IBERDROLA RENEWABLES

November 4, 2009

Thomas S. Burack, Chairman
Site Evaluation Committee
Department of Environmental Services
P.O. Box 95
29 Hazen Drive
Concord, NH 03302-0095

SUBJ: Lempster Wind Docket 2006-01 Post-construction sound monitoring reporting

Dear Chairman Burack:

Lempster Wind has completed the required sound studies in accordance with the conditions set forth in the SEC Decision dated June 28, 2007. Copies of the report have been forwarded to both the Town of Lempster and the NH Office of Attorney General in accordance with the Certificate. Enclosed please find a courtesy copy of the Lempster Wind Project report: *Lempster Wind Farm Post Construction Survey*.

Kind Regards,

Kristen Goland
Permitting Manager

attachment

RSG INC.
ENVIRONMENT, ENERGY, & ACOUSTICS

Lempster Mountain Wind Farm

Post Construction Sound Survey

Prepared for:

Iberdrola Renewables

October 29, 2009

DATA ■ ANALYSIS ■ SOLUTIONS

Report Prepared by

R|S|G INC.
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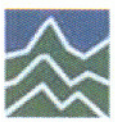


EXECUTIVE SUMMARY

The Lempster Wind Farm began operations in November 2008. As part of its New Hampshire Site and Facility Certificate and agreement with the Town of Lempster, the operator must submit a sound monitoring report that consists of a period during a winter and summer season, during the daytime and nighttime, and during at least one period when school is in session.

In the summer and winter of 2007, pre-construction monitoring was conducted at up to six sites around the wind farm, representing homes, the Goshen Lempster School and the Pillsbury State Park. The post-construction monitoring study described in this report followed identical monitoring procedures, monitored the same locations, and covered the same dates as the pre-construction monitoring.

The results of the post-construction monitoring show that:

1) At a "participating" home on Guilford Road, sound levels are affected by the wind turbines, with a winter ninetieth percentile sound level of 35 at the critical wind speed of 7 m/s and remaining at or below 45 dBA at all wind speeds. Evaluation of the sound levels before background sound was subtracted show that 9% of the ten-minute L90s exceeded 45 dBA during the winter and 0.2% exceeded 45 dBA during the summer.

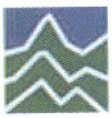
2) At a home on Nichols Road 2,400 feet west of the closest turbine, the regression results show wind farm sound levels during the winter and summer are at or below 40 dBA for all wind speeds.

3) The closest monitored non-participating home is on Maplewood Ave, 1,500 feet from the closest wind turbine. Given its proximity, sound levels there are affected to some extent by the wind farm. The ninetieth percentile sound level from the wind farm is 35 dBA at the critical wind speed of 7 m/s. Further work was done at this location to identify and analyze periods which exceeded 45 dBA before background sound was subtracted. Of the 16 distinct periods which had exceedences of 45 dBA during the winter and summer, only two had conditions for which the wind turbines may have substantively contributed. The remaining were likely due to other man-made and natural sounds.

4) At the Pillsbury State Park, the wind turbines do not significantly affect sound levels. While the wind turbines are audible at times, ninetieth percentile sound levels are below 40 dBA at all wind speeds.

5) At the Goshen Lempster School, the wind turbines do not significantly affect sound levels either inside or outside the school. The school is over a mile away and generally upwind of the turbines. The turbines were inaudible during all eight site visits there and regressions of the long-term monitors show ninetieth percentile wind turbine sound levels below 40 dBA for all wind speeds.

6) At Position 6 (Nichols Road opposite School Road), the wind turbines do not significantly affect sound levels. The site is 5,200 feet from the closest turbine and upwind relative to the prevailing winds. The turbines were inaudible during each of eight site visits. Regression results of the long term data show that ninetieth percentile turbine sound levels were at or below 30 dBA during all wind speeds.



1.0 INTRODUCTION

Resource Systems Group, Inc. (RSG) has completed post-construction sound level monitoring for the Lempster Mountain Windfarm, located in the town of Lempster, New Hampshire.

Pre-construction monitoring was performed in summertime and wintertime conditions by Hessler Associates, Inc.[1],[2] As part of the facility's Site and Facility Certificate and agreement with the Town of Lempster[3], it is required to conduct post-construction monitoring at sensitive receptor locations and inside and outside the Goshen/Lempster school. The measurements are required to include winter and summer seasons, daytime and nighttime, and periods when school is in session.

The post-construction sound monitoring described in this report was designed fulfill these requirements. The monitoring was conducted in wintertime and summertime on the same dates as the pre-construction monitoring. Wintertime post-construction monitoring was performed from December 17, 2008 through January 5, 2009,[4] and summertime monitoring was conducted from August 7 through August 21, 2009.[5]

Post-construction monitoring was conducted to measure sound levels with 12 wind turbines operating in the study area. This report summarizes the monitoring methodology and results.

2.0 DESCRIPTION OF TERMS

Sound can be measured in many different ways. Perhaps the simplest way is to take an instantaneous measurement, which gives the sound pressure level at an exact moment in time. The level reading could be 62 dB, but a second later it could 57 dB. Sound pressure levels are constantly changing. It is for this reason that it makes sense to describe noise and sound in terms of time.

The most common ways of describing noise over time is in terms of various statistics. Take, as an example, the sound levels measured over time shown in Figure 1. Instantaneous measurements are shown as a ragged grey line. The sound levels that occur over this time can be described verbally, but it is much easier to describe the recorded levels statistically. This is done using a variety of "levels" which are described below.

2.1 Equivalent average sound level - Leq

One of the most common ways of describing noise levels is in terms of the continuous equivalent sound level (Leq). The Leq is the average of the sound pressure over an entire monitoring period and expressed as a decibel. The monitoring period could be for any amount of time. It could be one second ($Leq_{1\text{-sec}}$), one hour ($Leq_{(1)}$), or 24 hours ($Leq_{(24)}$). Because Leq describes the average pressure, loud and infrequent noises have a greater effect on the resulting level than quieter and more frequent noises. For example, in Figure 1, the median sound level is about 47 dBA, but the equivalent average sound level (Leq) is 53 dBA. Because it tends to weight the higher sound levels and is representative of sound that takes place over time, the Leq is the most commonly used descriptor in noise standards and regulations.

[1] Environmental Sound Survey, Wintertime Conditions, Lempster Mountain Wind Power Project. Report No. 1800-022808-A. Prepared by Hessler Associates, Inc., Haymarket, VA. March 19, 2008.

[2] Environmental Sound Survey, Summertime Conditions, Lempster Mountain Wind Power Project. Report No. 1800-091207-0. Prepared by Hessler Associates, Inc., Haymarket, VA. September 17, 2007.

[3] Decision Issuing Certificate of Site and Facility with Conditions. State of New Hampshire Site Evaluation Committee, Docket No. 2006-01, Application of Lempster Wind, LLC. June 28, 2007.

[4] Winter pre-construction monitoring was conducted on December 18, 2007 through January 2, 2008.

[5] Summer pre-construction monitoring was conducted on August 7, 2007 through August 20, 2007.

Similar to a 24-hour Leq is the day-night sound level (Ldn). For Ldn, a 10 dB penalty is applied to the nighttime Leq between 10 P.M. and 7 A.M.

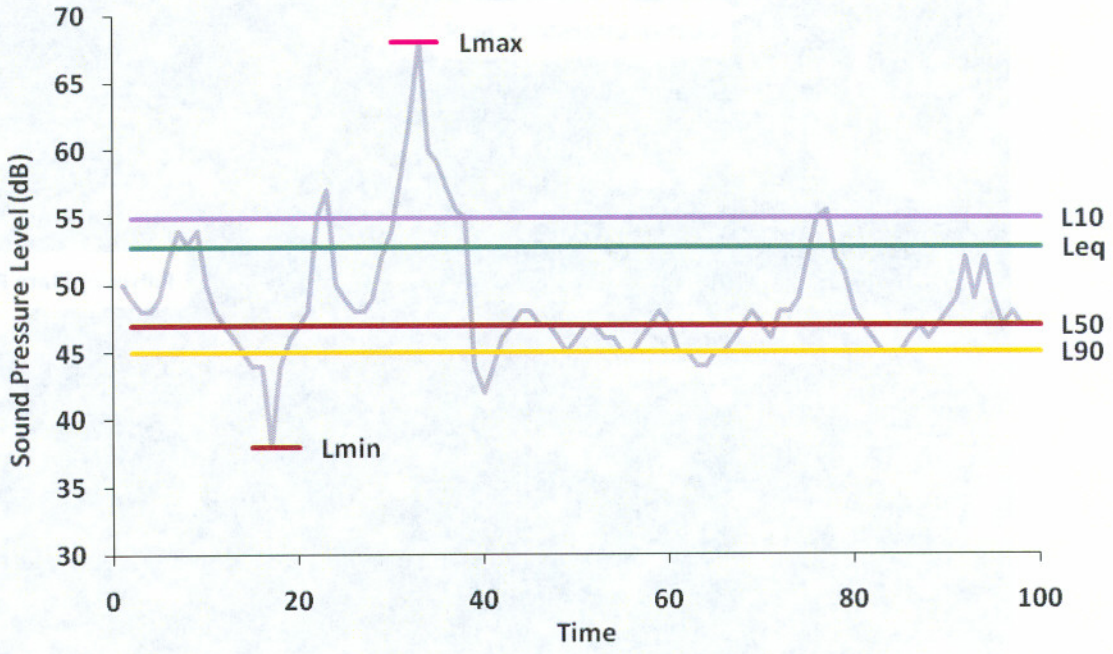
2.2 Percentile sound level - Ln

Ln is the sound level exceeded *n* percent of the time. This type of statistical sound level, also shown in Figure 1, give us information about the distribution of sound levels over time. For example, the L10 is the sound level that is exceeded 10 percent of the time, while the L90 is the sound level exceeded 90% of the time. The L50 is exceeded half the time. The L90 is a residual base level which most of the sound exceeds, while the L10 is representative of the peaks and higher, but less frequent levels. When one is trying to measure a continuous sound, like a wind turbine, the L90 is often used to filter out other short-term environmental sounds that increase the level, such as dogs barking, vehicle passbys, wind gusts, and talking. That residual sound, or L90, is then the sound that is occurring in the absence of these noises.

2.3 Minimum and Maximum level – Lmin and Lmax

The absolute minimum and absolute maximum sound levels are often used as environmental noise descriptors. These are represented by Lmin and Lmax, respectively.

Figure 1: Example of Time Domain Data and Resulting Levels



3.0 Description of the Study Area

Twelve variable-speed Gamesa G87 2-MW wind turbines are located along a north-south ridge in Lempster, NH (Figure 2). The hub heights are 78 meters with an 87 meter rotor diameter. The wind turbines have a cut-in wind speed of 3 m/s and increase in sound levels to a maximum at 7 m/s (measured at 10 meter anemometer height). This wind speed is termed the "critical wind speed" in this report, since it is at this speed and above which represents the maximum sound emissions from the wind turbine.

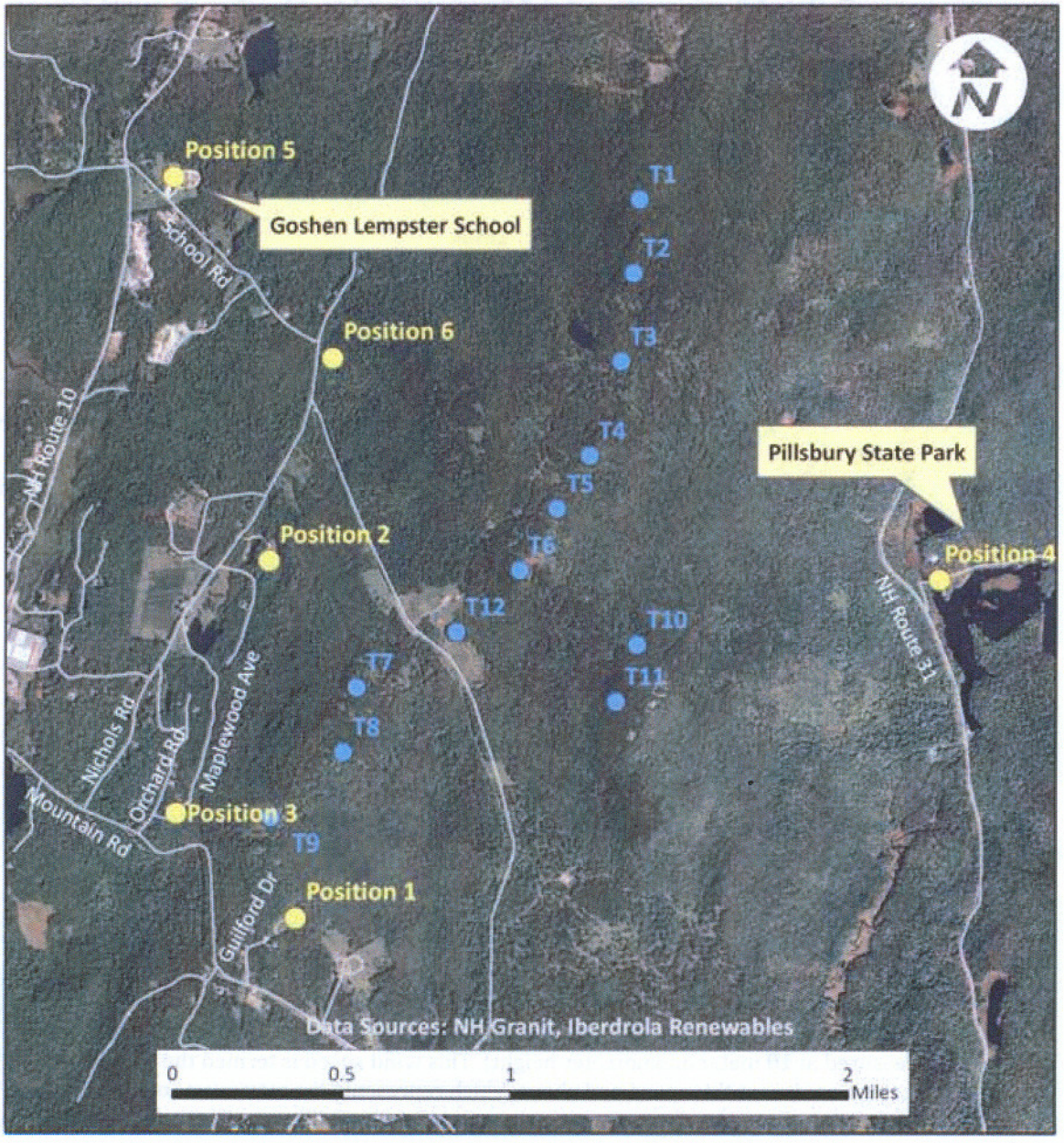
The turbines began operations on November 10, 2008.

