DOCUMENT 00901

ADDENDUM 4

DATE: August 28, 2014

TO: PROSPECTIVE BIDDERS

FROM: Cannon Design

PROJECT: West Haven Combined Heat and Power (CHP) Plant Design

This Addendum forms part of and modifies the Construction Documents dated July 18, 2014. Where any original item called for in the Project Manual or indicated on the Drawings is supplemented hereby, the supplemental requirements shall be considered as added thereto.

Where any original item is amended, voided, or superseded hereby, the other provisions of such items not specifically amended, voided, or superseded shall remain in effect.

ATTACHMENTS:

Drawing:
None

Specifications:
Acoustical Report (4/16/14)
[redacted]

[redacted]

NARRATIVE:

This addendum includes bid technical questions issued to date along with requested Acoustical Report [redacted].

END OF ADDENDUM

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16 April 2014

CannonDesign
100 Cambridge St., Suite 1400 ** via email: Dblouin@CANNONDESIGN.COM **
Boston, Massachusetts 02114

Subject: Acoustical Consulting Services - Initial Review of DD Package
Combined Heat & Power VA Healthcare West Haven, CT
Acentech Project No. 624485

References: Full Design Development Submission – Dwgs (1/14/2014)
Equipment Cuts and Engineering Calc Issued DD (1/14/2014)
VA West Haven CHP 004243.00 - Review Spec Draft (1/14/2014)
Cooling Tower Selection (1/29/2014)
PIL 058 Package Sound Levels Rev 06 (1/29/2014)
VA WHC Design Development BOD (11/2/2013)
Revit perspective – day (1/24/2014)
Acentech draft letter report (2/16/2014)
Additional project information (3/2014)

Attention: David Blouin, LEED AP
Vice President, Architecture

Dear Mr. Blouin:

INTRODUCTION

At your request, Acentech Incorporated reviewed the Design Development (DD) Package (dated 1/14/2014) that you have prepared for the planned combined heat and power (CHP) plant at the Veterans Administration Medical Center (VAMC) at 950 Campbell Avenue in West Haven, CT. This CHP will include combustion turbine generators, heat recovery steam generators, fuel gas compressors, chillers, roof-mounted cooling towers, ventilation fans, and auxiliary equipment. It will be located at a new building constructed along the north side of the existing VAMC campus, approximately 90 ft from the nearest residence on Overlook Street to the north. We conducted a site visit and ambient sound survey, reviewed the above-referenced project materials, developed initial sound estimates, and identified noise reduction goals. At your direction, our review addressed the noise environment in the mechanical spaces and the sound environment at the residence immediately to the north of the site. This letter report summarizes the findings of our review.

DESCRIPTION OF PLANNED CHP PLANT AND SITE

The CHP plant will be constructed along the northern boundary of the existing VAMC campus in West Haven, CT. The nearest community residence is located about 90 ft directly north of the new CHP site. Current plans for the CHP project consist of the following:

- Two Solar Saturn 20 combustion turbine generators (CTGs) (nominal rating of 1.2 MW each) in acoustical enclosures with Rentech heat recovery steam generators (HRSGs), two

fuel gas compressors in acoustical enclosures, and support equipment inside on the first floor of the CHP building; two absorption chillers (nominal rating of 1000 tons each), one 1.2 MVA transformer, and support equipment on the second floor; and one 1.2 MVA transformer and support equipment on the third floor; and

- Three BAC Model XES3E-1424-14M (or similar) mechanical draft crossflow cooling towers on the roof of the CHP; and

- Several equipment ventilation and building HVAC systems that include wall and rooftop openings.

EXISTING ACOUSTIC ENVIRONMENT

We conducted an ambient sound survey during our 6-8 February 2014 site visit. Figure 1 is an aerial photograph that shows the area near the proposed CHP facility and identifies the ambient sound measurement locations. Figures 2 and 3 present photographs that show the CHP site and the long-term and short-term sound measurement locations. The long-term data include continuous measurements of the overall A-weighted sound level at the north property line, Location A. We also performed short-term sampling of the overall A-weighted sound levels and spectral levels, and observed sound sources during the day, evening, and night hours at Locations 1 to 4.

