NOISE ANALYSIS REPORT

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A. INTRODUCTION

A noise assessment of the proposed Waterbury Generation Project (the Project or Facility) was conducted. The assessment consisted of determining the existing ambient noise environment through a noise monitoring program, and a noise modeling/impact evaluation of the Project. The noise impact evaluation consisted of performing computer noise modeling of the major noise producing equipment at the Project, and evaluating it against the State of Connecticut noise standards at bordering zones and nearby residential areas. Potential noise impacts were evaluated by determining the projected increases over existing ambient conditions.

B. GENERAL INFORMATION ON NOISE

Noise is defined as unwanted sound resulting from vibrations in the air. Excessive noise can cause annoyance and adverse health effects. Annoyance can include sleep disturbance and speech interference. It can also distract attention and make activities more difficult to perform (EPA, 1978).

There is a broad range of pressures that cause the vibrations that create noise. Noise is therefore measured on a logarithmic scale, expressed in decibels (dB). Noise is typically measured on the A-weighted scale (dBA). The A-weighted scale was developed to provide a good correlation with the human response to sound, and it is the most widely used descriptor for community noise assessments (Harris, 1991).

Common descriptors of noise include the L_{eq}, L_{90} and L_{10}. The L_{eq} is the equivalent noise level over a specified period of time (i.e., 1-hour). It is a single value of sound which includes all of the varying sound energy that occurs in a given duration. *Statistical Sound Levels* are A-weighted sound levels that are exceeded during a certain percentage of the time. The L_{90} is the sound level exceeded 90 percent of the time, and is often considered the background or residual noise level. The L_{10} is the sound level exceeded 10 percent of the time, and is a measurement of intrusive sounds, such as aircraft overflight.

The ability of the average person to perceive increases in noise has been documented. In general, an increase of 3 dBA or less is considered to be barely perceptible, while an increase of 10 dBA is perceived as a doubling of the sound. Provided in Table 1 is a set of criteria that have been used to estimate an individual's reaction to increases in noise.

Table 1:
Average Ability to Perceive Changes in Noise Levels

Increase (dBA)	Human Perception of Sound
2-3	Barely perceptible
5	Readily noticeable
10	Doubling of the sound
20	"Dramatic change"

Source: Bolt, Beranek, and Newman, Inc. 1973

In addition to these methods, the Federal Highway Administration (FHWA) considers that an impact will occur (from highway projects) when predicted noise levels "substantially exceed" existing levels. The FHWA does not define "substantially exceed." Different state agencies, however, define this term as minimum increases of from 5 to 15 dBA, with 10 dBA being typical (Harris, 1991).

C. APPLICABLE STANDARDS

The State of Connecticut has detailed noise standards that are applicable to the proposed Project (Connecticut DEP, 2007). These standards limit noise from a source, as measured at certain Noise Zones when emitted from other Noise Zones. These Zones include the following:

- Class A – Generally residential, hotels, hospitals and other sensitive areas
- Class B – Commercial areas
- Class C – Industrial uses

The proposed Project is an industrial use in an industrially zoned area (Class C). Industrial uses surround the Project site. Commercial areas are located further away, followed by residential areas even further away. The most applicable portion of the noise standards pertain to a source located in a Class C area, and the measured noise level from that source at a Class A area. The noise limits for this scenario are summarized in Table 2.

Table 2:
Applicable State of Connecticut Standards

Class C Source Emitting to a Class A Receiver	
Daytime	**Nighttime**
61 dBA	51 dBA

“Nighttime” is defined in the standards as the hours between 10 PM and 7 AM

A second limit is applicable to the nearest industrial property lines that border the site. Facility noise at these locations would be limited to 70 dBA at any hour of the day.

Since the Project will be able to operate at any time of the day or night, it has been conceptually designed to meet the most stringent of the above limits. Thus, the Project must be designed to meet a limit of 51 dBA at any residential area.