The study area is primarily rural with hilly to mountainous terrain. Most of the area is vegetated with deciduous and coniferous forest.

The area is bordered by New Hampshire State Route 10 (NH 10) to the west and NH 31 to the east. The Goshen Lempster School is located on the western side of the ridge and Pillsbury State Park is located on the eastern side of the ridge. Residences are sparsely located throughout the area. The closest non-participating home is approximately 1,500 feet to the west of Turbine 9.

The area was snow covered during the winter monitoring period. During the summer, the ground was mostly vegetated and trees were in full foliage.

Figure 2: Study Area Map Showing Turbine and Monitoring Station Locations



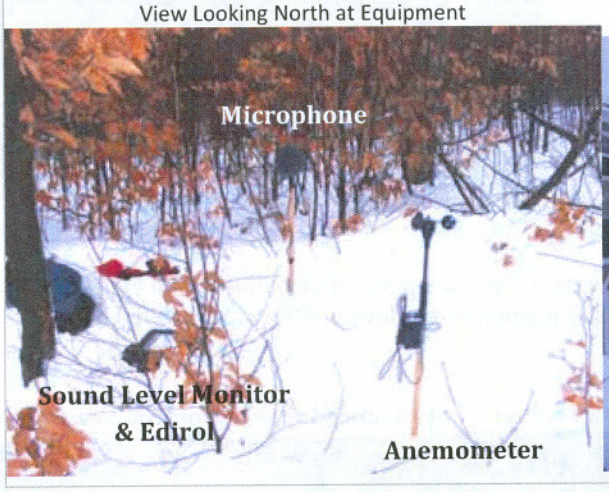
4.0 Sound Level Monitoring Locations

Long term sound level monitoring stations were installed at six locations (Figure 2). Equipment was installed at the same locations used in pre-construction monitoring. Short term measurements were also made inside the school. For consistency, measurement location names are the same as those listed in the Hessler report. Locations are described in further detail as follows:

- Position 1: At the end of a driveway extending north from the end of Guilford Drive (Figure 3). A Rion logging sound level meter, an Edirol sound recorder and an anemometer were installed at the edge of the woods slightly to the north and west of two residences served by the driveway. This site is approximately 1,530 feet south of Turbine 9. The monitor was placed on a participating property.

Figure 3: Pictures Illustrating Position One

View Looking North at Equipment



View Looking South Away From Equipment

- Position 2: At the end of a driveway curving southeast from Nichols Road toward the ridge (Figure 4). A Cesva logging sound level meter and an Edirol sound recorder were installed at the edge of the woods south of the residence, approximately 2,400 feet from Turbine 7.

Figure 4: Pictures Illustrating Position Two

View Looking South at Equipment from Driveway

View Looking North Away From Equipment

- Position 3: Located approximately 15 feet east of Maplewood Avenue in the woods (Figure 5). It is approximately 1,500 feet west of Turbine 9. There is a drainage ditch which flows intermittently, along the east side of Maplewood Avenue and is approximately 15 feet west of the equipment. A Rion logging sound level meter and Edirol sound recorder were installed here.

Figure 5: Pictures Illustrating Position Three

View Looking Southeast at Equipment from Road

View Looking Northwest Away From Equipment

- Position 4: Located in Pillsbury State park, near the park office building and approximately 4,800 feet from the Turbine 10 (Figure 6). A Rion logging sound level meter was installed here.

Figure 6: Pictures Illustrating Position Four

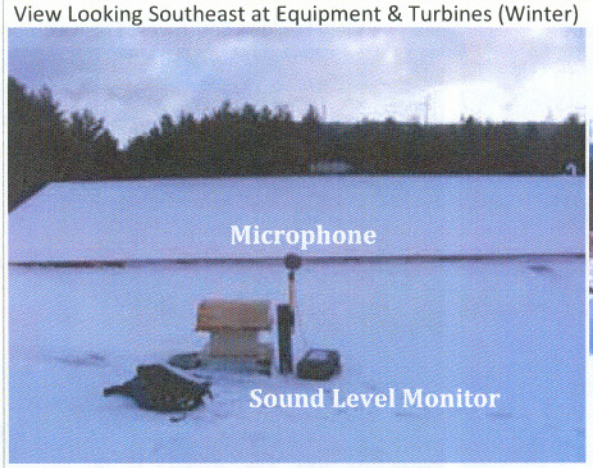
View Looking Northwest at Equipment & Access Road

View Looking Southeast From Equipment at Office Building

- Position 5: Located at the Goshen Lempster School (Figure 7). During the winter, a Cesva logging sound level meter was installed on the roof for security reasons (since school was in session) and in the summer, it was installed in the tree line next to the parking lot. This station is approximately 7,350 feet from the closest turbine (Turbine 2). Additional short-term measurements were taken inside of the school at the teachers' lounge.

Figure 7: Pictures Illustrating Position Five

View Looking Southeast at Equipment & Turbines (Winter)

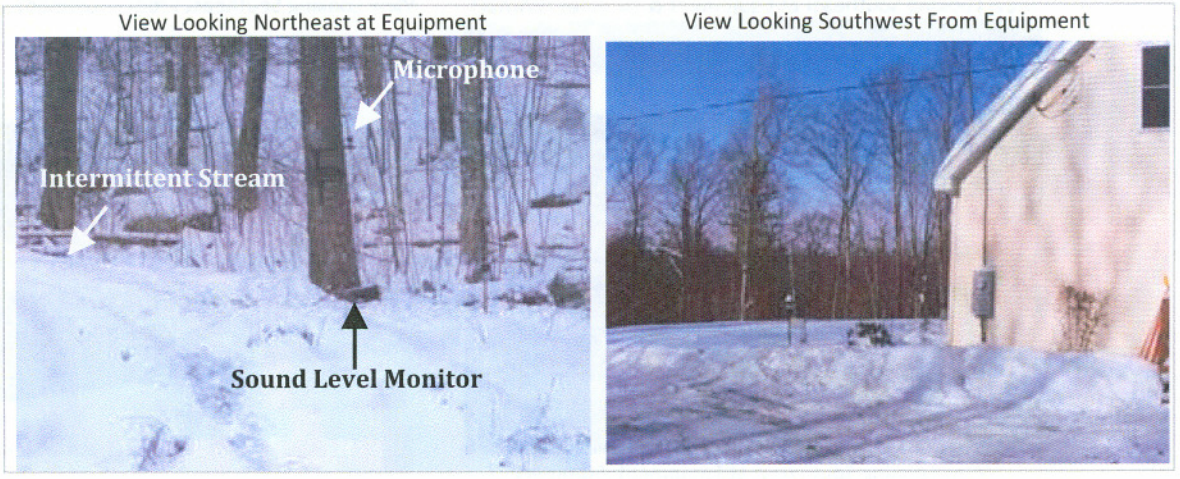


View Looking Southeast From Equipment (Winter)

View Looking Southwest at Equipment (Summer)

➢ Position 6: Located at the end of a driveway extending east from Nichols Road, opposite School Street (Figure 8). A Rion logging sound level meter and an anemometer were installed northeast of the residence at the edge of the woods. There is a small intermittent stream which runs along the perimeter of the driveway. The equipment was approximately 5,200 feet from Turbine 4.

Figure 8: Pictures Illustrating Position Six



5.0 EQUIPMENT DESCRIPTION

As previously described, either a Type 2 Rion NL-22 or Type 1 Cesva SC 310 sound level meter was installed at each monitoring station. All sound level monitors were configured to record statistics for every 10 minute period, as was done for the pre-construction monitoring. A Bruel & Kjaer Model 4231 calibrator was used to calibrate all equipment to a 94 dB tone before and after monitoring. The calibration drift was acceptable in each case.

Positions 1, 2 and 3 were also equipped with Edirol digital sound recorders in addition to sound level meters. An Edirol was also used inside the Goshen Lempster School for the short term monitoring performed there.

All equipment was enclosed in a waterproof case. For the winter monitoring period, microphones were covered with three-inch diameter windscreens initially, which were replaced with seven-inch diameter windscreens on December 23rd and December 24th, 2008. During the summer, each monitor used seven-inch diameter wind screens. All microphones were installed at approximately one meter above the ground surface.

Position 1 and Position 6 were equipped with anemometers, which were also installed at approximately one meter above the ground surface.

6.0 BACKGROUND SOUNDS

In addition to when equipment was set up and taken down, equipment checks and observations were performed on December 23, 24, and 30, 2008, and August 13 and 18, 2009.

The following natural sounds were noted during the five visits to the study area in the winter: wind blowing through the trees, leaf rustle (on branches), bird calls, water trickling (from springs and through

drainage ditches) and dogs barking. The following non-natural sounds were noted: snow plow trucks clearing roads, general roadway noise (mainly from NH 10 and NH 31), and airplane over-flights. There were a number of non-natural sounds which occurred just at the Goshen Lempster School. These were mainly associated with pick up at the end of school and therefore included doors slamming, cars idling/driving, and people speaking.

We noted the wind turbines were audible at least once at or near Positions 1, 2, 3 and 4, during equipment checks. The wind turbines were not audible at any other location.

Similar background sounds were observed during the summer. However, since school was in recess, there were no activities observed there.

7.0 Weather Conditions

Seasonable weather conditions occurred during both winter and summer monitoring period.

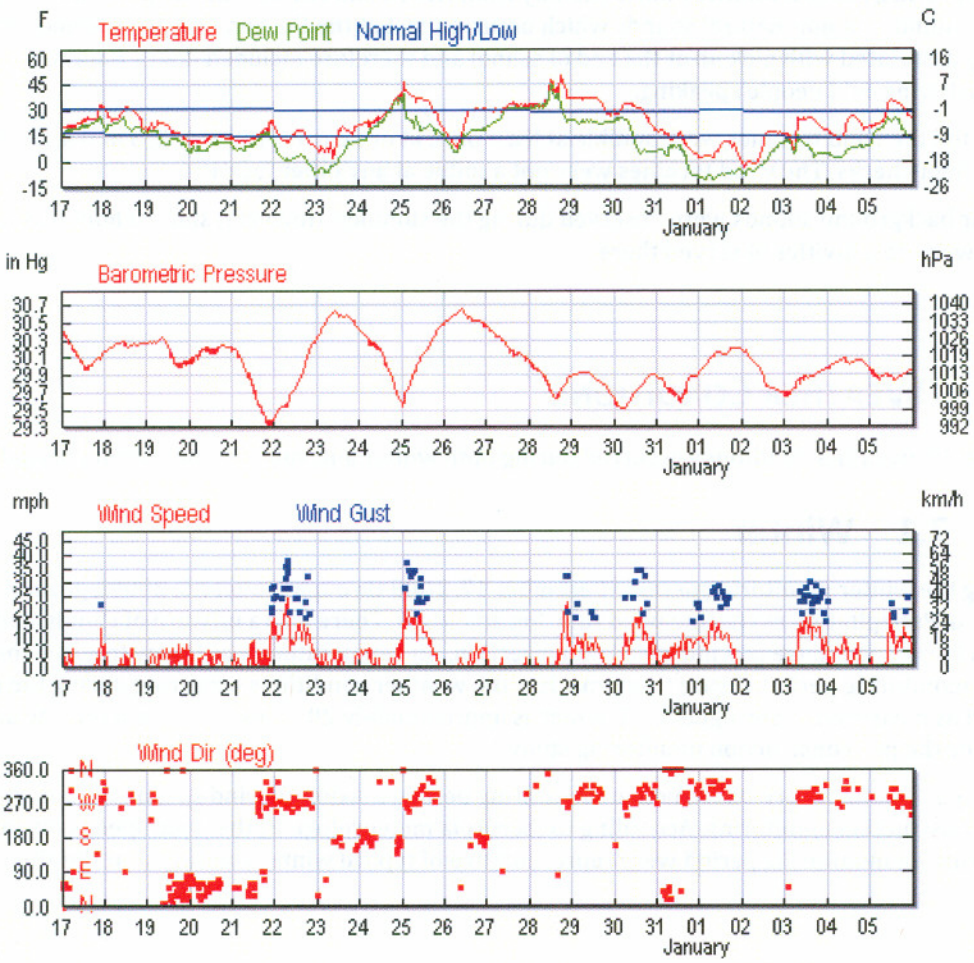
7.1 Winter

During the winter monitoring period (December 17, 2008 through January 5, 2009), ground was snow covered. Precipitation events included rain, fog and snow. There was a mixture of cloudy and sunny days with a fairly wide range in wind speed and direction. Air temperature was below freezing for the majority of the monitoring period. Figure 9 summarizes the weather conditions occurring during the monitoring period as measured in Springfield, VT, which is approximately 20 miles away from the site and was also used for the pre-construction monitoring study.[1]

In comparison to the pre-construction monitoring period, maximum wind speeds were higher during the post-construction monitoring. According to Iberdrola meteorologists, the wind speeds during the post-construction monitoring period were representative of typical winter conditions at the site.

[1] This information was provided by the Weather Underground Internet site at www.wunderground.com.

Figure 9: Springfield NH Weather Conditions Occurring During the Winter Monitoring Period



Source: www.wunderground.com

There were a total of 125 hours when air temperature was less than 14°F, the minimum ANSI specification of the sound level meters.

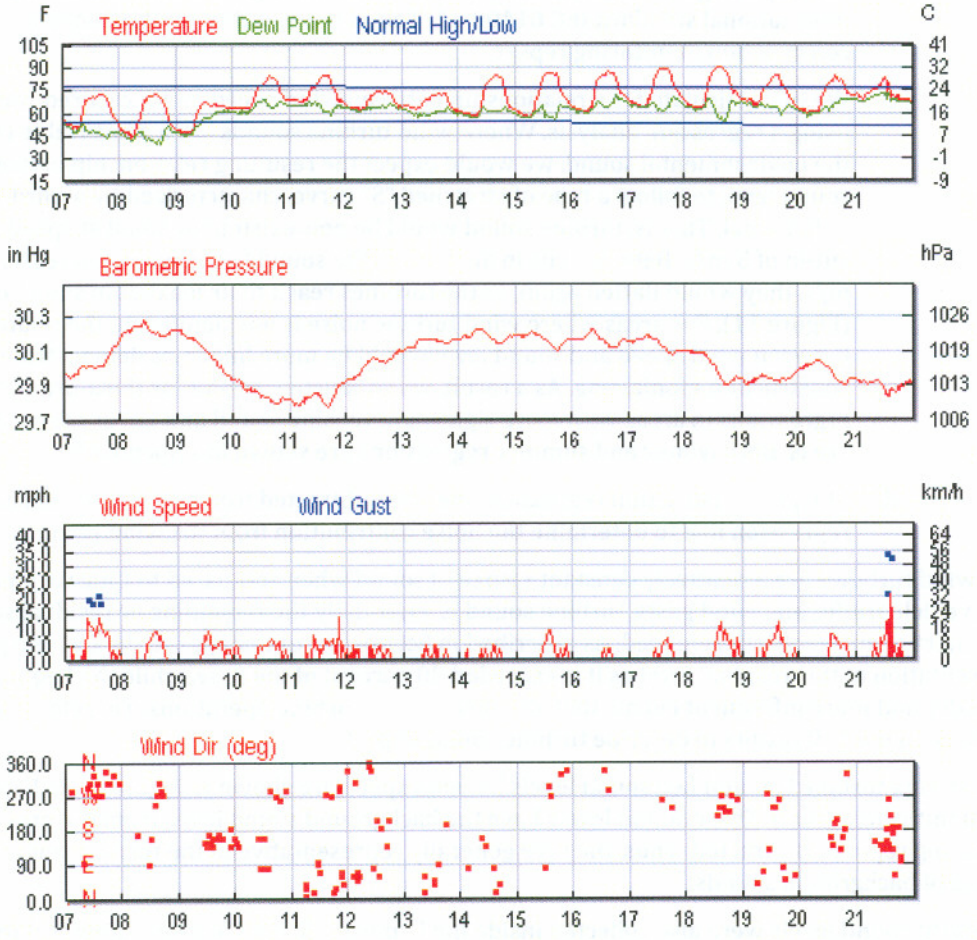
As mentioned, wind speed and direction were measured by anemometers installed at Position 1 and Position 6. The anemometer height was approximately one meter above ground. The 10 minute average wind speed never exceeded five meters per second, the limit specified in ANSI S12.18.