Table 1 lists the instruments that we employed for the ambient measurements. Each sound level meter/monitor was laboratory-calibrated within the past year, and each instrument's calibration was checked in the field with an acoustic calibrator before and after the measurements. In addition, each microphone was fitted with a windscreen and positioned at a nominal height of 5 ft. Weather conditions were seasonal over the survey with temperatures of 20 to 30ºF, generally clear skies, calm air, and crusted snow cover. We judge that the overall sound data and observations collected during this survey characterize the typical existing acoustic environment in the area for this season.

Long-Term Data
The long-term measurements at Location A illustrated the changes in ambient sound levels over the day, evening and night hours. Figure 4 shows the L1, Leq, and L90 A-weighted sound levels measured at this location; due to a battery issue with the long-term monitor, we extended the overall survey to 8 February. The energy-average Leq sound levels include both the steady background sounds (e.g., distant traffic) plus the short-term intrusive sounds (e.g., local car passby). The L1 sound levels represent the nominal maximum sounds, such as local traffic sounds, that must occur for at least 1% of each interval (i.e., six seconds of each 10-minute interval). The L90 sound levels characterize the lowest background, or residual sound level that is exceeded for 90% of the time of each interval (i.e., nine minutes of each 10-minute interval). The L90 sound level occurs when short-term intrusive sound sources, such as local traffic passbys or aircraft flyovers, are absent and the sound level returns to a lower residual value. These figures reveal that the nighttime sound levels were typically similar to or lower than the daytime levels. The sound levels at these locations were typically due to sounds of local and distant road traffic and distant fans. The data on Figure 4 indicate that the L90 sound levels ranged between about 45 to 52 dBA for the survey.

Short-Term Data
We also obtained sound level measurements and observations of the sound sources at four locations during representative short-term periods during day, evening, and night periods. Table 2 displays the residual (L90) overall A-weighted sound levels and octave band sound pressure levels that were measured with the hand-held instrument at each location, and Figure 5 presents the overall ranges of the sound levels that were measured across all locations. As previously stated, the L90 values are the levels exceeded for 90% of the sampling periods and represent the background, or residual, sound

levels.

Our measurements and observations, which are presented on Figure 5 and Table 2, indicate for the survey locations and the nearby residential area to the north of the project site:

- Acoustic environment was controlled by sounds from sources such as local and distant road traffic and fans (note: the existing VAMC ice plant with cooling towers was off during our site study).

- Typical residual sound levels in the residential area were relatively quiet and at the measurement locations ranged down to 42 to 46 dBA over the day, evening, and night periods.

SOUND CRITERIA AND SUGGESTED OVERALL PROJECT NOISE GOALS

Community

During the design phase of the CHP facility it is necessary to determine the degree of sound reduction required. This is based upon estimates of the sound that will propagate from the facility and the sound level criteria appropriate for the neighborhood. The sound criteria for this project address the following factors:

- Ambient or background sound levels during the quieter times
- Type of neighborhood – residential, business, or industrial
- Character of sound generated by proposed facility – sound pressure level and spectrum
- Existing State and Local noise requirements

We understand that this Federal facility is exempt from State and Local noise regulations but assume that the project as a goal would likely aim to comply with them. Depending on the major equipment and noise control selected for a project, a typical cogeneration facility could emit tonal and/or broadband sounds, significant low frequency sounds, and steady and/or intermittent sounds that are noticeable in the community. The State of Connecticut and City of West Haven have noise requirements that protect residents and other community receptors from excessive sound. These requirements are:

State and Local Noise Requirements

Connecticut Noise Regulation

Connecticut has enacted a regulation (Section 22a-69) that identifies allowable levels for impulse, tonal, infrasonic, ultrasonic, and broadband noise. Of most relevance to the CHP plant operation, the regulation provides noise standards for an industrial or commercial source (Class C or B emitter) that emits sound to residential land (Class A receptor), commercial land (Class B receptor), and industrial land (Class C receptor). The following table summarizes the Connecticut noise standards:

Connecticut Noise Standards (dBA)

Emitter's Zone	Receptor's Zone			
	Industrial	Commercial	Residential/Day	Residential/Night
Commercial	62	62	55	45
Industrial	70	66	61	51

The noise standards are typically applied at the boundary of the emitter's noise zone, which includes the emitter's property plus adjacent land such as streets, highways, waterways, and railroad right-of-ways. The regulation defines nighttime from 10pm to 7am. In addition, the regulation allows an increase of 5 dB above the background levels in areas with high background sound levels (if not caused by the same owner), and places limits on impulse noise.