D. EXISTING CONDITIONS

The area in the vicinity of the Project site consists of industrial uses, with a combination of commercial and residential uses further away. The nearest residential areas are located 1,000 feet to the east across Route 8 and 1,200 feet to the west across South Main Street. There are also a few residences on West Liberty Street (1,300 feet to the northeast) in a mainly industrial/commercial area.

The existing noise environment has been characterized through ambient noise monitoring (conducted on September 7 and 20, 2007) at five selected residential areas, which were identified through the use of topographic maps and later confirmed during the noise monitoring program. These locations are identified on Figure 1 and include the following:

- West Liberty Street – 1,300 feet northeast of the site;
- River Street – 1,700 feet east of the site;
- Lounsbury Avenue – 2,000 southeast of the site;
- Porter Street – 1,200 feet southwest of the site;

- Congress Avenue – 1,500 feet west of the site.

Short-term monitoring (20 minutes in duration at each location) was conducted during the day and late at night. Daytime monitoring was conducted on September 7, 2007 and nighttime monitoring was conducted during the early morning hours of September 20, 2007. Monitoring was conducted with a RION NA-27 precision Type 1 octave band analyzer. The instrument was configured to measure and store the L_{eq}, L_{90} and L_{10} one-third octave band levels. A summary of the overall A-weighted L_{eq}, L_{90} and L_{10} data collected during the two noise monitoring periods is presented in Table 3 below.

Figure 1: Noise Monitoring Receptor Locations
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Table 3: Measured Ambient Noise Levels (dBA)

Location	Daytime			Nighttime		
	L_{90}	L_{10}	L_{eq}	L_{90}	L_{10}	L_{eq}
West Liberty Street	53	70	68	45	51	53
River Street	50	57	57	42	53	51
Lounsbury Avenue	49	62	62	38	49	46
Porter Street	53	61	60	43	57	54
Congress Avenue	52	68	66	42	55	53

Existing noise sources in the residential areas during the day included local vehicular traffic (cars, busses, trucks), local activity, natural sounds (crickets, dogs) and aircraft. At night, more distant traffic sources (Route 8, South Main Street), local traffic and natural sounds were present. The data in the above table reveal that L_{90} levels ranged from 49 dBA to 53 dBA during the day. Lower L_{90} levels, ranging from 38 dBA to 45 dBA were found at night. The lowest noise levels were measured at the Lounsbury Avenue location. Ambient L_{eq} levels were much higher during the day and at night, due to more intrusive noise sources such as passing cars, motorcycles and trucks.

E. NOISE MODELING

A noise modeling program, Cadna/A, version 3.0, was used to evaluate the noise emissions of the proposed Project. Based on the sound power levels input for each source, the program maps the noise contours of the overall plant in accordance with a variety of standards, primarily VDI 2714 *Outdoor Sound Propagation* and ISO 9613 (ISO, 1993). All sound propagation losses, such as geometric spreading, air absorption, ground absorption, and barrier shielding, are calculated automatically in accordance with these recognized standards. Reflection off of adjacent structures and the ground was accounted for in the modeling.

Sound power levels of major equipment used as input to the noise model were obtained from the equipment manufacturers where possible. Sources of noise analyzed in the modeling included:

- GE LMS100 turbine and generator casing
- GE LMS100 stack exit
- GE LMS combustion air inlet
- Cooling tower
- SCR casing breakout
- Main transformer
- Gas compressor
- Gas compressor cooler

Discrete modeling receptors were chosen in the same residential locations as where ambient noise monitoring was conducted in order that direct comparison to existing noise levels could be made.

1. Modeled Project Noise Levels/Impacts

The results of the noise modeling analysis are presented in Table 4. Also presented are the existing nighttime L_{90} noise levels and the projected future noise levels at each location. A noise contour map of the entire area, which also depicts the residential receptors evaluated, is presented in Figure 2.