7.2 Summer

The summer monitoring period (August 7 through August 21, 2009) was typical of the type of weather for the summer - characterized by relatively light winds, morning fog, warm temperatures and periods of rain (Figure 10). Heavy rain fell on August 11 (0.9 inches) and light rain fell during the night of August 18 (0.1 inches).

Maximum wind speeds during the post-construction monitoring period were lower than during the pre-construction period. According to Iberdrola meteorologists, the average wind speed during the summer post-construction measurement period was 3.3% below normal.

Figure 10: Springfield NH Weather Conditions Occurring During the Summer Monitoring Period



Source: www.wunderground.com

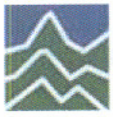
8.0 Sound Level Monitoring Results

To determine the sound level from the wind turbines, the pre-construction sound levels were subtracted from the post-construction sound levels. This was done using the following method:

1) Pre-construction sound levels were obtained from the regression line shown in the pre-construction modeling report. The regression line shows the relationship between the adjusted 10 meter wind speed and background sound levels.

2) Post construction sound levels by wind speed were obtained using a similar method. Regressions for the sound level versus wind speed were made at each monitoring location.

    a. The sound levels were calculated as the both the ninetieth percentile and equivalent average sound level for every 10-minute period (Appendix A). Overall sound levels for the summer and winter two-week monitoring periods are shown in Table 1 and 2 for each location. The percentile measurements (Ln) represent the level exceeded in percent of time. The equivalent average (Leq) is the pressure weighted average sound level.



b. The wind speeds were calculated by taking the average turbine hub height wind speed and adjusting it to a height of 10 meters using the logarithmic profile found in the international standard IEC 61400-11. This is the identical methodology used in the pre-construction monitoring report.

c. We then calculated the relationship between wind speed and measured sound level using a regression analysis. Where wind turbine sounds are a measurable component in the environmental sound, we would expect the resulting relationship between wind and sound level to follow a type of stretched "S" curve, characterized by a third-order polynomial. That is, turbine sound would be non-existent or small at speeds below the cut-in of 3 m/s. Between cut-in and 7 m/s, the sound levels would increase. Above 7 m/s, they would flatten again, as the turbines reach their maximum sound output (Figure 11). For areas where wind turbine noise is not significant, the relationship between wind speed and sound level would be more linear, as demonstrated in the pre-construction monitoring. As a result, we conducted second- or third-order polynomial regressions in areas with more significant turbine sound and linear regressions in other areas. Both winter and summer regressions are shown in Appendix B.

d. The pre-construction regression line was subtracted from the post-construction regression line to determine the noise contribution from the wind turbines.

Since wind turbines are a relatively constant source of sound when compared to time varying sounds of birds, vehicle traffic, and wind gusts, turbine sound is essentially the remaining or residual sound after these short-term events are removed. As described in Section 2.1 of this report, the L90 is a good representation of this residual level as it is exceeded 90 percent of the time, while the Leq tends to weight the louder and more infrequent events that are unrelated to turbine operations. Therefore, this report will focus on the L90 results to describe turbine sound impacts.

The resulting turbine L90 and Leq sound levels by wind speed are shown in Figure 12 to Figure 17 for each monitoring station. These sound levels have the background sound level, from the pre-construction monitoring reports, subtracted. Thus, they are generally representative of the turbine sound levels in the absence of background sounds.

Short-term sound levels were also collected inside the Lempster School teachers' lounge during four winter and four summer site visits. During all of those visits, the wind turbines were not audible inside the teachers' lounge or outside the school. Sound levels inside the lounge were recorded as low as 20 dBA.

Detailed monitoring results are provided in Appendix A.

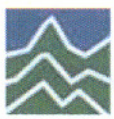


Table 1: Overall sound levels for each monitoring position – Winter

Measurement Position	10th percentile (L10)	50th percentile (L50)	90th percentile L90	Equivalent Average (Leq)
Position 1	41	38	36	54
Position 2	37	34	32	54
Position 3	40	37	35	49
Position 4	39	35	33	48
Position 5	40	36	32	51
Position 6	35	32	29	40

Table 2: Overall sound levels for each monitoring position – Summer

Measurement Position	10th Percentile (L10)	50th Percentile (L50)	90th Percentile (L90)	Equivalent Average (Leq)
Position 1	30	35	28	54
Position 2	30	33	29	48
Position 3	34	38	32	47
Position 4	31	38	26	50
Position 5	45	39	36	57
Position 6	30	35	31	51

Figure 11: Sound Emissions from the G87 Wind Turbine as a Function of Wind Speed

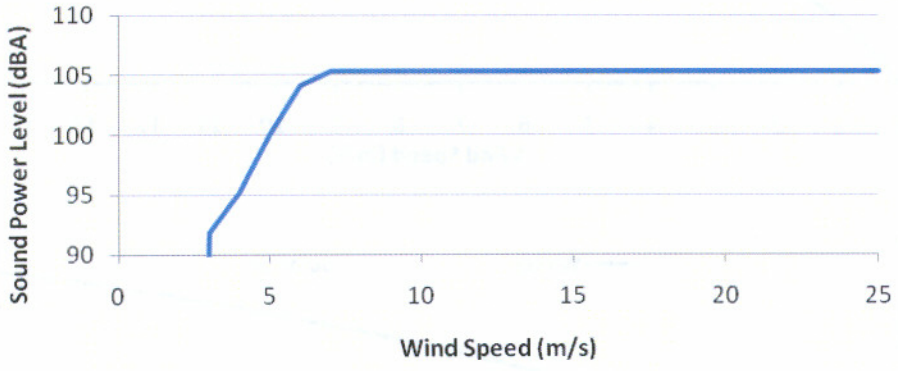
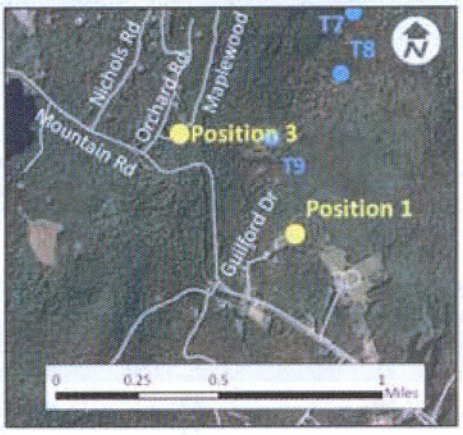
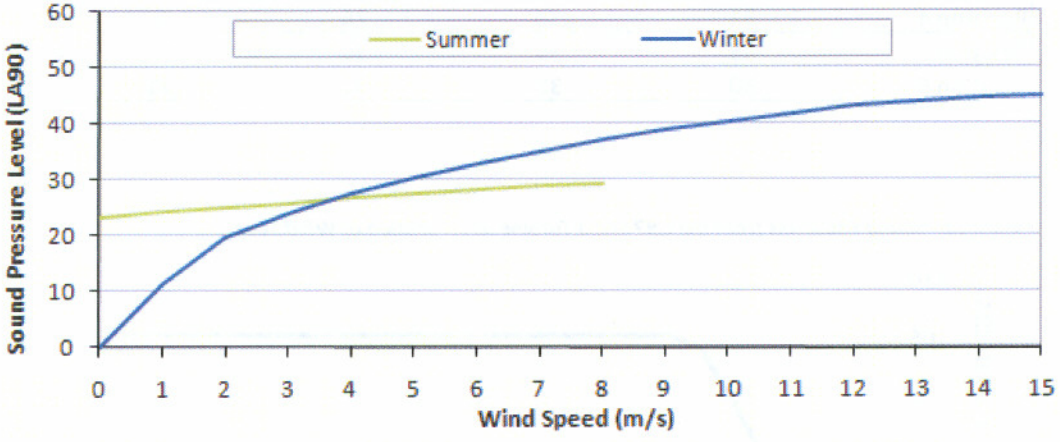


Figure 12: Position 1 Wind Turbine Sound Levels

Position 1 is approximately 1,530 feet from Turbine 9, and is located at a participating residence





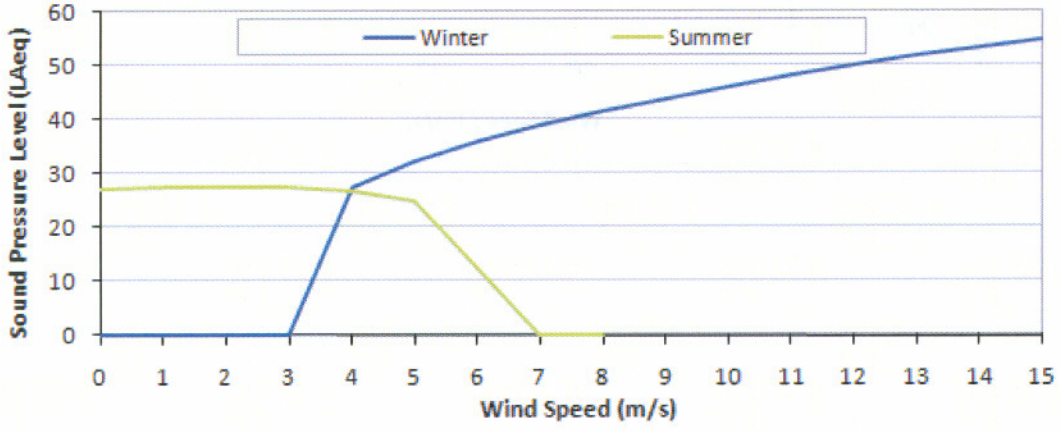
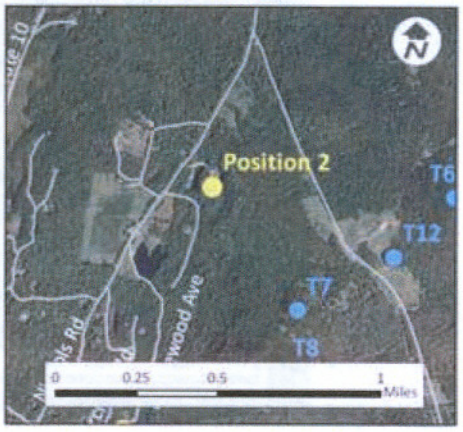
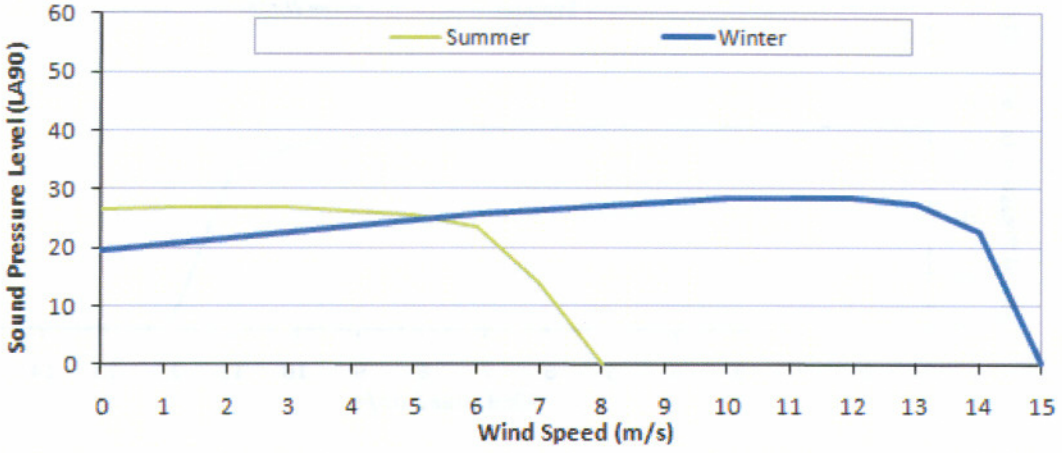
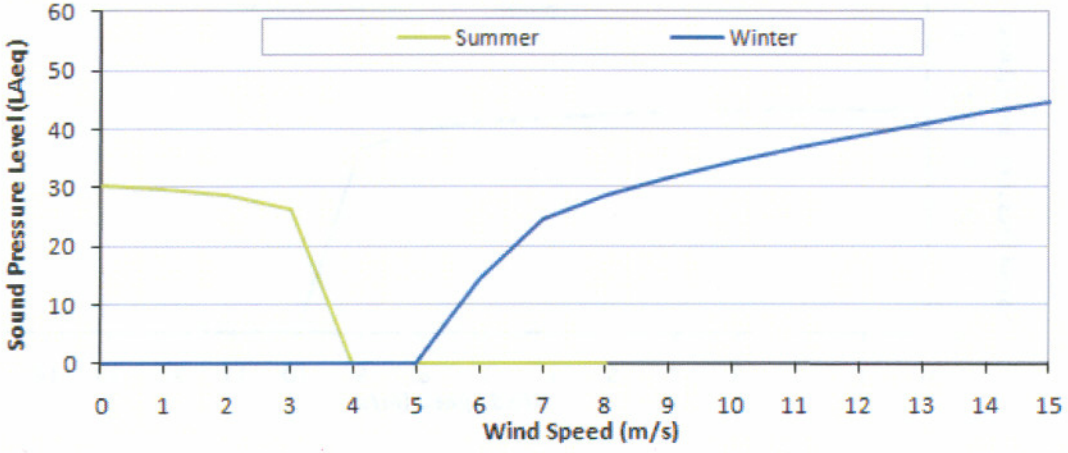