The regulation also prohibits prominent discrete tones, which are identified by measurement of one-third octave band sound pressure levels and comparison of the spectral peaks to their allowable values. Exclusions to the regulation include noise related to an emergency, which may cover some sources at a power plant. Finally, the regulation states that compliance with the noise standards and the tonal criterion is no defense against a nuisance claim, and conversely, violation of any portion of the regulation is not deemed to create a nuisance per se.

West Haven Noise Standards
The City of West Haven has adopted noise standards (Section 154-5 of City Code) that are consistent with the above State standards.

Suggested Project Goals - Community

Based on our review of the project information, the recent sound survey results, the Connecticut and West Haven noise standards, and the overall goals for the project we would recommend that the design goals for the CHP project include:

- 45 dBA at the nearest residence to the north, about 90 ft from the CHP site;
- No significant tonal sounds at the community residences.

Although greater sound from the project than 45 to 50 dBA may not cause the nearby resident to complain, it would likely be noticed on particular days, evenings, and nights, and at times, be judged disturbing.

Workplace - OSHA

The Occupational Safety and Health Act set a standard with respect to allowable exposure periods and sound levels for plant workers. The intent of the standard is to protect employees from the possibility of occupational hearing loss. The standard allows exposure to 90 dBA for eight hours per day with higher levels allowed for shorter periods with a tradeoff rate of 5 dBA greater per halving of time. Therefore, 95 dBA is allowed for 4 hours and 100 dBA for 2 hours. The standard also limits the maximum sound level at anytime to 115 dBA. For areas where the employees are overexposed to noise according to this standard, the employer is required to institute feasible engineering and/or administrative noise control measures. Later enforcement instructions, which were issued in 1983, allow employers to use hearing protectors rather than engineering or administrative controls to comply with the standard when exposure levels are less than 100 dBA. We note that these instructions could be revised or nullified by OSHA in the future.

In addition, a Hearing Conservation Amendment to the above standard was promulgated to address the potential for hearing loss of individual employees. The amendment considers exposure of noise down to 80 dBA for up to 16 hours per day and includes the 5 dBA per halving of time exchange rate. For a specific employee with an exposure to noise in excess of 85 dBA for an eight-hour day, the amendment requires that that employee be enrolled in a hearing conservation program. The amendment details the program's requirements, including baseline and annual hearing tests for the specific employee, tracking any hearing loss that may occur for the employee, and providing the

employee with a lower noise work environment for part or the entire work shift, and/or providing hearing protectors.

Suggested Project Goals - Workplace

The primary overall goals for the CHP project include reliable and easy-to-maintain equipment operation. Another project goal is a suitable work environment in the control room and nearby offices within the CHP facility. We understand that the main generator room in particular will not be continuously occupied, and therefore, elevated sound levels may be acceptable in this area as long as the building design can adequately control the noise from this room to the control room, offices, and community, and worker exposure to noise is limited.

We typically suggest the following in-plant noise goals to address the need for worker speech communication and concern for worker exposure to noise within plant areas:

- Control room – 56 dBA (NC-50)
- Offices – 50 dBA (NC-43)
- Workshop – 66 dBA (NC-60)
- 85 to 90 dBA in the general plant floor areas

We did not identify a control room, offices, workshops, or other non-equipment worker areas in the DD package. Therefore, we judge that only the 85 dBA to 90 dBA noise goal would apply to the interior spaces of the CHP building.

REVIEW COMMENTS AND RECOMMENDATIONS

Based on our review of the above-referenced DD materials and the results of our site visit and initial analysis, we offer the following comments and recommendations:

- Installing acoustical enclosures around the turbine generator and fuel gas compressor units will greatly aid the interior building sound environment. However, the DD package did not identify noise specifications (e.g., 85 dBA at 3 ft) for the balance of the interior equipment, such as the chilled water pump sets or fan/motor sets. An additional equipment noise specification would help address the 85 dBA to 90 dBA noise goal for interior spaces of the CHP building and also help address compliance with the OSHA noise regulation for plant personnel during typical CHP operation.

