and mitigation described in Section V.G of this Exhibit K.

Contractor will support but not be responsible for passing tests required under the Equipment Contract.

V. TEST DESCRIPTIONS/CONDITIONS OF TESTS

Using the criteria of the Equipment Contractor's Test Protocol, Contractor will prepare a proposed testing plan for the Facility so that the Performance Test Protocol is established by Contractor and Equipment Contractor, and agreed to by Owner, one hundred twenty (120) days before the tests described below are scheduled to take place. Contractor shall perform detailed uncertainty calculations for each test described below and the calculated uncertainty shall be utilized in determining whether Contractor has met the stated guarantees.

A) Auxiliary Load Tests – These tests shall be corrected to the Design Conditions. The Auxiliary Load Test is conducted for the purposes of determining Contractor's Guaranteed Auxiliary Load. The auxiliary loads can be measured and tested any time during Facility operation as long as conditions meet the requirements of the performance test and appropriate notice is given to the Owner.

1) BOP equipment needed to support Facility operation shall be in service as listed in Section VII below. The Auxiliary Load shall be measured at the high side of the Unit Auxiliary Transformers for one hour during the test period.

2) Transformer losses for the GSUs shall be calculated using the results from the factory test reports and added to the measured auxiliary load value from the high side of the Unit Auxiliary Transformers to determine the Facility Auxiliary Load.

3) During the test, the Equipment Contractor's auxiliary loads shall be measured with either dedicated plant meters or clamp-on-meters and be deducted from the Facility Auxiliary Load to determine the Contractor's Auxiliary Load for comparison with the stated guaranteed values. Equipment Contractor auxiliary loads will include the following:

   i. Combustion Turbine (CT) auxiliary loads including, but not limited to the lube oil pumps, hydraulic fluid pumps, lube oil tank vapor extractors, evaporative cooling pumps, mist eliminator, HVAC for GE equipment enclosures, package vent fans, and controls and instrumentation

   ii. Steam turbine (ST) auxiliary loads including, but not limited to the lube oil pumps, lube oil tank vapor extractor, hydraulic fluid pumps, hydraulic fluid cooling fans, lube oil conditioner, controls and instrumentation, and gland seal exhaust fans

   iii. CT generator (CTG) and ST (STG) generator exciter and exciter transformer losses

   iv. CTG and STG bus and cable losses to exciter

   v. Distributed Control System (DCS) load

   vi. Heat recovery steam generator (HRSG) loads including but not limited to the SCR/CO catalyst aux power, low pressure economizer recirculation pump, duct burner aux loads, and CEMS.

B) Emissions Tests - Contractor shall perform a stack test on the Auxiliary Boiler at 100% load to demonstrate compliance with the guaranteed values in Section II.C. Contractor

shall furnish documentation certifying that the Standby Diesel Generator and Diesel Fire Pump have been designed to meet the emissions guarantees in Section II.C. Equipment Contractor shall be responsible for emissions testing of the Owner-Supplied Equipment.

C) Pressure Drop Tests – Contractor shall demonstrate compliance with stated guarantee values for piping pressure drop through necessary field measurements during Facility operation using both plant instrumentation and additional test equipment as needed. Results shall be adjusted to deduct the pressure drops of devices that are in the scope of supply of the Equipment Contractor and installed in Contractor's piping systems. Should the measured pressure drops for both the 50F Baseload Unfired case and the 90F Baseload Duct Fired operating conditions exceed their respective guarantee values, the Contractor shall be responsible for Performance Damages amounts based only on the operating condition with the greatest difference between measured and guaranteed values, less commercial offsets as described in Section VI below.

D) ACC Vacuum Test – Contractor shall demonstrate compliance with stated guarantee value for ACC vacuum through necessary field measurements during Facility operation using both plant instrumentation and additional test equipment as needed. . The ACC Vacuum Test will be conducted per the agreed test procedure for purposes of achieving the Guaranteed ACC Vacuum at the ST interface. Should the ACC vacuum for both the 50F Baseload Unfired operating condition and the 90F Baseload Duct Fired operating condition exceed their respective guarantee values, the Contractor shall be responsible for liquidated damage amounts based only on the case with the greatest difference between measured and guaranteed values, less commercial offsets as described in Section VI below.

E) Reliability Test – The Reliability Test shall run for seventy two (72) hours as described in Section II.D above. The BOP equipment shall support plant operation during that time period. If the Facility is dispatched off line or incurs derating or outages due to Owner Supplied Equipment, Contractor shall be credited for any added time in bringing the Facility back on line while achieving base load and shall be credited for time run before being dispatched off line. If the BOP equipment causes the facility to incur a derating or a trip during the reliability test, the test will be rerun in its entirety unless directed differently by the owner.

F) Noise Survey – Contractor will conduct a noise survey with the Facility at the 50F Baseload Unfired operating condition as a condition of Substantial Completion to determine if far field noise A-weighted sound levels are being met. The Contractor shall conduct noise testing in accordance with the reference test methods for measurement of near field and far field sound pressure levels in ASME PTC 36. The

tests may be conducted during the Net Output and Heat Rate Test or during the Reliability Test. If the results of the noise tests indicate the far field noise limits defined in Section II.E are not being met and Contractor has followed the recommendations of the noise study as explicitly stated in this Exhibit K, Section II.E.4, Contractor shall develop a mitigation plan for approval by Owner. Owner will issue Contractor a Change Order, and Contractor shall implement the plan and retest the far field noise as a condition of Final Completion in accordance with Section V.G.