Table 4: Noise Modeling Results Compared to Nighttime L_{90} (dBA)

Location	Calculated Project Noise Level	Measured Ambient Nighttime	Projected Future Total Noise Level	Maximum Increase Over Existing Nighttime Noise Level
West Liberty Street	44	45	48	3
River Street	45	42	47	5
Lounsbury Avenue	49	38	49	11
Porter Street	49	43	50	7
Congress Avenue	50	42	51	9

A review of the data in the above table reveals that noise generated by the Project will be below the State of Connecticut nighttime noise standard at all residential locations. Increases in noise would occur over the minimum late night L_{90} levels, but Project noise, even when added to ambient noise, will remain at or below the specified State noise standard (noting that the standard applies only to the source, not the total noise level). The magnitude of the increases is due to the fact that ambient L_{90} levels were quite low at some locations late at night. Further review of the ambient data in Table 3 reveals that L_{eq} (or the average) existing late night noise levels were much higher, which was due to cars, motorcycles and other intrusive sources of noise. Provided in Table 5 below is a comparison of calculated Project noise to the late night L_{eq} levels.

Figure 2: Noise Contour Map
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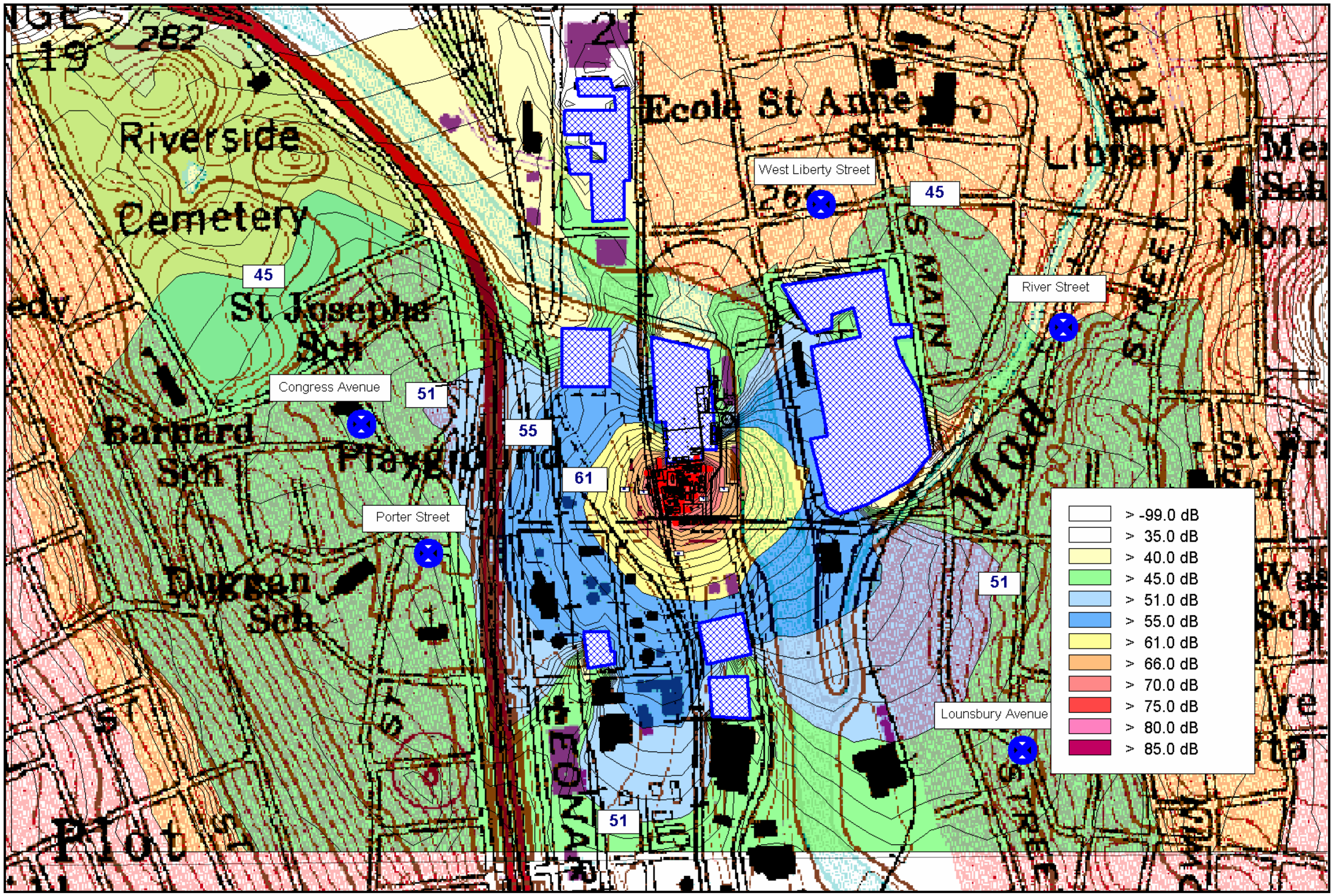