- To address a sound goal of 45 dBA at the nearest residence to the north of the CHP, we would recommend that the various CHP equipment items be grouped into three major sound sources: equipment inside the building, ventilation systems serving the building and inside equipment (e.g., turbine ventilation and combustion air inlet and exhaust systems, and room ventilation systems), and the rooftop cooling towers. Each of these three major source groups (or another similar grouping) would have a budget of 40 dBA for its sound contribution at this nearby residence, and individual sources within each group would necessarily have lower budgets.

- The DD package appears to show areas of brick, glass, doors, louvers, and other vent openings for the CHP building façades. No clear details were seen in the DD package about the building's outer wall construction and no attenuation schedules or sound specifications were provided for the turbine and building ventilation systems. Based on our initial sound estimates, we recommend that the building shell, and the north wall in particular, be

designed and constructed to reduce the interior equipment noise by at least 33 dBA (i.e., you could simply adopt a minimum STC 33 guideline for all wall components). Typical CMU construction would provide this reduction, typical overhead doors would be somewhat shy, and louvered openings would depend on what area and equipment they are serving. We assume that the glass areas on the north façade cover only the two stairwells; if the stairwells are enclosed, the noise reduction of these windows should not be of significant concern.

- The acoustical enclosure for the Solar turbine generator units are intended to provide 85 dBA at 3 ft (free-field conditions, although the units will be indoor), however, no information is provided on the ventilation and combustion air inlet and outlet sources of noise and no attenuation is shown. We understand though, that the combustion air inlet filter will provide some attenuation to the CTG air inlet noise and the Rentech HRSG and the SCR module will provide significant attenuation to the CTG exhaust noise. We recommend that all of the sources associated with the CTGs be evaluated and appropriate attenuator specifications be developed.

- No attenuator schedule was noted for the building HVAC systems. We recommend that all of the HVAC sources be evaluated and appropriate attenuator specifications be developed.

- We initially estimated that the three cooling tower units in total could produce up to about 60 to 65 dBA at the nearest residence during high fan speed operation. This result assumed little shielding of the towers by the CHP building and a mostly clear line-of-sight from the towers to the nearest residence. You provided us more recently with drawings and updated information on a quieter cooling tower model (BAC Model XES3E-1424-12P with Whisper Quiet Fan). Based on our review of your drawings and the new information, we estimate that the new tower will produce significantly less sound than the initial tower, the CHP building will provide useful shielding of the new tower at the nearest residence (about 140 ft north of the tower), and the sound of the new tower will contribute 40 dBA or less to the levels at the residence and will meet it source goal.

ADDITIONAL COMMENTS AND RECOMMENDATIONS

We offer the following additional comments and recommendations in response to specific questions from the project team:

- *"What is noise level and what will be engineering control for noise during construction and CHP operation that may impact surrounding buildings, especially B15 and B15A only 10 ft away?"* We recommend that the project review the constructions and uses of the adjacent buildings, which include B16 to the east, B15 to the southeast, and B15A to the south, and identify any nearby noise or vibration sensitive areas (e.g., MRIs, operating rooms, and patient rooms). If building areas near the new CHP building are judged to be sensitive, then we would recommend further analysis and perhaps isolation measures. To address project construction noise and vibration at community residences and adjacent buildings, we would recommend encouraging the contractor to adopt construction practices that minimize unnecessary noise (e.g., install and maintain engine exhaust mufflers and use broadband backup alarms rather than beepers) and to schedule noisier activities, such as demolition and pile driving, for regular daytime hours. The CD package (e.g., Volume 1) details construction noise mitigation procedures.

- *"Offer suggestions on specifications."*

  We reviewed the updated acoustics criteria for the CHP that was prepared by CannonDesign (3/11/2014). We recommend the following revised sound criteria:

  A. Overall noise levels generated by the CHP facility specified herein shall be guaranteed to meet the following noise criteria under the full range of normal operating conditions.

  1. The aggregate of all operating CHP plant equipment within the plant building and the building HVAC systems shall not generate an overall sound level at the nearest residence (90 feet north of the CHP plant) greater than 40 dBA. (This criterion may be waived if Criterion No. 4 below is met).