G) Compliance Noise Tests Required for Final Completion - For purposes of determining whether the Contractor has achieved the Noise Guarantees, the Contractor shall perform the Noise Survey. Achievement of the Noise Guarantees shall be determined as follows:

1) The far field noise levels shall not exceed the Far Field Noise Limits
2) If the results of the far field noise test indicate the noise levels of the Plant exceed the Far Field Noise Limits, the Contractor shall conduct near field testing and mitigate the near field noise based on the equipment near field guarantees and Section II.F.4.
3) If the Contractor meets the near field noise requirements and the facility does not pass the far field noise requirements, Contractor shall develop a mitigation plan for approval by the owner and will employ the mitigation measures under a Change Order and Contractor shall implement the plan and retest the far field noise as a condition of Final Completion.

H) Equipment Contract/BOP demonstrations – Contractor will follow the Performance Testing Protocol and will coordinate test periods for the tests required under the Equipment Contract with Contractor's construction and commissioning schedule.

VI. COMMERCIAL OFFSETS

Commercial offsets may be applied for calculating Performance Damages for the test results as described below. However, offsets can only be applied within the operating condition that the guarantees apply: (1) 50F Baseload Unfired and (2) 90F Baseload Duct Fired. Offsets from test results for 50F Base Load Unfired operating condition may not be applied to the test results from the 90F Baseload Duct Fired operating condition.

If the offset calculation indicates that Performance Damages are owed for both operating conditions, the Contractor shall pay Performance Damages for the operating condition with the higher calculated Performance Damages only. If one operating condition is incurring Performance Damages and the other operating condition is not, the two cases do not offset each other.

The description below applies to offset calculations for either the 50F Baseload Unfired Case or the 90F Baseload Duct Fired Case.

If test results indicate that guaranteed values for Auxiliary Load, Steam Line Piping Pressure Drop, or ACC Vacuum are not being met, and Performance Damages are owed, the calculated Performance Damage value shall be offset by calculated test values for other guaranteed parameters that may be in excess of guarantee requirements.

Calculated credits or deficits for HP Steam Line Piping Pressure Drop, Reheat Steam Line Piping Pressure Drop, LP Steam Line Piping Pressure Drop, ACC Vacuum, and Auxiliary Load shall be summed to determine the net amount owed, but in no event shall a bonus be paid.

For example, Performance Damages for HP, Reheat and LP Steam Line Piping Pressure drops may be mitigated by a calculated offset. Calculated Performance Damages (in $) for pressure drops higher than the guaranteed HP, Reheat or LP pressure drops shall be assigned as positive values and calculated Performance Damages (in $) for pressure drops lower than the guaranteed HP, Reheat or LP Pressure drops shall be assigned a negative value. A single net piping pressure drop Performance Damage value for these three items will be calculated from the sum of the positive and negative values and will be available for offset of the Auxiliary Load and ACC Vacuum guarantees. Similarly, favorable performance values for Auxiliary Load or ACC Vacuum may offset unfavorable results for steam line pressure drop.

VII. OPERATING STATUS OF BOP EQUIPMENT DURING AUX LOAD TEST:

BOP Equipment	**Unfired Test**	**Fired Test**
Condensate Pumps	On	On
HP Boiler Feedwater Pump and Ancillary Equipment	On	On
HRSG Blowdown Pumps	Off	Off
Fin Fan Cooler fans as required	On	On
Closed Cooling Water Pumps	On	On
Service Water Pumps	On	On
Demineralized Water Pumps	Off	Off
Firewater Jockey Pump	On	On
Electric Motor Driven Fire Pump	Off	Off
Air Cooled Condenser (ACC) fans as required	On	On
ACC Drain pumps	On	On
Vacuum pumps (1 out of 2 used for Holding)	On	On
Fuel Gas Compressors as required	On	On
~~Fuel Gas Heater if compressors are required~~	~~Off~~	~~Off~~
~~Fuel Gas Heater if compressors are not required~~	~~On~~	~~On discuss~~
Aux Boiler and Ancillary Equipment	Off	Off

Fuel Oil unloading pumps	Off	Off
Fuel Oil forwarding pumps	Off	Off
Air Compressors	On	On
Air Dryer	On	On
Steam Cycle Chemical Feed System		
Phosphate Feed Pumps	On	On
Phosphate Day Tank Mixer	On	On
Feedwater Amine Feed Pumps	On	On
Sampling and Analysis System	On	On
Ammonia Forwarding Pumps	On	On
Oil/Water Separator Lift Station Sump Pump, if required	Off	Off
Plant Sump Pumps	Off	Off
Sanitary Lift Station Pumps, if needed	On	On
HVAC / Ventilation	On	On
UPS	On	On
Battery Charger	On	On
Motorized Valves	On	On
Freeze protection and tank Heaters	Off	Off
Safety Shower Tepid Water Heaters	On	On
Lighting / Misc		
Admin Bldg and Control Room - Lighting and Parasitic Power	On	On
Maintenance Shop - Lighting and Parasitic Power	On	On
Warehouse - Lighting and Parasitic Power	On	On
Steam Turbine Building - Lighting and Parasitic Power	On	On
Switchgear Room/Enclosures - Lighting and Parasitic Power	On	On
Cranes and Hoists	Off	Off

APPENDIX Q

Noise Report

The requirements of the CPV Towantic Energy Center are expected to mirror the requirements of the Noise Report (Appendix Q). The final Noise Report is subject to review by the Parties for potential changes in scope in accordance with applicable provisions of this (EPC) Contract.