Table 5: Noise Modeling Results Compared to Nighttime L_{eq} (dBA)				
Location	**Calculated Project Noise Level**	**Measured Ambient Nighttime**	**Projected Future Total Noise Level**	**Maximum Increase Over Existing Nighttime Noise Level**
West Liberty Street	44	53	54	1
River Street	45	51	52	1
Lounsbury Avenue	49	46	51	5
Porter Street	49	54	55	1
Congress Avenue	50	53	55	2

A review of the data in the above table reveals that increases in the total average noise late at night would be much smaller than the increases over the L_{90} level.

2. Discrete Tones

A discrete tone is a sound that consists primarily of a single pitch such that it is clearly audible against the normal broadband background sounds, even when the tone is at a lower level. Tones are generally more annoying than broadband noise. If a source generates a discrete tone noise as defined in the Connecticut standards, the allowable overall level of noise is reduced by 5 dBA. It was not possible to model the potential for discrete tone noise, since this would require 1/3 octave band data, which are not available from any equipment vendors. The facility design will therefore include a specification to all equipment vendors that discrete tone noise must be controlled. Further, experience at other combustion turbine facilities indicates that discrete tone noises are not produced by these facilities.

F. PROPOSED MITIGATION MEASURES

Computer noise modeling of the proposed Project was conducted in order to determine if the Project could be designed to comply with the State standards and minimize potential noise impacts to the surrounding residential areas. The Facility is sited in the interior of an industrial area, with residential locations over 1000 feet away. The most significant noise source at the proposed Facility would be the turbine stack exit. As such, specifications, based on this conceptual analysis, were developed and submitted to a potential stack silencer vendor. The specifications were developed such that stack exit noise would be reduced to the point were it was no longer a significant source, and, together with the balance of plant, be in compliance with the State of Connecticut noise standards. The potential vendor returned a proposed silencer that would meet the Project needs. After incorporation of this noise control measure into the model, the modeling results revealed that the proposed Project will be in compliance with the Connecticut standards. It is important to note that the final noise mitigation measures may differ, and could change based on final equipment noise guarantees or other factors. In the end, the final noise mitigation measures employed must be sufficient to achieve the 51 dBA Connecticut noise standard limit at residential locations.

G. CONCLUSION

A noise modeling analysis of the proposed Waterbury Generation, LLC Project was conducted in order to determine if noise levels from the proposed Project would comply with the State of Connecticut noise standards. Ambient noise levels were also measured and compared to proposed Project noise levels.

The modeling study utilized vendor obtained data for the major equipment sources, which were incorporated into the CadnaA computer model. The modeling results, with noise mitigation measures built in, revealed that the sound level from the proposed Project would be in compliance with the State of Connecticut noise standards at all residential property lines. Increases in total average L_{eq} noise levels would be minimal. Larger increases would occur over the minimum L_{90} levels, although L_{90} levels do not account for existing intrusive sources of noise such as local cars and motorcycles that were noted in the area at night.

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