  2. The aggregate of new louver duct connections, including combustion inlet air, enclosure ventilation air, and boiler stack, shall not generate an overall sound level at the nearest residence (90 feet north of the CHP plant) greater than 40 dBA. (This criterion may be waived if Criterion No. 4 below is met).

  3. The aggregate of cooling tower units on the roof of the CHP building shall not generate an overall sound level at the nearest residence (90 feet north of the CHP plant, 140 feet north of cooling tower) greater than 40 dBA. (This criterion may be waived if Criterion No. 4 below is met).

  4. The aggregate of all operating CHP plant equipment shall not generate an overall sound level at the nearest residence (90 feet north of the CHP plant) greater than 45 dBA.

  5. The CHP plant shall not produce a prominent tonal sound [as identified by the one-third octave band criteria in Connecticut Noise Regulation (Section 22a-69)], which are clearly noticeable in the community.

  6. Upon commissioning of the CHP plant, conduct field tests and submit a report with appropriate measurements that demonstrate compliance with the sound criteria for the CHP system running at half and full rated electrical output.

  We reviewed the Procedures for Sound Level Measurements that was prepared by CannonDesign (3/12/2014). We offer the following comments:

  These procedures are intended to cover the measurement of HVAC system sound and other equipment sound in building rooms and exterior areas. The instrumentation and the calibration and measurement procedures are suitable, although we would recommend that a microphone windscreen always be used and that instrument calibration be checked in the field with an acoustic calibrator before and after each complete round of measurements.

- *"Offer comments on CD Package."*
  Based on our brief review of the CD package, we note that the package did not include an attenuator schedule for the building HVAC systems, although an exhaust fan schedule was provided (e.g., 19-EF-1 to EF-5). We suggest that the party responsible for the HVAC systems evaluate their designs, and if appropriate, develop attenuator specifications.

The overall sound criteria in the CD package (Volume 3) should be replaced with the above-recommended revised sound criteria.

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I would welcome discussing our initial analysis and recommendations with you. Please contact me (617-499-8018 or jbarnes@acentech.com) to discuss any questions or comments about this letter or our study.

Sincerely yours,

James D. Barnes, P.E.
Acentech Incorporated

Figures 1 to 5
Tables 1 & 2

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Figure 1.
Aerial Photograph Showing CHP Site and
Ambient Sound Monitoring Locations A (Long-Term) and 1 to 4 (Short-Term).

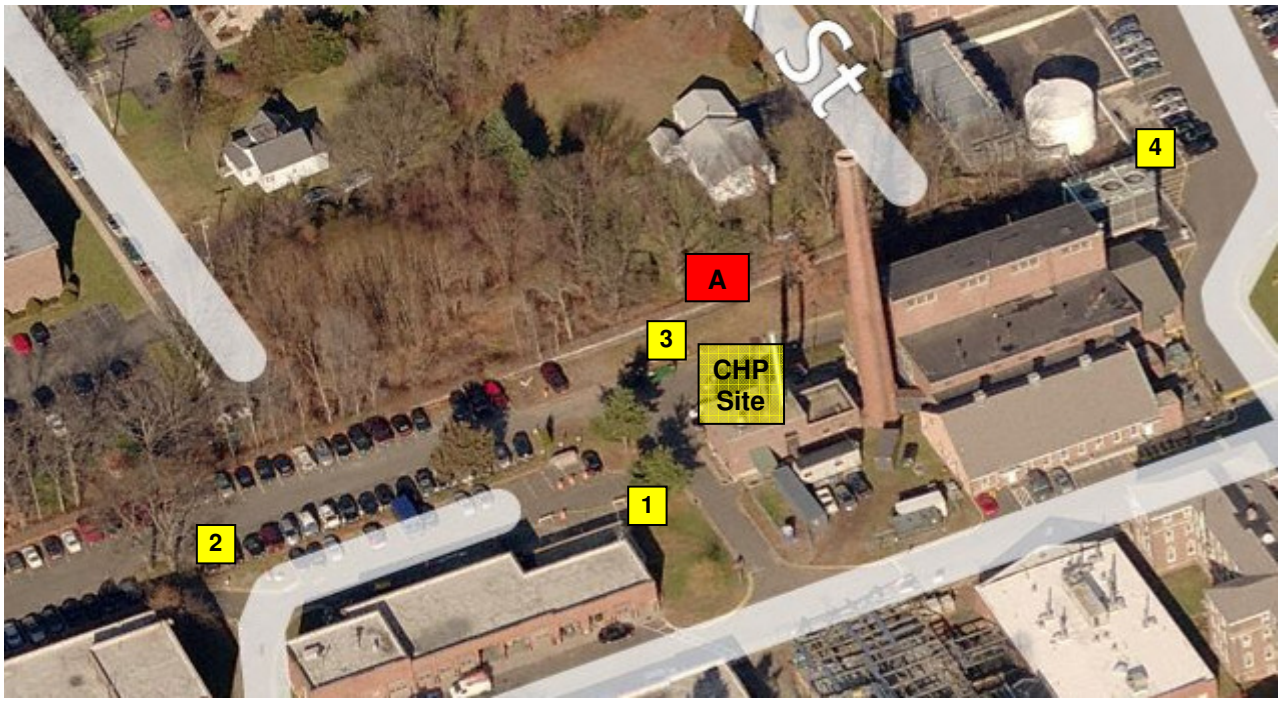
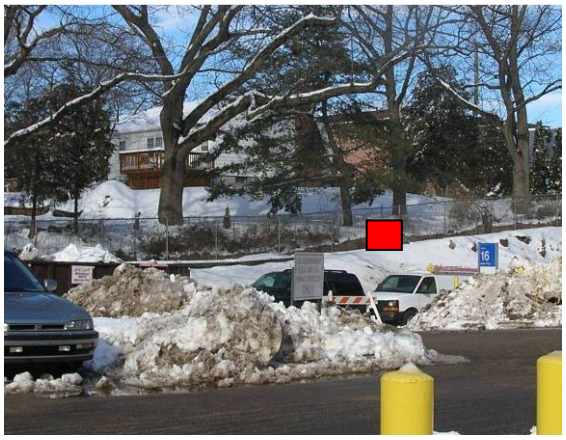