Figure 13: Position 2 Wind Turbine Sound Levels

Position 2 is approximately 2,400 feet from the closest wind turbine, Turbine 7



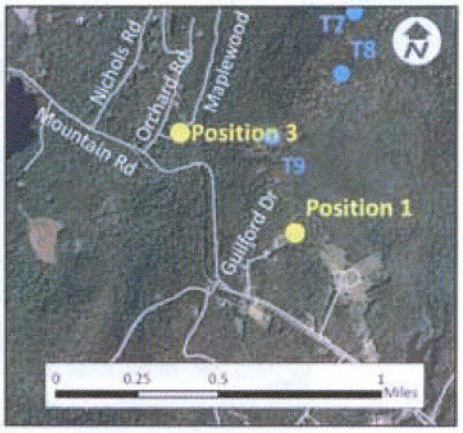


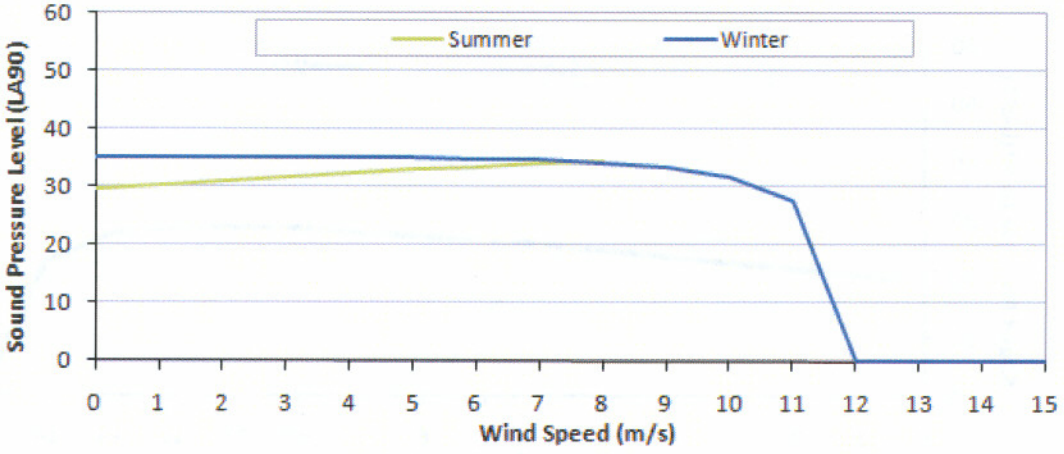


Notes: The wind turbines were not audible at this location during the summer monitoring site visits.

Figure 14: Position 3 Wind Turbine Sound Levels

Position 3 is approximately 1,500 feet west of Turbine 9, and is one of the closest homes to the wind farm





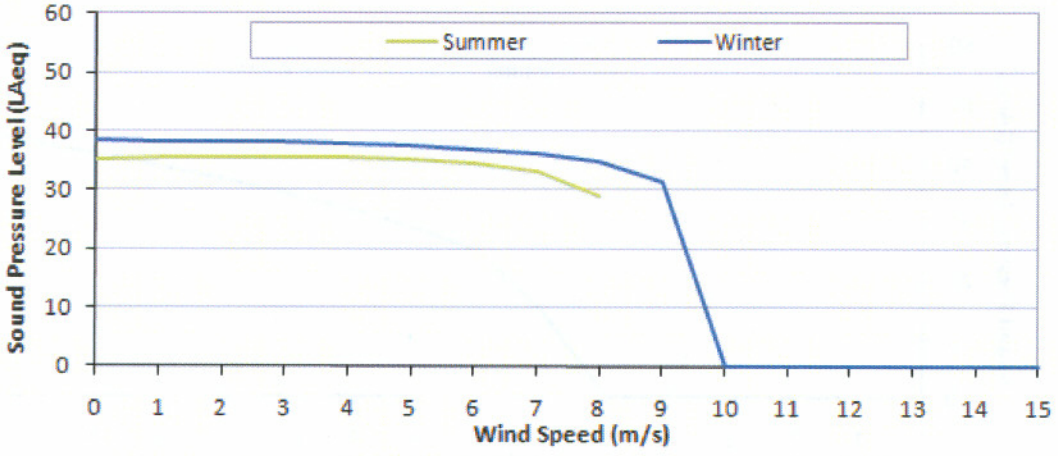
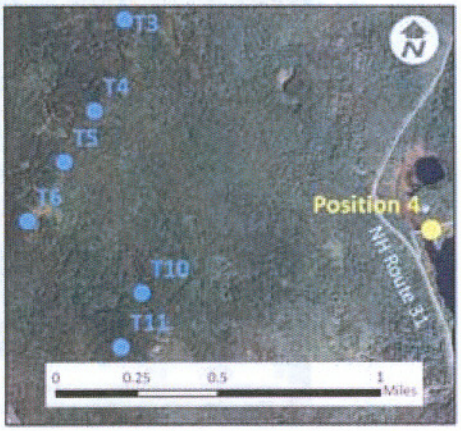
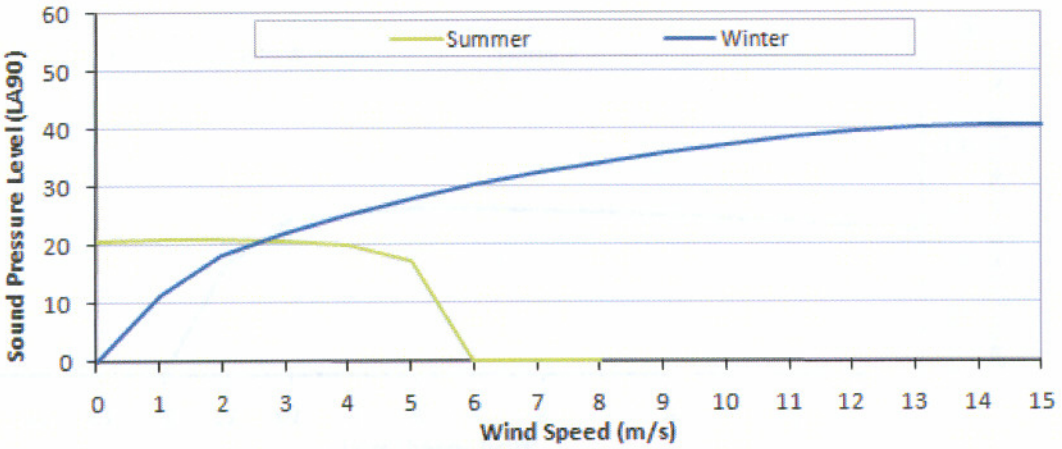
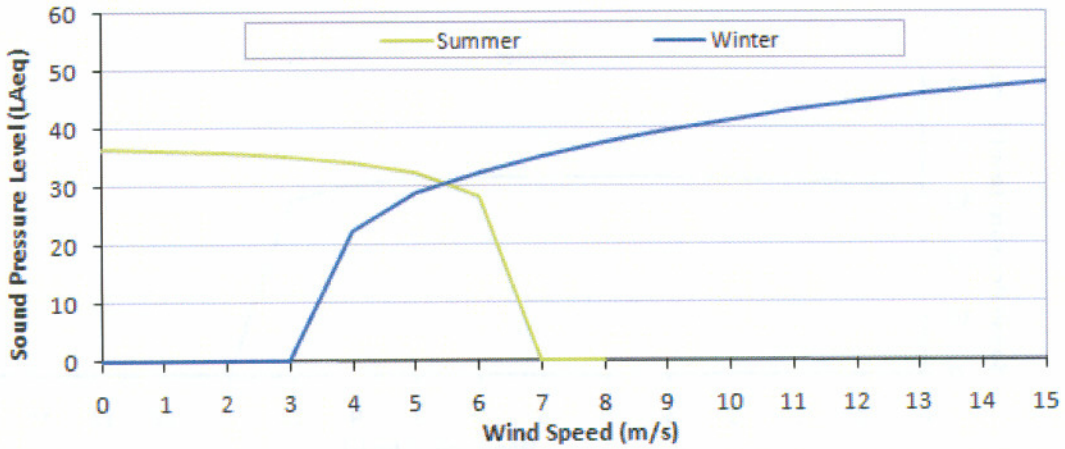


Figure 15: Position 4 Wind Turbine Sound Levels

Position 4 is approximately 4,800 feet east of Turbine 10



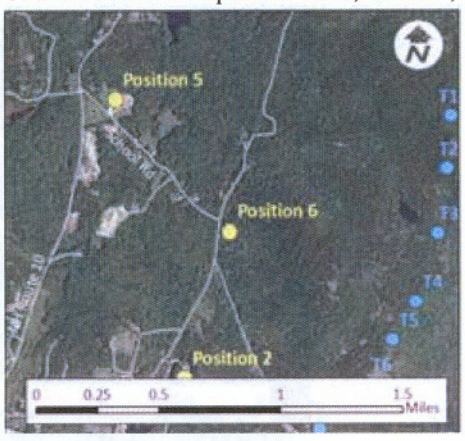


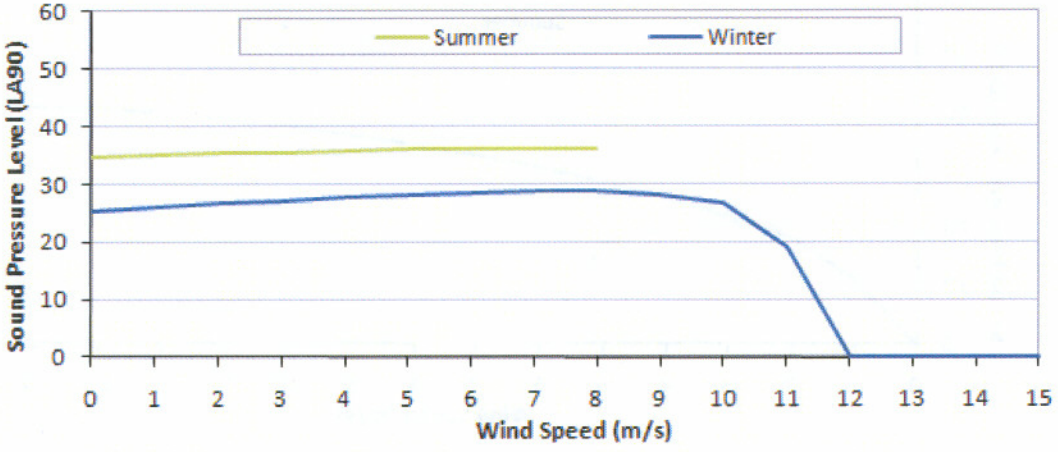


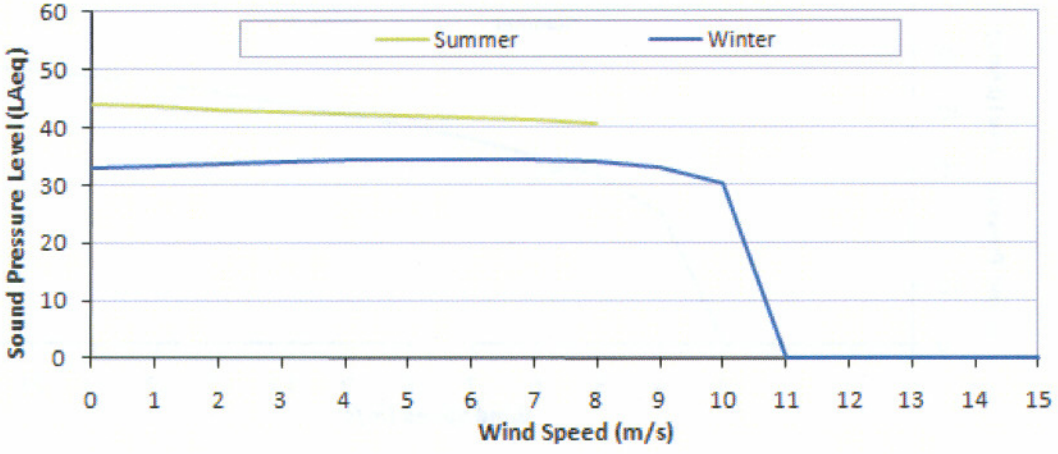
NOTE: The wind turbines were not audible at this location during three of four summer monitoring site visits.

Figure 16: Position 5 Wind Turbine Sound Levels

Position 5 is located on the roof of the Goshen Lempster School, about 7,350 feet from the Turbine 2



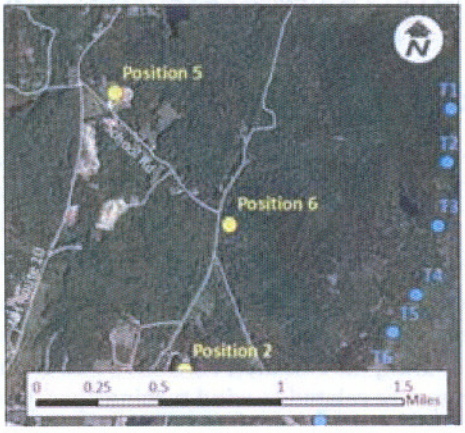


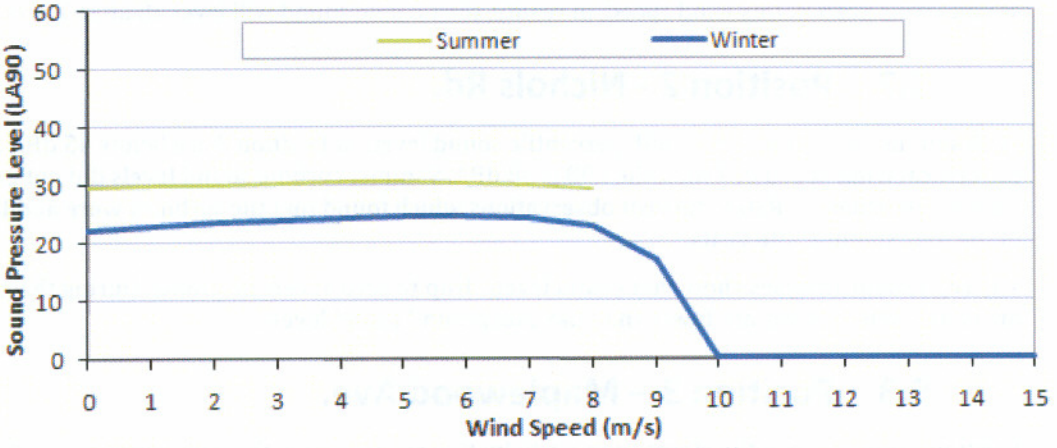


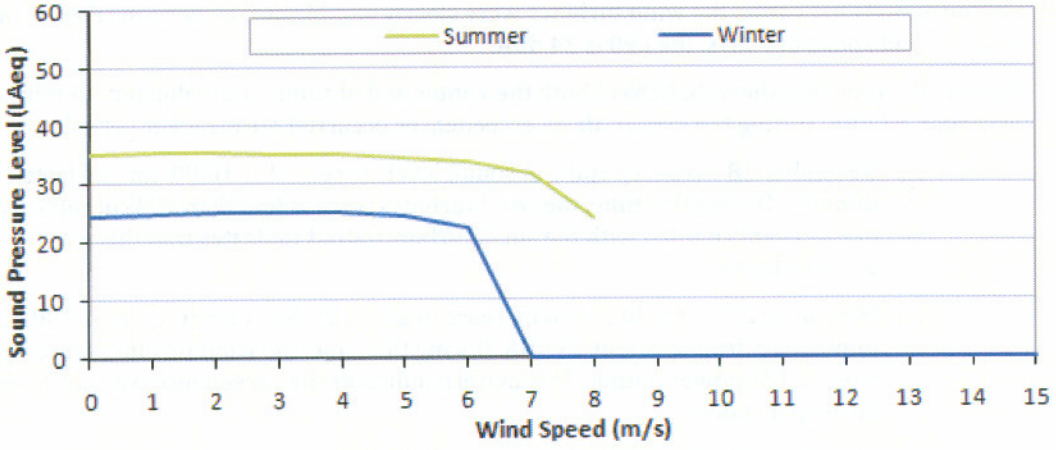
Notes: Wind turbines were not audible at this location during any of the site visits.