To:	CPV Towantic, LLC
From:	Tetra Tech, Inc.
Date:	Tuesday, October 13 2015
Subject:	CPV Towantic Energy Center – Final Noise Mitigation Design

CPV Towantic LLC (CPV) has submitted a Petition to the Connecticut Siting Council (CSC) to modify its Certificate of Environmental Compatibility and Public Need for the CPV Towantic Energy Center (the Project). The proposed Project has a nominal capacity of 805 megawatts (MW) utilizing two highly efficient General Electric (GE) Frame 7HA.01 combustion turbine generators (CTGs) operating in a combined-cycle mode. As a combined-cycle power plant, the exhaust heat of the CTG is used in the heat recovery steam generator (HRSG) to produce steam to generate additional energy in a steam turbine generator (STG). The two CTGs and the STG are located in separate acoustically treated enclosures. An air-cooled condenser (ACC) is located south of the CTG and STG enclosures. Other external equipment on-site includes transformers, a fuel gas metering station, and gas compressors.

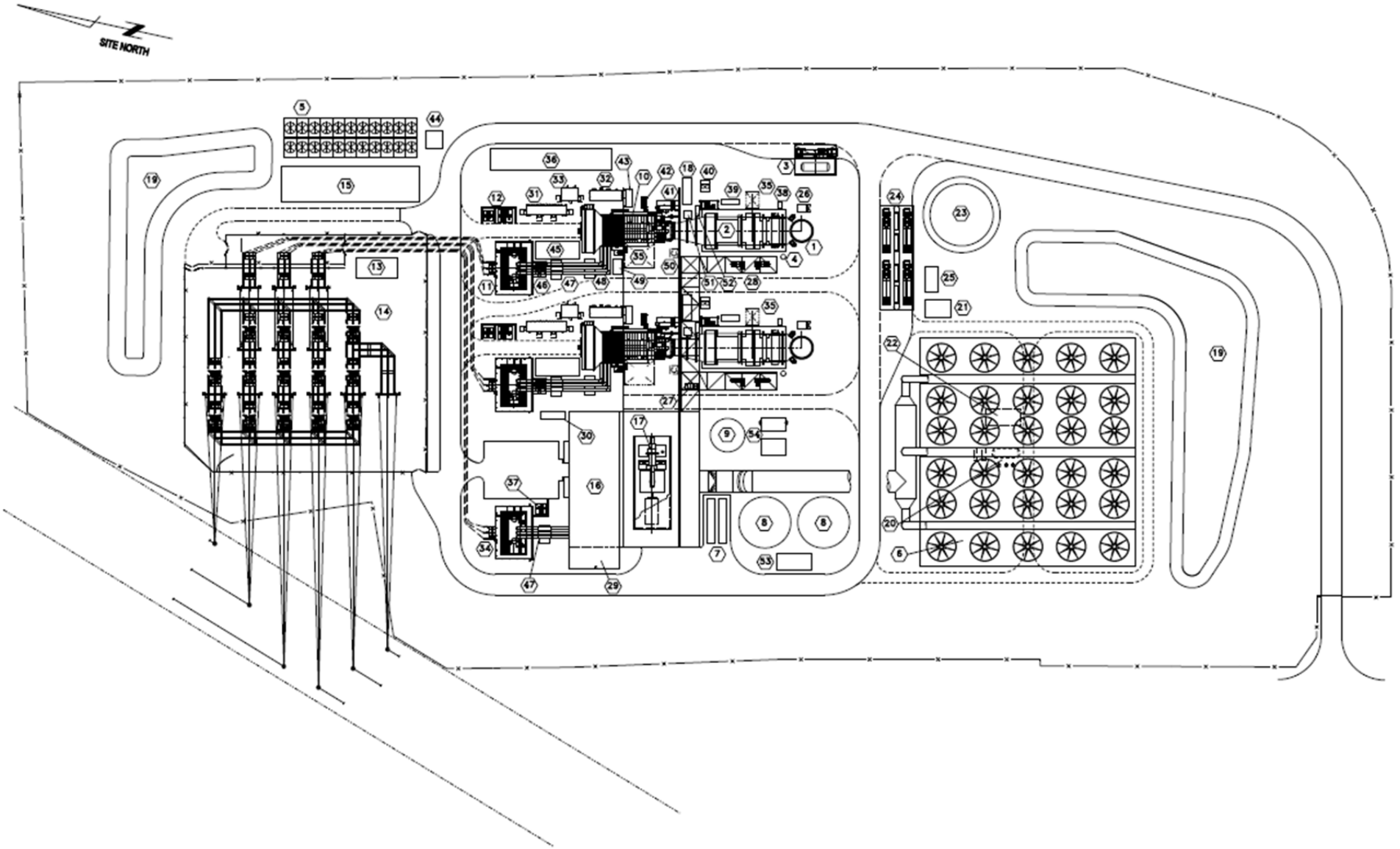
The Project requires mitigation of noise emissions from many different sources in order to meet its commitments regarding noise levels at various receptor locations near and around the Project Area. Two primary noise sources are the CTG air inlets and the ACC, with key elements of the noise mitigation strategy including air inlet silencers and larger diameter reduced noise fans for the ACC. In addition, enclosures and buildings are assumed around certain equipment. Other secondary sources and assumptions were also included in the analysis to support overall compliance goals.