Figure 2.
Photographs of Long-Term Sound Monitoring Location A.



Looking NE toward Residence. Location of Long-Term Monitor (on fence) is shown.

Looking S from Location of Long-Term Monitor.

Figure 3.
Photographs of Short-Term Sound Monitoring Locations 1 to 4.

Looking NW toward Loc. 1

Looking E from Loc. 2

Looking S toward Loc. 3

Looking NW toward Loc. 4

Figure 4.
L1, Leq, and L90 Sound Levels Measured for Ten-Minute Intervals at Long-Term Monitoring Location A – North Property Line (7 to 8 February 2014).

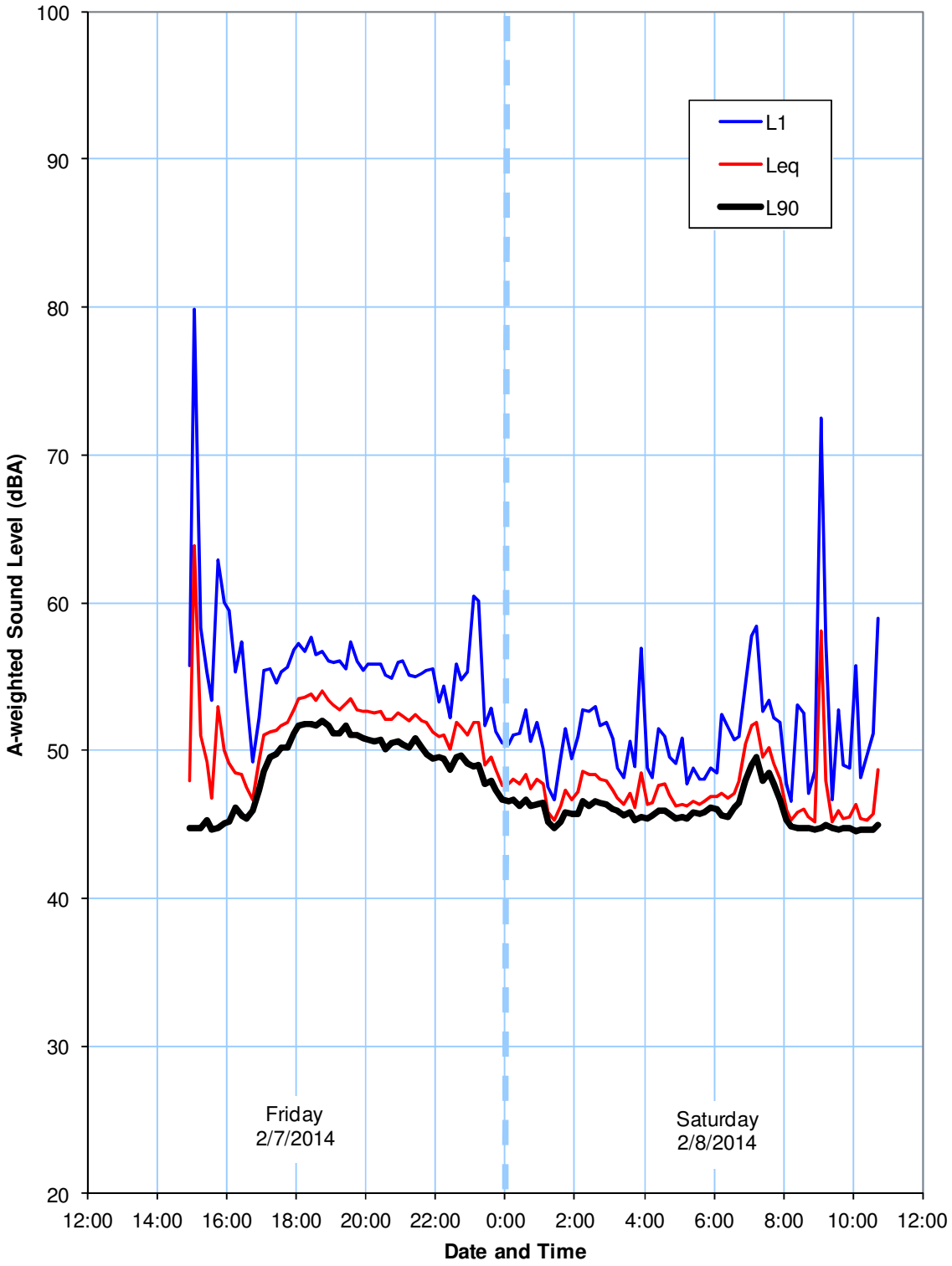


Figure 5.
Range of Residual (L90) Octave Band Sound Pressure Levels and Overall A-Weighted Sound Levels (dBA) Measured at Locations 1 to 4 during Day, Evening, and Night on 6 February 2014.