Figure 17: Position 6 Wind Turbine Sound Levels

Position 6 is located along School Road, 5,200 feet from Turbine 4







Note: Wind turbines were not audible at this location during any of the site visits.

9.0 Discussion of Regression Results

9.1 Position 1 – Guilford Dr.

The sound monitor on Guilford Dr. was located on a participating property, one of the closest homes to the wind turbines. The ninetieth percentile sound levels here, shown in Figure 12, are consistently above background sound, indicating a clear representation of wind turbine sound. This is confirmed by RSG's observation during the site visits that wind turbines are clearly audible at this location.

The linear regression results in Figure 12 show that nintieth percentile turbine sound levels do exceed 45 dBA. The unadjusted raw data that showed 9% of the 10-minute L90s exceeded 45 during the winter monitoring period. During the summer, 0.1% of the 10-minute L90s exceeded 45 dBA. None of the summer exceedences were related to wind turbine operations.

As mentioned above, the sound emissions from a Gamesa G87 reach a maximum and stay level at and above 7 m/s. While some of the regression graphs in Figures 12 through 17 show continuing increases in sound levels beyond this wind speed, in reality, the turbine sound will level off after 7 m/s.

9.2 Position 2 - Nichols Rd.

Both summer and winter ninetieth percentile sound levels at Position 2 are below 45 dBA (Figure 13). At the critical wind speed of 7 m/s, the L90 is 38 dBA. Summer turbine sound levels did not exceed 30 dBA. This is confirmed by RSG's site visit observations which found that the turbines were audible at only one of the four summer site visits.

The regression analyses show that sound levels drop to zero at certain points. During these periods, the measured sound levels are lower than the background sound levels.

9.3 Position 3 – Maplewood Ave.

Position three is one of the closest non-participating residences to the wind farm, at 1,500 feet west of Turbine 9. Ninetieth percentile sound levels at this location were nearly identical for the summer and winter periods indicating the wind turbines were clearly audible at this location (Figure 14). At the critical wind speed of 7 m/s, the L90 is 34 dBA.

Overall, the raw data show that 2% of both the winter and of summer unadjusted 10-minute L90s exceeded 45 dBA. During the winter, these exceedences occurred during eight periods

1) December 18 – A sharp spike in sound levels occurred at 10:00 am and lasted for 20 minutes. During this time, the wind turbines were at less than 20% of capacity. The pattern of this event coupled with the small turbine output indicates that this was not likely from the wind turbines.

2) December 20 – At 3:30 pm an increase of about 25 dBA occurred in the L90, followed by an immediate drop by about 25 dBA. During this time, the wind turbines were operating at close to 0% power output. This pattern indicates the exceedence was not a result of wind farm operations.

3) December 22 – At 10:00 am, an increase in sound levels by 10 dB over 20 minutes, followed by a decrease by 10 dB was found. While the wind turbines were operating at close to capacity, they did not change during this period. Given the sharp rise and fall in sound levels, this pattern is not indicative of wind turbine operations.

4) December 24 – Between 7:30 pm and 7:30 am the following day, 9 ten-minute L90s exceeded 45 dBA. This was during a period of rain. While the turbines were operating at nearly 100% power output, the rain droplets hitting the microphone windscreen and surrounding vegetation would have increased the registered sound during this period. As a result, this exceedence of 45 dBA is not likely a result of wind farm operations.

5) December 30 – Between 11:25 am and 12:25 pm, there were periods exceeding 45 dBA. The wind turbines were operating near 100% and the weather data indicated a period of melting snow. Wind turbines may have contributed to higher sound levels during this period.

6) December 31 – Between 6:00 pm on December 31 and 4:00 am on January 1, 28 ten-minute periods exceeded 45 dBA. This period included both increased background and wind turbine sound, along with high wind turbine power output. Recordings made during this period indicate wet roads, local wind effects, and wind turbines all contributed to the monitored sound levels.

During the summer, there were eight periods that exceeded 45 dBA. Each of these events coincided with turbine output at or close to 0%. As a result, the wind farm did not significantly contribute to measured sound levels during the summer monitoring.

9.4 Position 4 – Pillsbury State Park

The sound level monitor at Position 4, Pillsbury State Park, was affected significantly by traffic along NH Route 31. This shows up especially in the L90 and Leq declining with wind speed during the summer monitoring (Figure 15). The L90 data show that summer and winter sound levels at the critical 7 m/s wind speed is about 35 dBA. This is confirmed by RSG's observations during both winter and summer site visits, where the wind turbines were either inaudible, or at a low level of audibility.

9.5 Position 5 – Goshen Lempster School

Position 5 is the roof of the Goshen Lempster School. The wind turbines were not audible during any of the site visits. While the regression result showed that turbine ninetieth percentile sound levels were about 29 dBA during the winter and 36 dBA during the summer at this location during a 7 m/s wind event (Figure 16), the patterns in the raw data and on-site observations indicate that these increases in sound from the pre-construction to post-construction period were due to factors other than the wind turbines.

Short-term monitoring was also conducted inside of the teachers' lounge during eight site visits both with the school in and out of session. The wind turbines were not audible at any time, even when interior levels were as low as 20 dBA.

9.6 Position 6 – Nichols Rd. at School St.

RSG's did not observe wind turbine sounds at this location during any of the winter or summer site visits. This may be due to the fact that the site is generally upwind and almost one mile from the closest turbine. The regression results show ninetieth percentile turbine sound levels at or less than 30 dBA at the critical wind speed of 7 m/s. The background sound dominates the perceived noise in this area and effectively masks the wind turbine sound, especially at higher wind speeds.

10.0 Noise Complaints

Iberdrola has set up a noise hotline, whose phone number is posted in the Lempster Town Hall. The Town can also receive complaints from affected residences. Iberdrola has provided the Town with a sound level meter with which they can investigate noise complaints.

According to Iberdrola records, no complaints have been filed with the Town, and two calls have been made to the hotline since operations began at the wind farm:

- August 2009 – A complaint was lodged with Iberdrola from a resident about 1 mile from the wind farm. The follow-up investigation found that there was a problem with the resident's hearing aid and there was no noise from the wind farm.
- September 2009 – An informational call was made to the noise hotline from a resident on Guildford Dr. to report that the wind farm noise was noticeable at times. No complaint was filed.

11.0 CONCLUSIONS

Post-construction sound monitoring was conducted at six locations around the Lempster Wind Project in Lempster, NH during the winter of 2008/2009 and the summer of 2009. The post-construction measurements were compared with pre-construction monitoring that took place during identical periods during the winter of 2007/2008 and the summer of 2007.

Our conclusions are as follows:

7) At Position 1 (Guilford Road), sound levels at this participating household are affected by the wind turbines, with a winter ninetieth percentile level of 35 at the critical wind speed of 7 m/s and remaining at or below 45 dBA at higher wind speeds. Looking at the raw data, unadjusted to account for background noise, 9% of the ten-minute L90s exceeded 45 dBA during the winter and 0.2% exceeded 45 dBA during the summer.

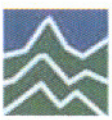
8) At Position 2 (Nichols Road), turbine sound levels during the winter and summer are at or below 40 dBA for all wind speeds.

9) At Position 3 (Maplewood Ave), given its proximity to the wind turbines and the fact that the wind turbines were audible, the sound levels are affected to some extent by the wind farm. The ninetieth percentile sound level from the wind turbine is 35 dBA at the critical wind speed of 7 m/s. Further work was done at this location to identify and analyze periods which exceeded 45 dBA. Of the 16 distinct periods which had exceedences of 45 dBA during the winter and summer, only two had conditions for which the wind turbines may have substantively contributed. The remaining were likely due to other man-made and natural sounds.

10) At Position 4 (Pillsbury State Park), the wind turbines do not significantly affect sound levels. While the wind turbines are audible at times, ninetieth percentile sound levels are below 40 dBA at all wind speeds.

11) At Position 5 (Goshen Lempster School), the wind turbines do not significantly affect sound levels either inside or outside the school. The school is over a mile away and generally upwind of the turbines. The turbines were inaudible during all eight site visits there and regressions of the long-term monitors show ninetieth percentile levels below 40 dBA for all wind speeds.

12) At Position 6 (Nichols Road opposite School Road), the wind turbines do not significantly affect sound levels. The site is 5,200 feet from the closest turbine and upwind relative to the prevailing winds. The turbines were inaudible during each of eight site visits. Regression results of the long term data show that ninetieth percentile sound levels were below 30 dBA during all wind speeds.



Appendix A-1: Winter Results

Sound level monitoring results are provided in two series of charts. The first series (Figure 1 through Figure 7) shows the 10-minute L90 and Leq with the percent power output from the wind farm. The results for each site are provided in three charts with each chart representing a one week time period. These charts are shaded to show daytime and nighttime.

The second series of charts (Figure 8 through Figure 19) show regression analysis results of the 10 minute L90 and Leq plotted against wind speed. These results are compared to the winter 2007 regression analysis prepared by Hessler Associates for the pre-construction period.[1] Note Hessler study prepared a single regression analysis for all of the sites in the study area.[2] That is, it assumed ridge-top wind speeds are identically related to sound levels at each location in the study area. This is not a valid assumption to make for this type of study, due to differing distances between each wind turbines and each site. Therefore, we compared our results for each site to the regression line from the winter 2007 survey for *all* sites combined.

[1] "Environmental Sound Survey, Wintertime Conditions: Lempster Mountain Wind Power Project," Prepared for Lempster Wind LLC by Hessler Associates, Inc, Report No 1800-022808-A, March 19, 2008.

[2] More specifically, for the winter 2007 measurements, only sites 1, 3, 4, and 5 were included in the overall regression analysis. Sites 2 and 6 had equipment problems and were excluded.

Figure 1: Ten Minute Leq and L90 at Position 1 Compared with Average Percent of Total Turbine Power Output

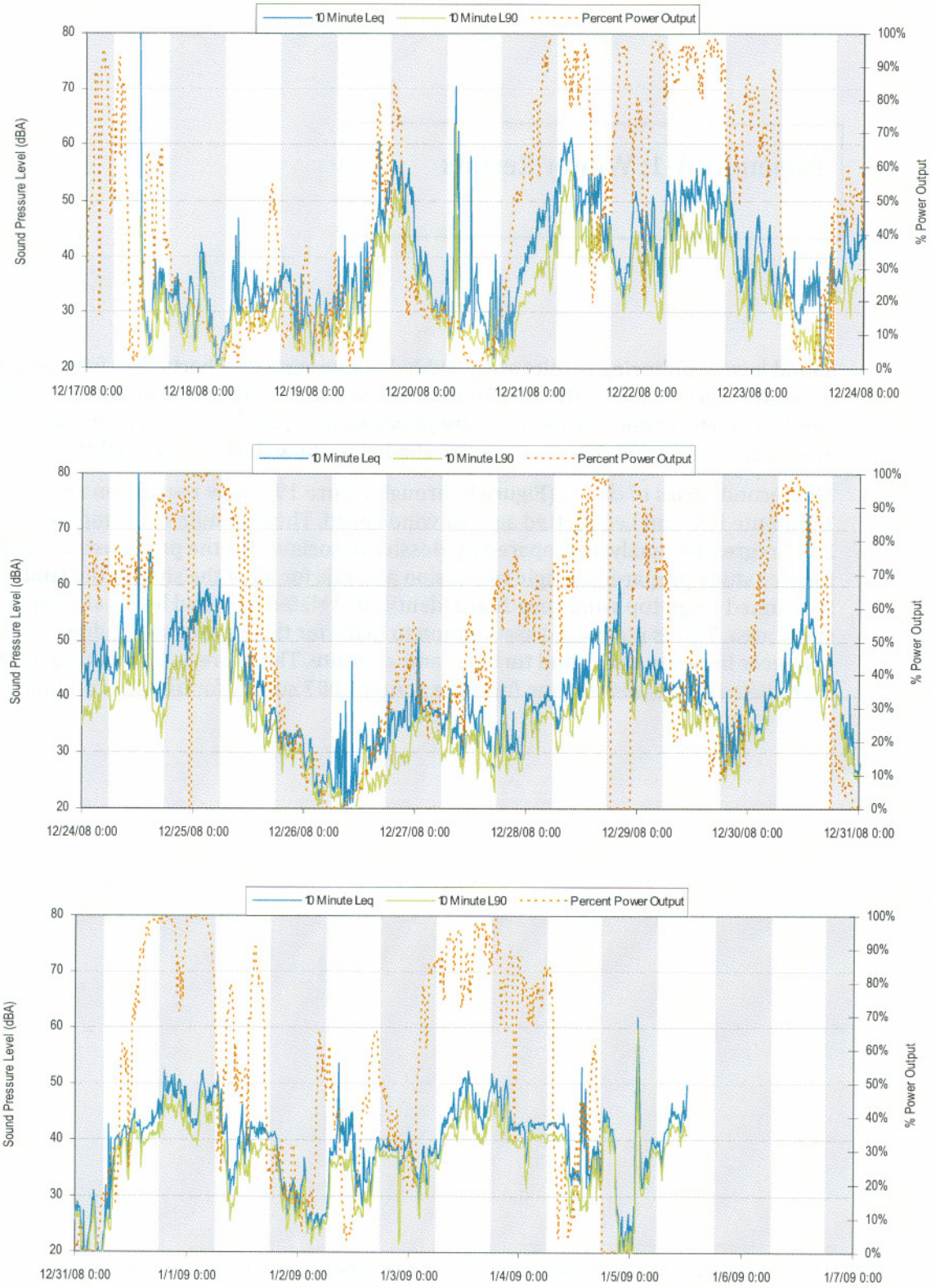


Figure 2: Ten Minute Leq and L90 at Position 2 Compared with Average Percent of Total Turbine Power Output