This noise modeling analysis has been updated to reflect the Project layout shown in Figure 1, which includes incorporation of the following adjusted Project facilities and has confirmed that the Project can continue to demonstrate compliance with applicable requirements:

- Addition of fuel gas compression (Item #36 on Figure 1) necessary to meet the gas turbine pressure requirements. These units will either be housed in full or partial acoustical enclosures, provided with acoustical walls, or will be specified as low noise, capable of meeting a sound power emission level (L_w) of 102 A-weighted decibels (dBA);
- Placement of the condensate storage tank underneath the ACC;
- Relocation of the CTG heater, filter, and metering skid adjacent to the combustion turbine package to comply with vendor design;
- Increased size of the fin fan cooler to comply with vendor design necessary to meet the final Project auxiliary cooling loads and noise design targets;
- Addition of two selective catalytic reduction (SCR) ammonia vaporizer skids (Item #39 on Figure 1) with an assigned an L_w of 102 dBA; and
- An auxiliary cooling pump (Item #44 on Figure 1) was added adjacent to the auxiliary fin-fan cooling system and assigned an L_w of 101 dBA.

Tetra Tech, Inc.
160 Federal Street, 3rd Floor, Boston, MA 02110
Tel 617.443.7500 Fax 617.737.3480 www.tetratech.com

Figure 1 – Site Plan Layout



MODELING PROCEDURES

The final site plan has been analyzed and evaluated with respect to noise compliance with the study updated to reflect modifications as shown in Figure 1 Gemma drawing M-200-1 Rev D. The acoustical modeling for this Project was conducted using Cadna-A® computer software developed by DataKustik GmbH. The model incorporated the physical features of the Project, such as buildings and stacks and the surrounding area topography as shown in Figure 2. The propagation calculations were carried in adherence to International Organization for Standardization (ISO) 9613, Part 1: Calculation of the absorption of sound by the atmosphere, 1993 and Part 2: General method of calculation (ISO 9613-2:1996). Cadna-A assesses the sound propagation based on the Octave Band Center Frequency (OBCF) range from 31.5 Hertz (Hz) to 8,000 Hz.