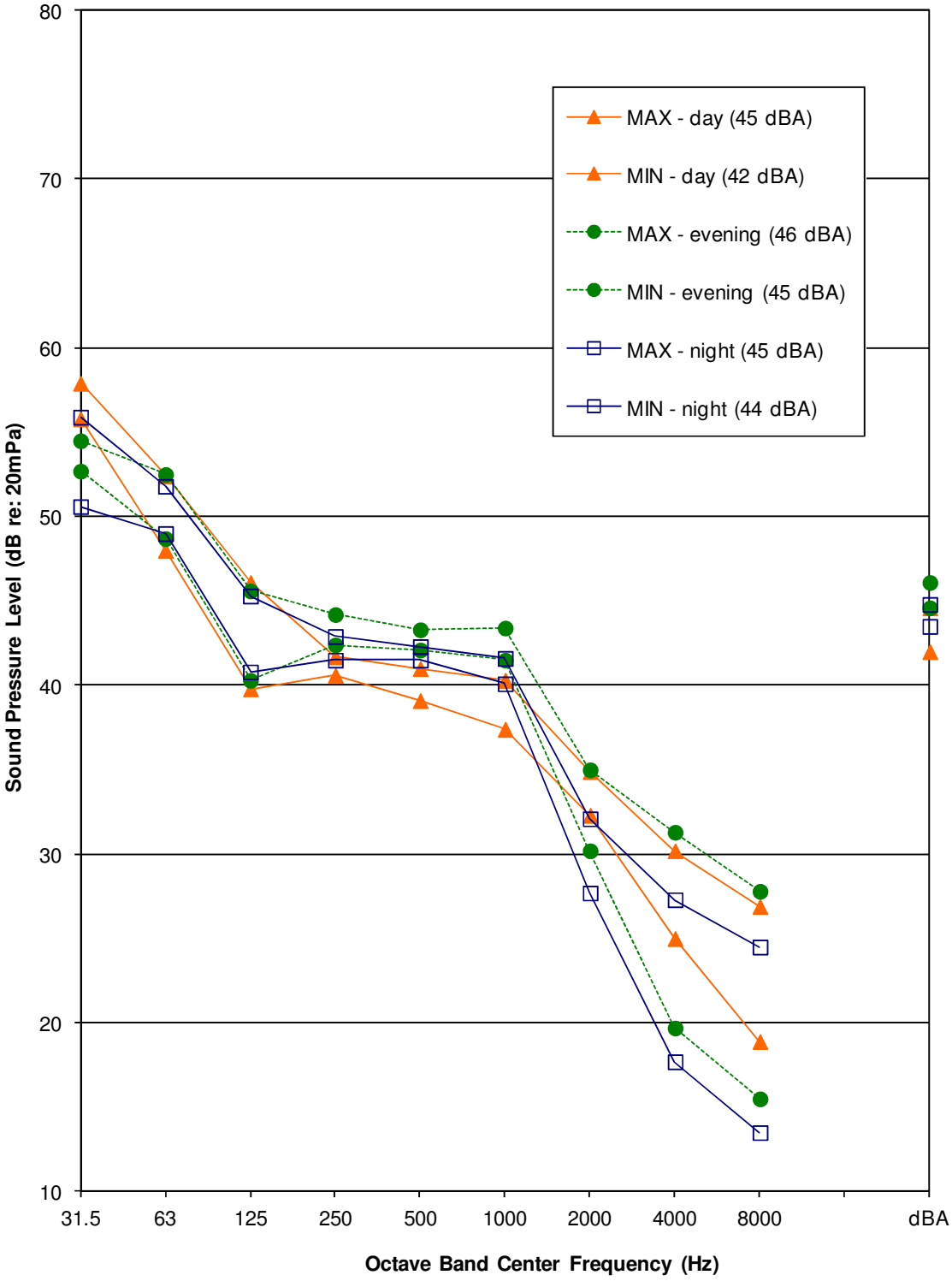


Table 1.
Type of Acoustic Instrumentation Used for Ambient Sound Measurements (6 to 8 February 2014).

Instrument Type	Manufacturer	Model
Sound Level Monitor	Rion	NL-31
Preamplifier	Rion	NH-21
1/2" Microphone	Rion	UC-53A
Precision Sound Level Meter and Octave Band Analyzer	Rion	NA-28
Preamplifier	Rion	NH-23
1/2" Microphone	Rion	UC-59
Acoustic Calibrator	Rion	NC-74

Table 2.
Residual (L90) Octave Band Sound Pressure Levels and Overall A-Weighted Sound Levels (dBA) Measured at Locations 1 to 4 during Day, Evening, and Night on 6 February 2014.

	Octave Band Center Frequency (Hz)									
Location	**31.5**	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**	**dBA**
Ambient - Thursday day (2:00p-3:40p on 2/6/2014)										
1	57	48	40	41	39	37	32	26	23	42
2	56	52	42	41	41	40	35	30	23	45
3	58	52	43	42	40	38	34	30	27	43
4	56	52	46	41	40	39	33	25	19	43
Sources: distant & local traffic, distant snow plowing, no obvious HVAC sound										
Weather: partly cloudy, calm, about 4" snow cover w/crust, 23 degrees F										
Ambient - Thursday evening (8:40p-9:20p on 2/6/2014)										
1	53	49	40	43	42	43	35	26	23	46
2	54	49	42	43	43	43	32	21	16	46
3	55	53	46	44	43	43	34	31	28	46
4	53	50	45	42	42	42	30	20	16	45
Sources: distant traffic, broadband fan sound										
Weather: clear, calm, about 4" snow cover w/crust, 23 degrees F										
Ambient - Thursday night (11:15p-11:50p on 2/6/2014)										
1	51	49	43	42	42	40	28	18	14	44
2	52	50	41	43	42	41	32	24	19	44
3	54	52	44	43	42	41	32	27	25	45
4	56	50	45	42	42	42	30	20	15	44
Sources: distant traffic, broadband fan sound										
Weather: clear, calm, about 4" snow cover w/crust, 20 degrees F										