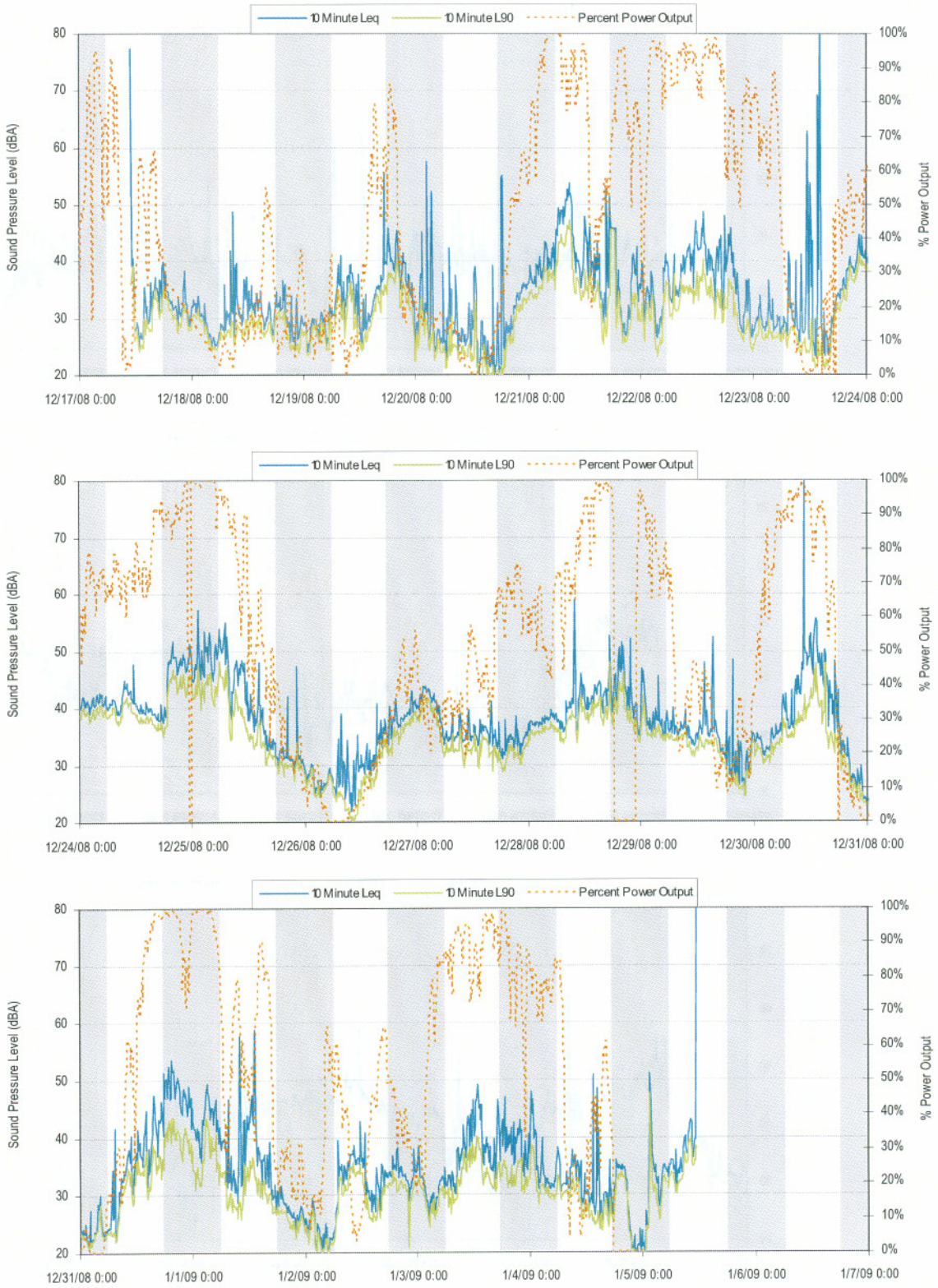


Figure 3: Ten Minute Leq and L90 at Position 3 Compared with Average Percent of Total Turbine Power Output

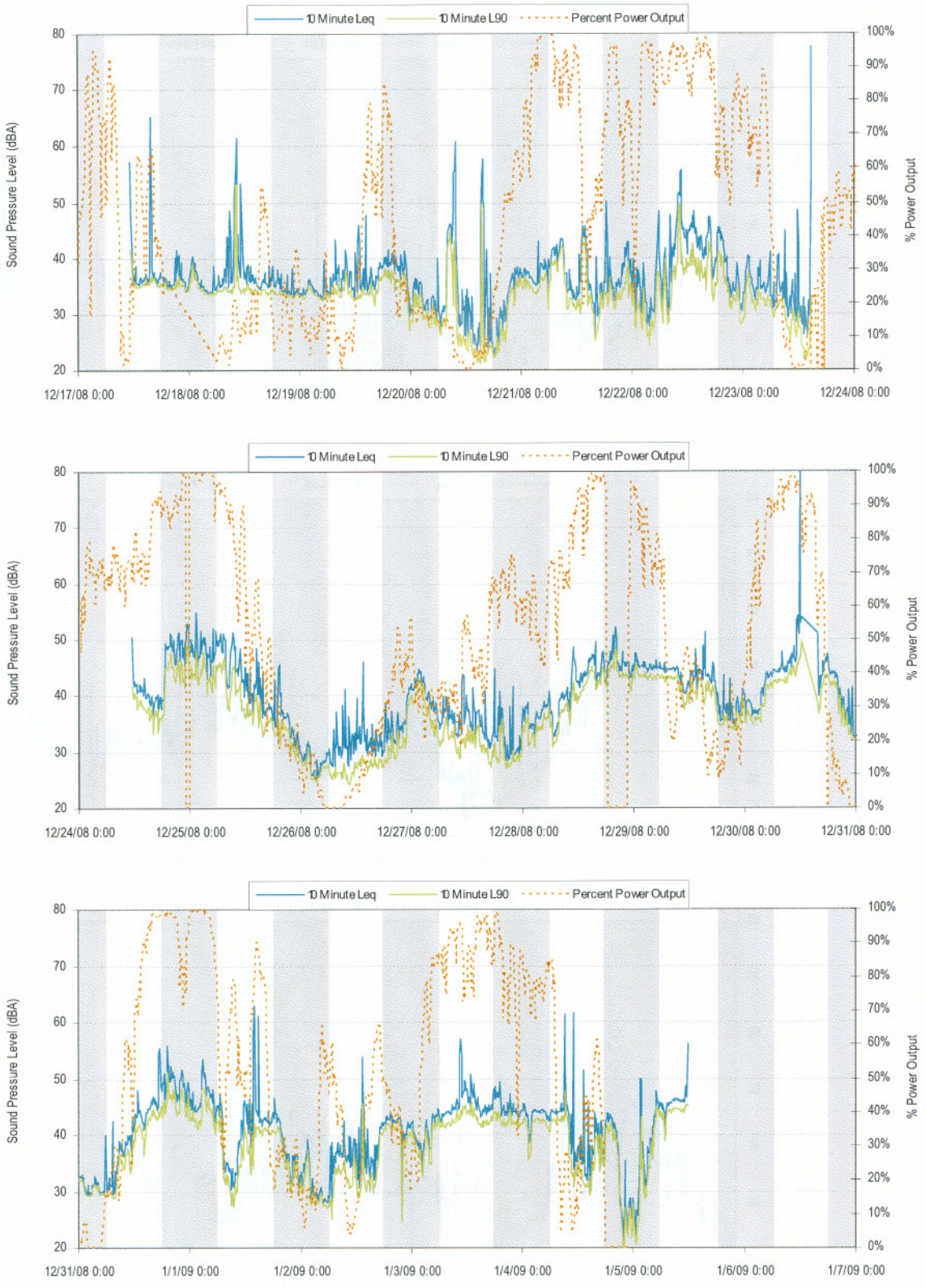


Figure 4: Ten Minute Leq and L90 at Position 4 Compared with Average Percent of Total Turbine Power Output

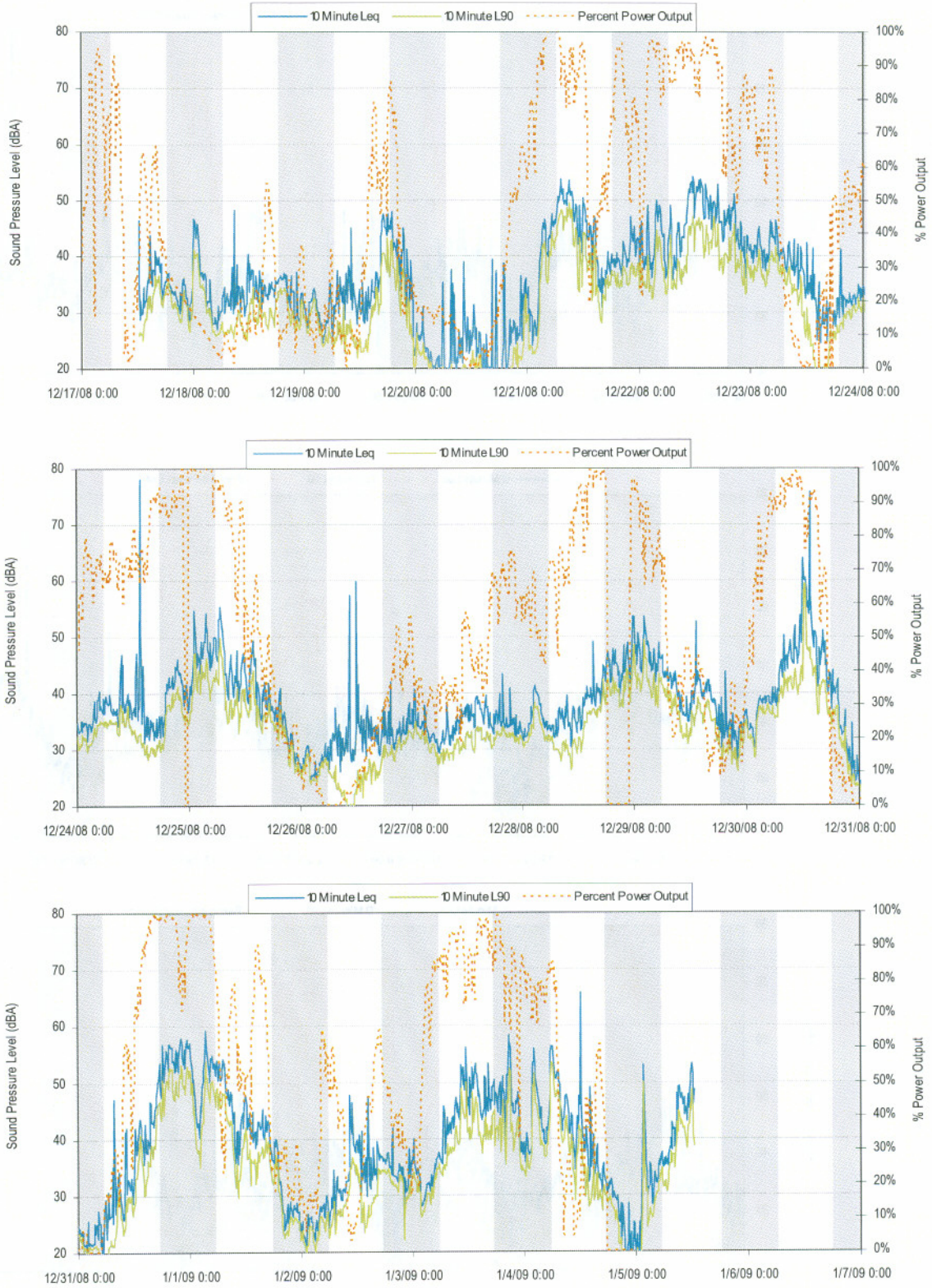


Figure 5: Ten Minute Leq and L90 at Position 5 Compared with Average Percent of Total Turbine Power Output