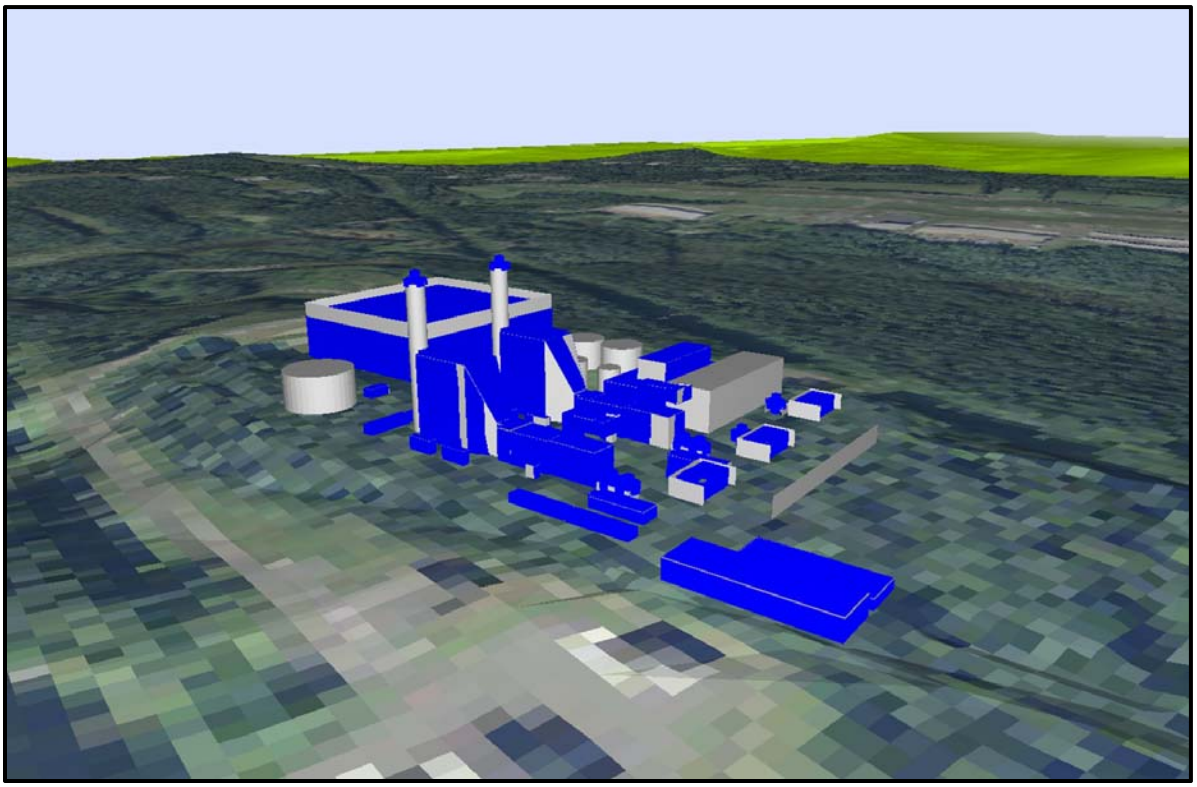


Figure 2 – 3-Dimensional Model

A three-dimensional model of the Project was created directly from the site plan drawing by defining the height and extent of significant noise source components. Cadna-A allows for three basic types of sound sources to be introduced into the model: point, line, and areas sources. Each noise radiating element was modeled based on its noise emission pattern. Point sources were programmed for concentrated small dimension sources such as building ventilation fans that radiate sound hemispherically. Line sources are used for linear-shaped sources such as ducts and pipelines. Larger dimensional sources, such as the HRSGs and building walls, were modeled as area sources. Noise walls, equipment enclosures, stacks, and plant equipment were modeled as solid structures as diffracted paths around and over structures tend to reduce computed noise levels. The interaction between sound sources and structures was further taken into account with reflection loss. The storage tanks were modeled as obstacles impeding noise propagation. The reflective characteristic of the structure is quantified by its reflection loss, which is typically defined as a smooth façade from which the reflected sound energy is 2 decibels (dB) less than the incident sound energy.

The propagation calculation parameters are shown in Table 1. Calculations under the ISO 9613 standard incorporate meteorological conditions favorable to propagation from sources of known sound emission, such as

downwind condition and moderate atmospheric inversion. Correspondingly, no additional corrections for meteorological conditions, beyond those incorporated into the ISO standard, were applied in the calculations. The local terrain geometric data is input into the model based on United States Geological Survey digital elevation datasets to accurately represent terrain in three dimensions, including grading. Also critical to the modeling results is accounting for the effects of ground absorption. Ground absorption can vary from 0.0 (completely reflective) to 1.0 (completely absorptive). The receiver height is set to 6 feet (1.52 meters [m]) above the sidewalk, which represents the height of the ears of a person when standing. Calculations at residential structures were calculated at a height of 16 feet (5 m) above the ground to represent a second story window.

Table 1 – Acoustic Modeling Setup Parameters

Model Input	Parameter Value
Standards	ISO 9613-2, Acoustics – Attenuation of sound during propagation outdoors.
Engineering Design	Site plan Rev D printed June 23, 2015 (Gemma drawing M200-1)
Reflection Loss	2 dB – indicates reduction in acoustic energy due to Reflection
Reflections	Two reflections (from buildings and obstacles) were allowed for individual acoustic rays during propagation calculations
Terrain Parameters	U.S. Geological Survey digital elevation dataset to accurately represent terrain in three dimensions and incorporating onsite grading changes
Ground Absorption	0.5 (semi-reflective) and 0.0 (reflective) on-site
Receiver Characteristics	1.52 meters (5 feet) above ground level for contour isopleths
Meteorological Factors	Omnidirectional downwind propagation/atmospheric temperature inversion
Temperature	50^{o}F (10^{o}C)
Relative Humidity	70%

Other assumptions used in the acoustic modeling included:

- Sound associated with use of the fuel oil forwarding pump (Item #24 on Figure 1) was not included, as this would not operate when natural gas is used in the CTG (and reflects a lower sound level than natural gas-related equipment);
- The startup/bypass operation was not simulated; results are for steady state normal operation only;
- The model predicted the noise levels generated from the Project only; site construction noise was not included in the analysis; and
- The model assessed the sound levels in Octave Band Center Frequency from 31.5 Hz to 8000 Hz.

NOISE DESIGN TARGET OF PROJECT

The purpose of the modeling was to demonstrate the ability of the updated Project to comply with the established regulatory requirements: 51 dBA at night at the boundaries of residential land use classifications and 70 dBA at all industrial property lines (essentially the Project site boundaries). The Sound Survey and Analysis Report (Appendix D) of the Environmental Overview provided to the CSC on November 3, 2014 demonstrates compliance with those limits, but includes a number of mitigation assumptions in order to achieve those objectives. There is latitude to achieve those objectives in other ways; the proposed mitigation was selected as reasonable based on experience with similar projects.

ACOUSTIC MODELING INPUTS AND MITIGATION DESIGN

Our review of the Project is based on an examination of representative portions of the design parameters and conditions supplied by the Project. If CPV did not provide all of the required information, Tetra Tech assumed representative design parameters and conditions, based on in-house literature and in-house equipment database. Estimated sound power data for the power train package is based on the latest datasheet that GE has supplied,

dated December 24, 2014. Table 2 lists the L_w, average building interior sound pressure levels ($L_{i(c)}$), and far field (L_P) ACC design target by OBCF and broadband values. Table 2 outlines the basic sound level input assumptions.