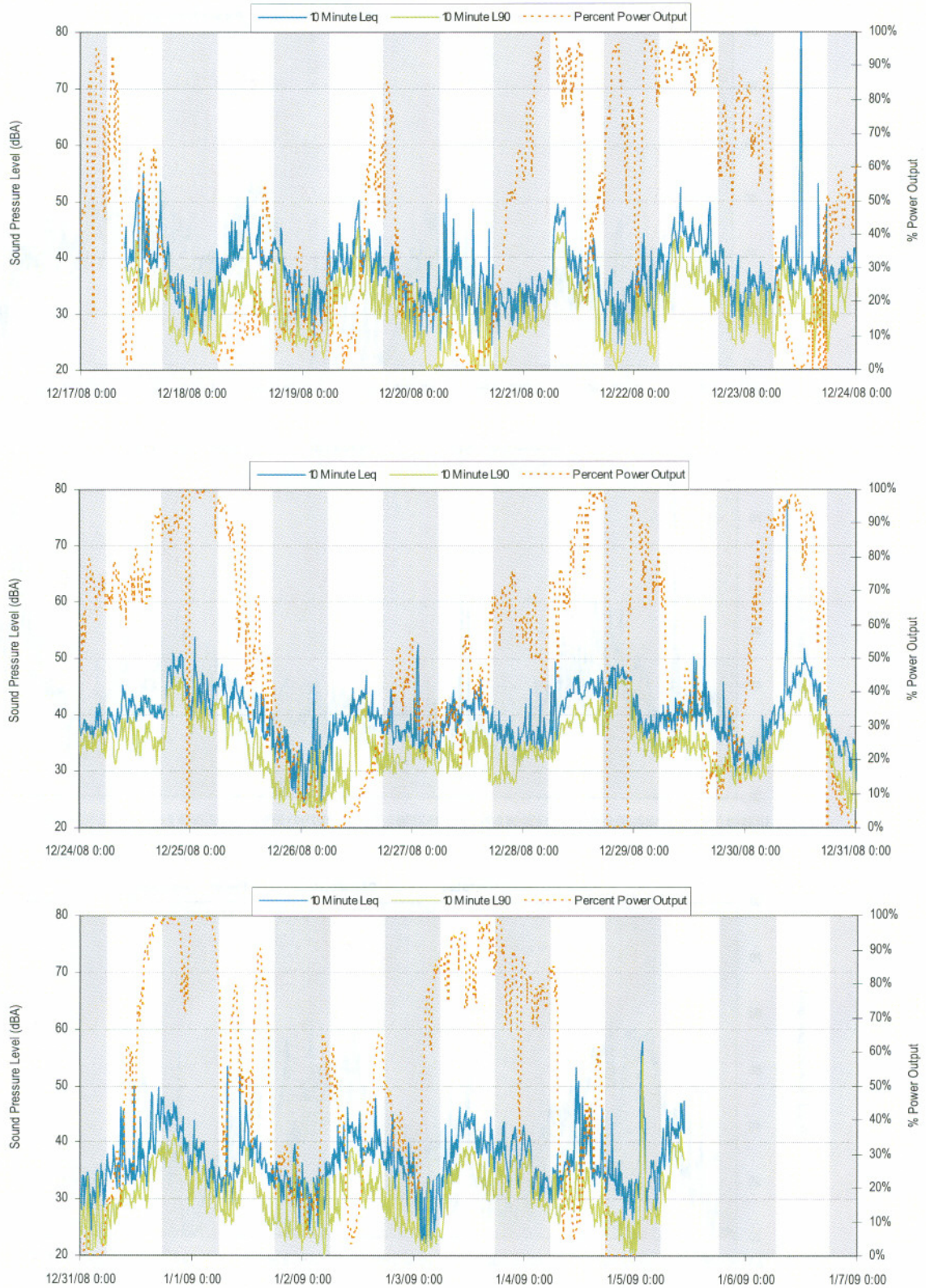
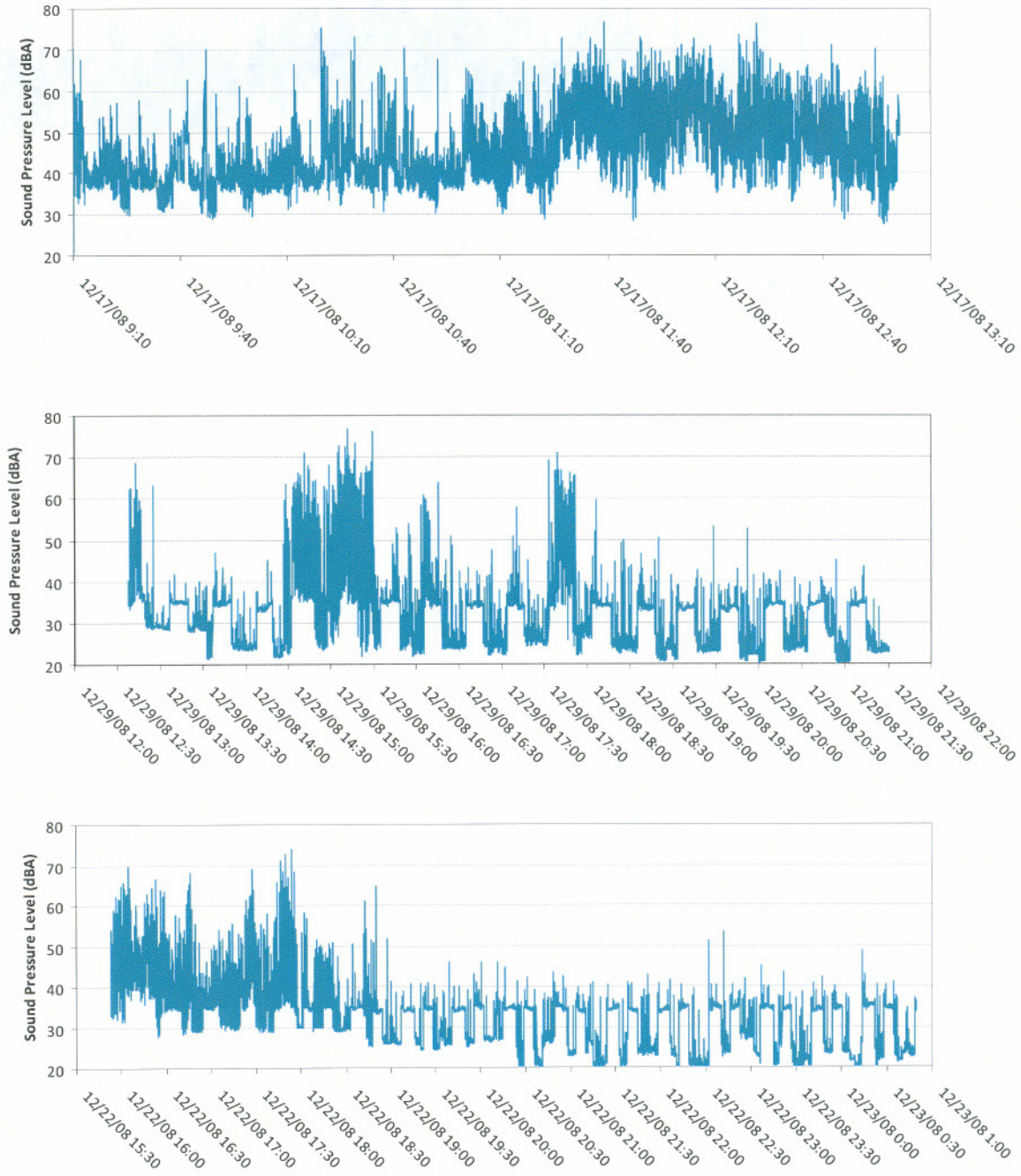


Figure 6: 1-sec Leq Inside Teacher's Lounge at the Goshen Lempster School



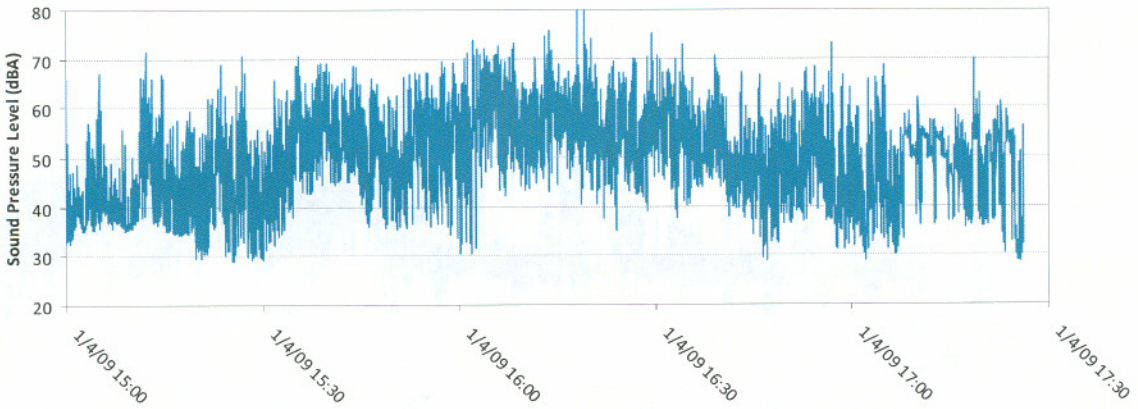

Sound Pressure Level (dBA)
80
70
60
50
40
30
20
1/4/09 15:00
1/4/09 15:30
1/4/09 16:00
1/4/09 16:30
1/4/09 17:00
1/4/09 17:30

Figure 7: Ten Minute Leq and L90 at Position 6 Compared with Average Percent of Total Turbine Power Output