Table 2 – Facility Sound Source Levels for Major Project Components

Sound Source	Type[1]	Sound Power Level (L_P) by Octave Band Frequency Linear Decibel (dBL)									Broadband Level
		31.5	63	125	250	500	1k	2k	4k	8k	dBA
CT[2]	L_w	108	106	103	99	100	101	104	107	95	111
CT Load Compartment[2]	L_w	96	101	99	91	94	99	98	93	83	103
CTG	L_w	101	120	113	103	102	97	93	90	79	104
Steam Turbine[2]	L_w	112	112	108	107	106	101	96	94	93	107
Boiler Feedwater Pumps[2]	L_w	101	106	108	99	104	103	102	97	93	108
CT Air Inlet Face w/ 8-foot Silencer	L_w	113	116	116	101	94	95	98	91	79	104
CT Air Inlet Plenum	L_w	102	96	93	90	92	97	97	94	83	102
STG	L_w	106	106	105	102	104	103	102	97	88	108
Turbine Compartment Vent Fans	L_w	102	102	110	101	98	95	94	98	95	104
Fuel Gas Piping	L_w	104	100	89	81	80	86	88	91	89	96
HRSG Body and Inlet	L_w	115	119	118	108	94	92	85	68	51	105
HRSG Accessories Package	L_w	106	110	109	103	94	90	78	69	62	99
Stack Exit (90 degrees directivity)	L_w	111	118	117	108	93	90	75	66	59	104
Air-Cooled Condenser	L_p	67	68	60	48	45	43	36	29	12	50
Auxiliary Fin Fan Cooler	L_w	100	103	101	100	100	98	97	95	93	103
Condenser	L_w	100	101	100	98	99	93	88	83	79	107
Main Step-up Transformers (NEMA 73)	L_w	100	99	103	96	100	91	87	82	75	99
Auxiliary Transformer	L_w	90	96	98	93	93	87	82	77	70	93
Fuel Gas Metering Station	L_w	96	85	82	75	82	83	93	90	88	97
Fuel Gas Heater	L_w	84	88	93	85	94	97	98	101	91	105
Auxiliary Steam Boiler	L_w	101	101	100	98	95	92	89	86	83	98
STG Building Enclosure (all interior sources)	$L_{i(c)}$	89	87	94	84	81	80	75	65	56	85
Control /Auxiliary Boiler Building (all interior sources)	$L_{i(c)}$	81	82	81	79	80	74	69	64	60	80
CT Lube Oil Module	L_w	102	105	101	100	99	97	97	95	87	103
Gas Compressor (each)	L_w	112	107	108	104	102	94	88	96	98	115
SCR Ammonia Skid	L_w	96	103	99	96	97	97	95	92	87	102
Auxiliary Cooling Pump	L_w	101	101	100	102	105	102	105	97	94	101

[1] "L_w" is the sound power level in dBL OBCF, and dBA broadband, (re: 1 picoWatt). "$L_{i(c)}$" is the calculated average interior sound pressure in dBL OBCF, and dBA broadband, (re: 20 µPa), within a building or structure, based on the sound power levels of noise sources located within that building or structure. L_P is the sound pressure level from the ACC at a reference distance of 400 feet. Data presented may contain Project proprietary information and is not intended for use for any other purposes.

[2] Sound levels presented are equipment housed in acoustical package enclosures.

Combustion Turbine Air Inlets

The CTG air inlets will require additional silencing beyond standard manufacturer specifications. The CTG air inlet L_w from GE is 106 dBA; however, even assuming the 8-foot silencer reflected in their data, an additional 2 dBA of sound reduction (to 104 dBA, as shown in Table 2) is likely required to demonstrate compliance. Because the air inlet structures are oriented directly toward the closest residential area, this sound source feature was an unavoidable reduction target in the mitigation analysis.

ACC

The ACC is a dominant noise source on the Project Area. An ACC with low noise fans and configuration of the number of cells and horsepower per fan cell providing no more than sound pressure level of 52dB(A) at any point 400 feet from the periphery of the ACC structure will be required to meet design targets.

GSU Transformers

The 3 main step-up transformers are located on the north side of the CTG and STG compartments. From the engineering design documents and site plan, it was suggested the transformers would likely be rated at 330 mega-volt ampere (MVA) and would be approximately 20 feet in height. A standard un-quieted National Electrical Manufacturers Association (NEMA) 85 rated transformers would have an L_w of 110 dBA. Additional mitigation consideration is required for compliance with residential standards. The modeling analysis assumed the use of low-noise transformers with a NEMA sound rating of 73 dBA (L_w = 99 dBA) as shown in Table 2.

Exhaust Stacks

The stack sound power levels from GE are inclusive of attenuation provided by the HRSG. GE states that the HRSG information is 'typical', but will be vendor specific. The stack silencer specified by GE appears to be an entry grade (Level 1) silencer specified to achieve a total 90-degree directional L_w of 104 dBA (as provided in Table 2). No additional attenuation assumptions were made, but this source is noted for CPV's confirmation. As discussed, the HRSG does provide substantial sound attenuation benefits for a combined cycle facility. Turbine exhaust noise stems largely from turbulence, and on entering the large cavity inside the HRSG, the flow velocity slows dramatically and turbulence diminishes. Noise is attenuated not only because of this expansion in cross-sectional area, but also because of interference as sound waves pass through the tube bundles. A substantial acoustical loss also occurs as the flow passes through the stack transition and turns up the round stack. The HRSG vendor will need to determine the net dynamic insertion prior to finalizing silencer design.

Auxiliary Fin Fan Cooler

This noise source is located less than 50 feet from the eastern property line shared with the adjacent Spectra compressor station. In Table 2, we have assumed an L_w of 103 dBA which is 5 to 7 dBA lower than a standard grade 22-cell fin-fan cooler. .

Equipment Enclosures

Equipment enclosures are normally steel sandwich construction: a steel skin, mineral wool within the wall section and perforated metal interior wall for sound absorption. A reasonable approach for an engineering study is to specify an enclosure using equivalent sound transmission class (STC) ratings. Table 2 of the Sound Survey and Analysis Report reflects unmitigated values (unless as noted). The following items have been specified with acoustical enclosures in the modeling analysis, with item number as referred to in the Plot Plan Drawing M200-1 rev D:

- Gas compressors will be walled or fully/partially enclosed (Item 36); and
- Boiler feedwater pumps (Item 25).

For the gas compressors, alternatively a low-noise unit with a stated L_w of 102 would also be an acceptable solution. Standard equipment enclosures transmission loss (TL) values for the walls and roofs of the structures are shown below.

Table 3 – Modeled Noise TL Level Reductions

Type of Acoustical Enclosure	Modeled Noise TL Level Reductions (dB re: 20 µPa) by Octave Band Center Frequency dBL								
	31.5	63	125	250	500	1k	2k	4k	8k
Standard Equipment Enclosure STC 28	13	15	18	21	24	26	32	30	28

Combustion and steam turbines, load compartment and CT lube oil module are specified in acoustical enclosures by GE to reduce noise emissions. Modeling inputs for the building enclosures were, therefore, applied as specified, and no information was provided regarding specific STC ratings. These values inclusive of the net reduction of the sound mitigation packages for the specified power train package were provided directly from GE, and are incorporated in Table 2 values.

Turbine Compartment Ventilation Fans

The CTG turbine enclosure vent fans will be ducted outside the CTG building. The ventilation fans associated with the combustion turbine compartment were provided by GE at an L_w of 104. Additional silencing is required for these vent fans such that the sound power level of the vent outlet will not exceed 97 dBA in order to demonstrate compliance with the eastern industrial property line limit to 70 dBA. All ventilation equipment is equipped with acoustic silencers as required to reduce noise emissions from ventilation openings and fans. Lower levels of silencing may be needed on turbine compartment fans on the side of the enclosures that do not directly face this property line.

Non-Steady State Noise Sources

The acoustical modeling and report reflect steady state compliance. There are conditions of Project start-up and steam bypass that could cause noise from the ACC steam piping to increase substantially. Internally, steam bypass noise comes from two primary sources: the steam bypass control valve and the final dump element that directs exhaust steam in to the ACC duct. To address the potential for extended start-up, the ACC vendor could be directed to provide highly efficient control valves and dump elements with low noise technology such that the radiated sound power levels from the ACC ductwork will be of a low noise design for the main duct and header. We have further assumed that the ductwork from the STG to the ACC headers are lagged that will absorb airborne sound; reduce transmittance of airborne sound; dampen vibration-induced sound; and reduce transmittance of vibration-induced sound, allowing us to exclude it from the model.

Other Noise Sources

All fuel gas piping/valves and steam piping/valves will be lagged which allowed us to exclude these features from the model.

ACOUSTIC MODELING RESULTS

Due to their distance and position in relation the new Project arrangement, four key receiver positions were determined to be the most impacted by the Project. Using the source values given in Table 2 and the mitigation plan as outlined above, the expected noise levels at the critical receptors under the revised layout were calculated. Results of this analysis and the key guarantee locations are depicted in the attached Figure 3. Figure 3 illustrates the noise contribution of the Project during normal operation on the surrounding area in a contour line format. Figure 3 also shows the monitoring locations and identifies zoning districts that define the surrounding land use classifications and confirms that the maximum Project sound in all nearby residentially-zoned areas in the towns of Oxford and Middlebury will meet the 51 dBA nighttime limit and also confirms that maximum Project sound will comply with the 70 dBA limit set for industrial areas off the premises of the Project, including the adjacent compressor station, and nearby Waterbury-Oxford Airport.

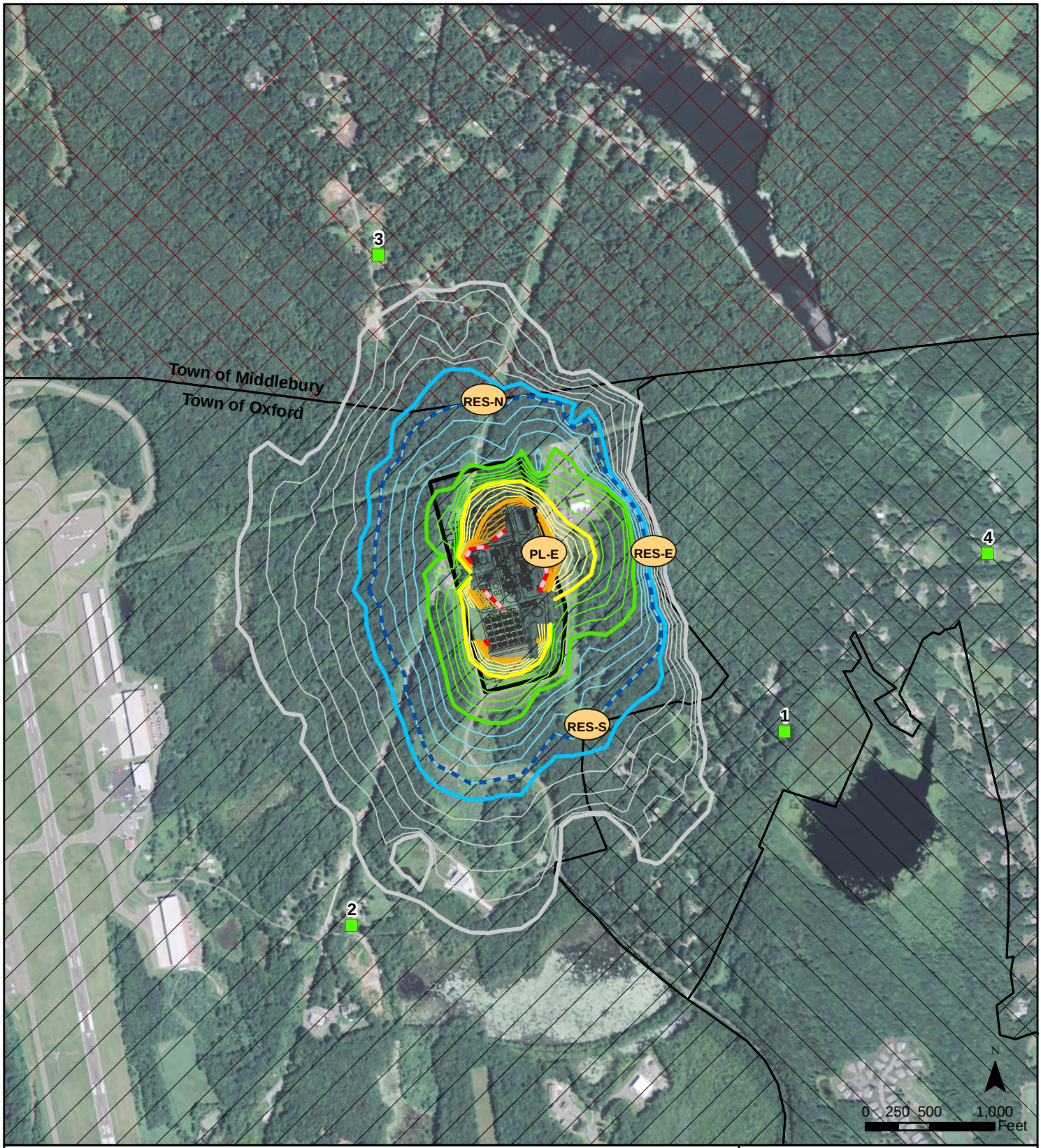
Since sound levels decrease with distance, compliance with the applicable zoning limits at the closest boarder ensures compliance at more distant receptors, i.e., structures found within a given zoning district. Although the specific mitigation assumptions incorporated in this iteration of the modeling effort may continue to be refined in final design, results demonstrated how the prescribed level of impact reflected in the analysis can be readily achieved by the Project.

The assessment results provided by Tetra Tech herein are subject to those sound power levels being met. The predicted sound levels during normal steady state operation are provided in terms of overall A-weighted sound levels In addition, noise compliance guarantees are requested during the normal steady state operation. According to the industry standard, a 2 to 3 dBA safety margin for the overall A-weighted sound levels may be applied in the acoustic design for the project where noise guarantees are required. This margin takes into account the modeling accuracy, variations in source noise emissions, manufacturing and installation tolerances and other factors which could affect sound propagation. Note that no engineering safety margin has been included in these results. Cadna-A predictions are accurate to within 1 dB of the ISO propagation standard. Calculations based on the ISO 9613 Standard are typically accurate to within 3 dB of actual measurements and in most cases yield conservative results. The software accuracy is well within the uncertainties introduced by factors such as source noise data, actual and varying ground attenuation characteristics, actual environmental conditions, atmospheric turbulence, presence of inversion layers, and the direction of the wind.

Because of the overall importance of the two primary noise sources, the air inlet face should remain at 4 dBA below originally specified L_w of 106 dBA and the ACC should remain at 8 dBA below originally specified value of 58 dBA at 400 feet, inclusive of a net safety factor of 2 dBA. With the mitigation elements described (or their equivalent), the Project has demonstrated the ability to fully comply with the nighttime residential, property line, and zoning limits at all receiver locations.

Finally, our review of the Project is based on an examination of representative portions of the design parameters and conditions as supplied by CPV. It must be further acknowledged that our study is based on the present design parameters and conditions listed in this report only, and that we cannot and do not warrant any design parameters and conditions that may exist, but which were not represented in this study. Therefore, it should be noted that any further changes to the equipment may result in differences in noise generation. Any increases in the Project's noise resulting from future changes to the equipment may also invalidate current sound level predictions.

Figure 3. Received Sound Levels: Normal Operation



Legend

- Sound Monitoring Locations
- Key Receptor Locations
- Project Area

Oxford Zoning

- I: Industrial District
- R-A: Residential A
- R-CGD: Residential Community Golf District

Middlebury Zoning

- R: Residential District

Sound Level Contour (dBA)

- 45 dBA
- 50 dBA
- 55 dBA
- 60 dBA
- 65 dBA
- 70 dBA

- DEEP and Oxford 70 dBA Industrial Noise Limit Isopleth
- DEEP and Oxford 51 dBA Residential Nighttime Noise Limit Isopleth

Figure 3
Received Sound Levels: Normal Operation

Towantic Energy Center
New Haven County, Connecticut

R:\Projects_2014\Towantic\maps\Figure_3_Sound_Levels_Normal_Operation.mxd