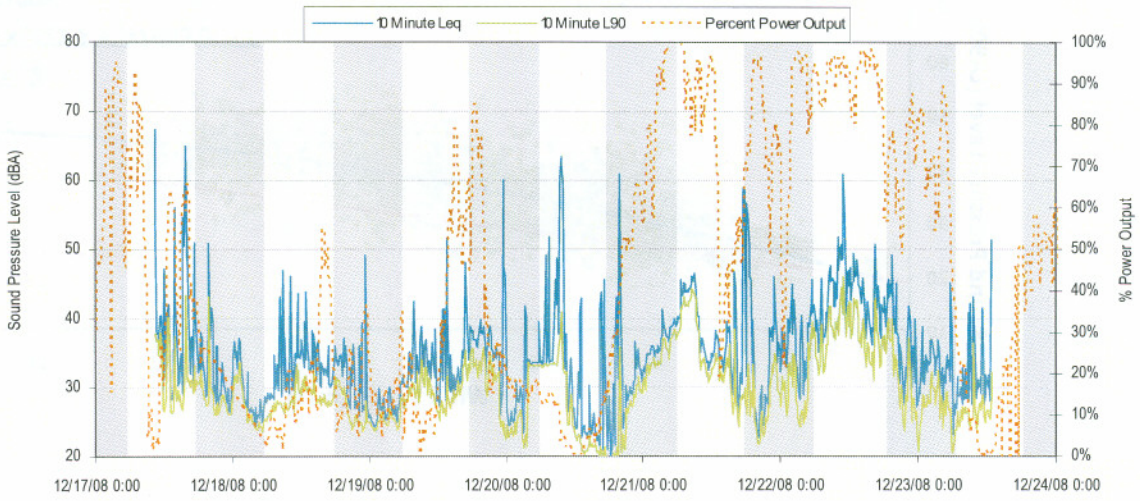


Figure 8: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 1

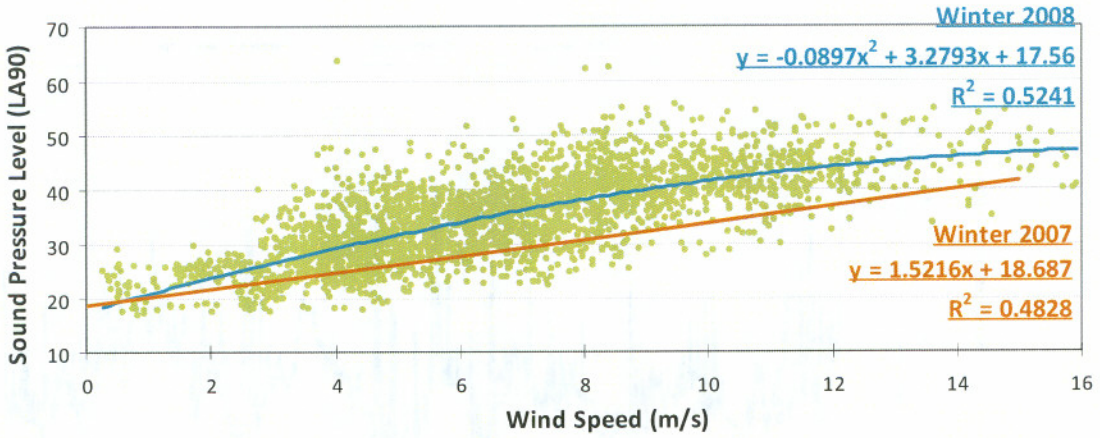


Figure 9: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 1

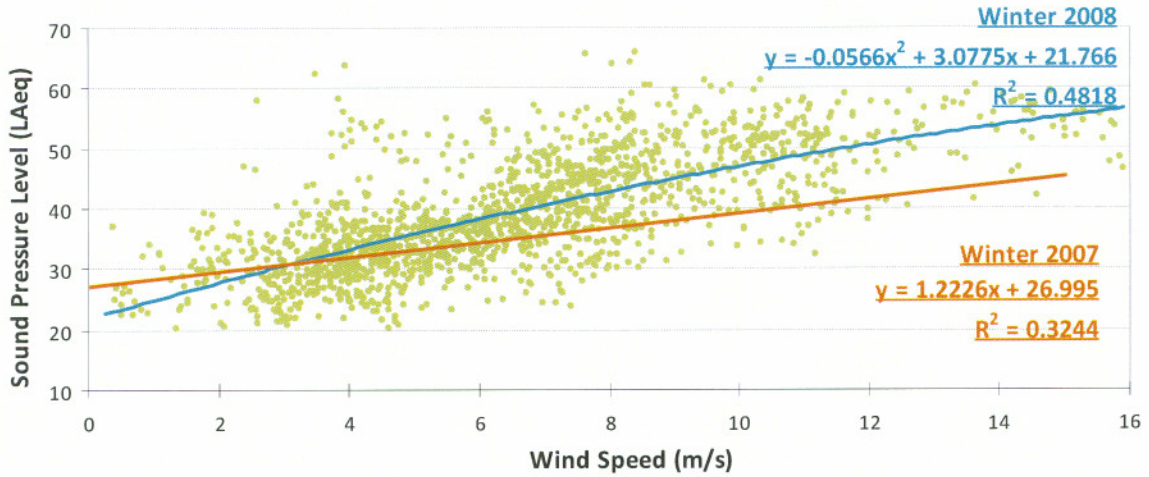


Figure 10: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 2

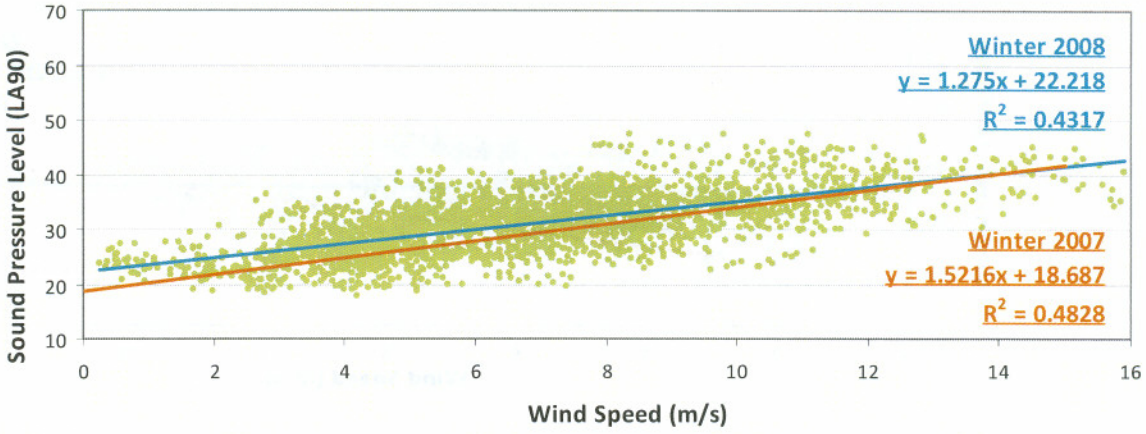


Figure 11: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 2

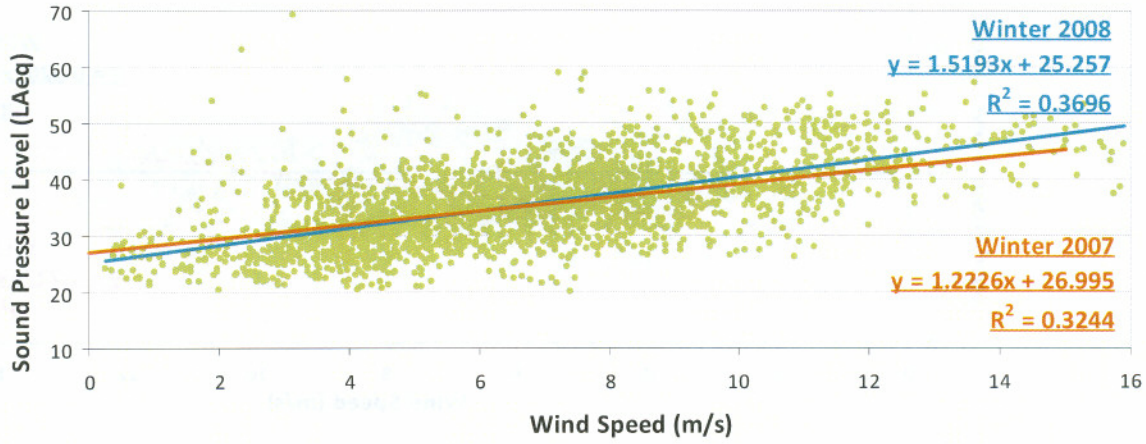


Figure 12: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 3

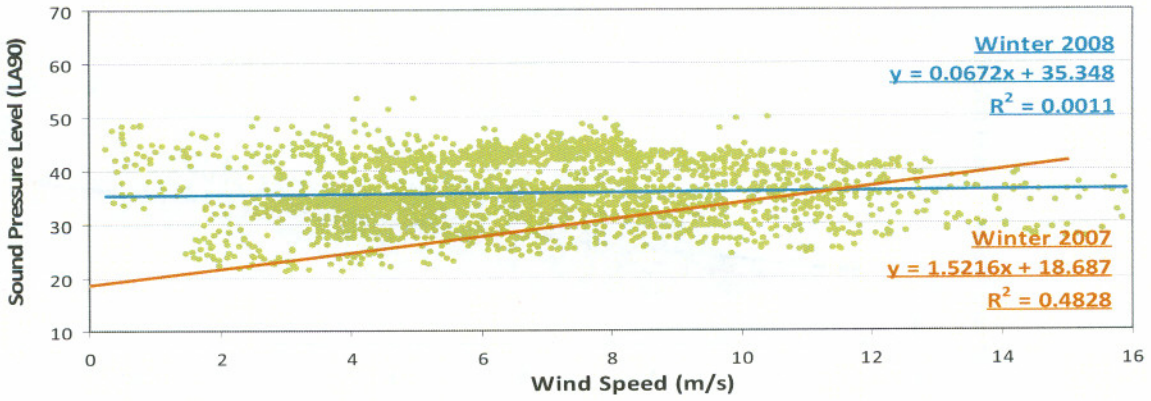


Figure 13: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 3

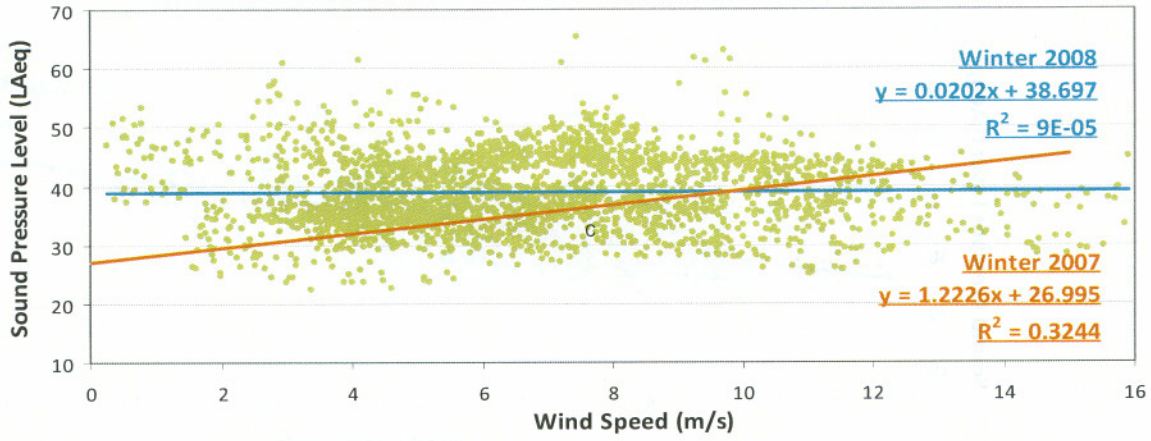


Figure 14: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 4

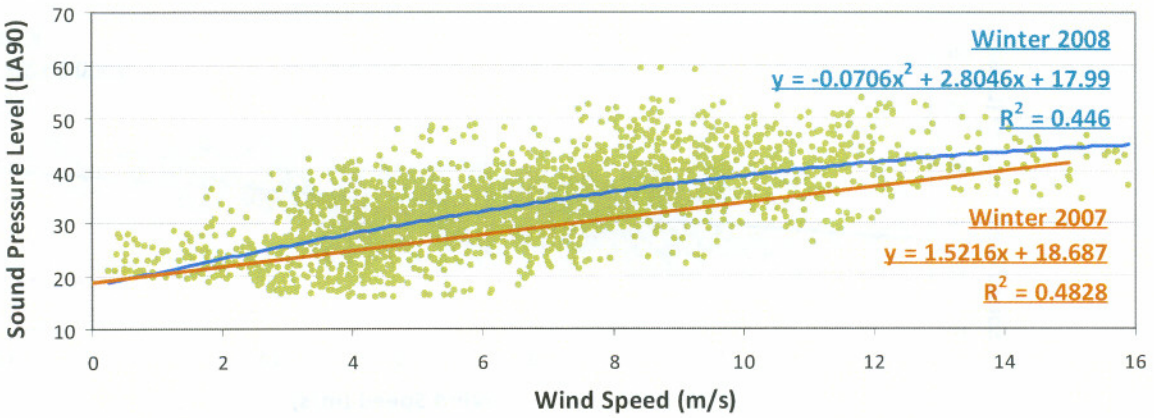


Figure 15: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 4

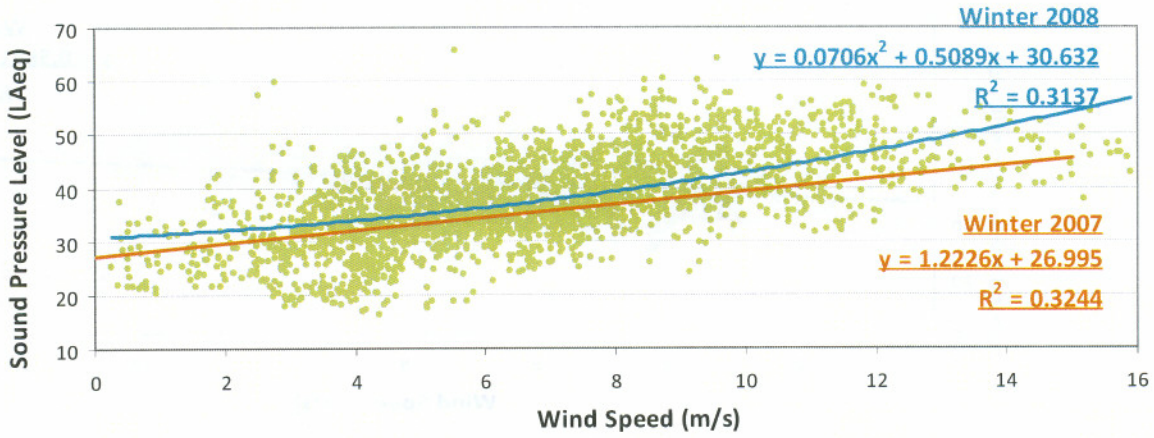


Figure 16: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 5

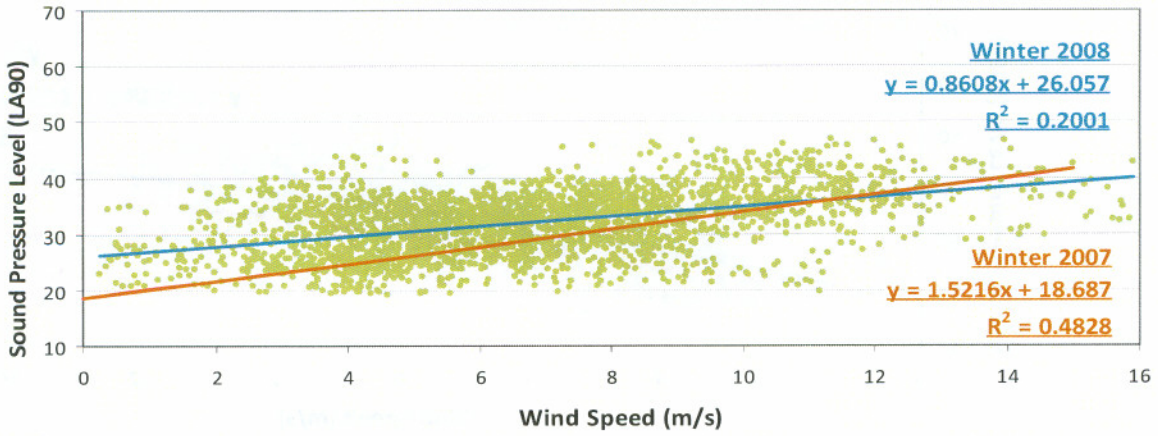


Figure 17: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 5

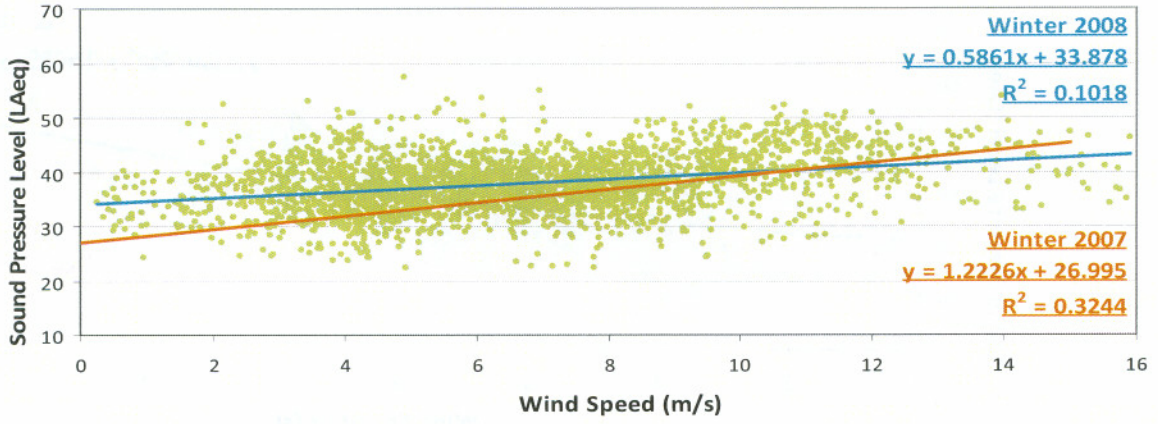


Figure 18: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 6

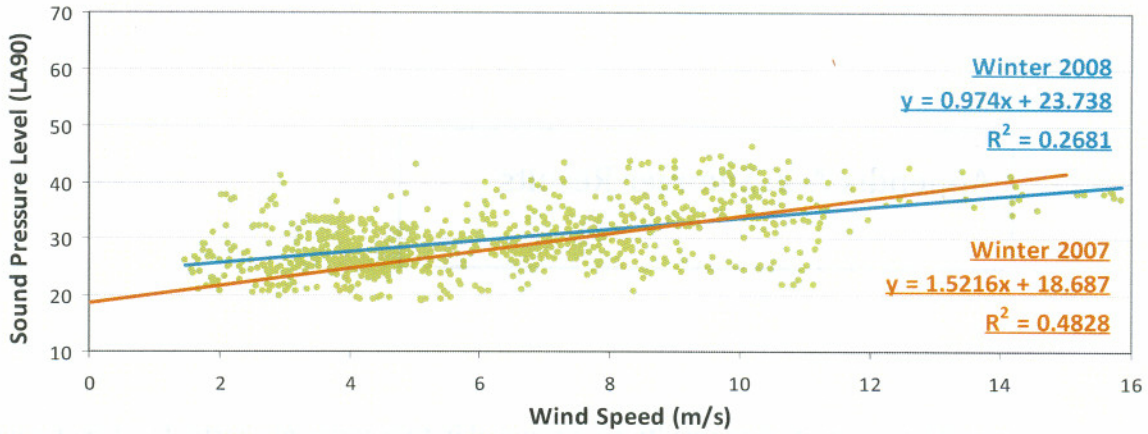
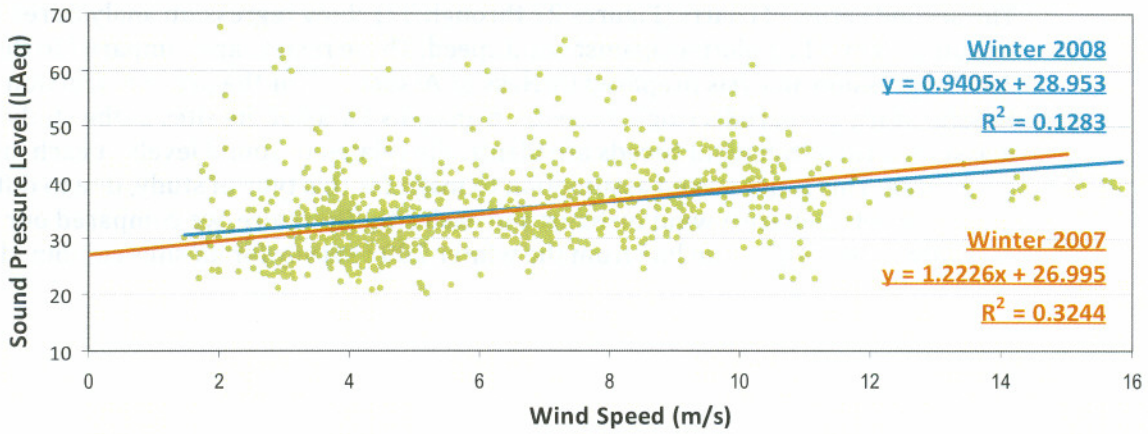


Figure 19: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 6



Appendix A-2: Summer Results

Sound level monitoring results are provided in two series of charts. The first series (Figures 20 through 26) shows the 10-minute L90 and Leq with the percent power output from the wind farm. The results for each site are provided in three charts with each chart representing a one week time period. These charts are shaded to show daytime and nighttime.

The second series of charts (Figures 27 through 37) show regression analysis results of the 10 minute L90 and Leq plotted against wind speed. These results are compared to the summer 2007 regression analysis prepared by Hessler Associates for the pre-construction period.[1] Note Hessler study prepared a single regression analysis for all of the sites in the study area.[2] That is, it assumed ridge-top wind speeds are identically related to sound levels at each location in the study area. This is not a valid assumption to make for this type of study, due to differing distances between each wind turbines and each site. Therefore, we compared our results for each site to the regression line from the winter 2007 survey for *all* sites combined.

[1] "Environmental Sound Survey, Summertime Conditions: Lempster Mountain Wind Power Project," Prepared for Lempster Wind LLC by Hessler Associates, Inc, Report No 1800-091207-0, September 17, 2007.

[2] The winter 2007 measurements included all sites in the overall regression analysis.

Figure 20: Ten Minute Leq and L90 at Position 1 Compared with Average Percent of Total Turbine Power Output

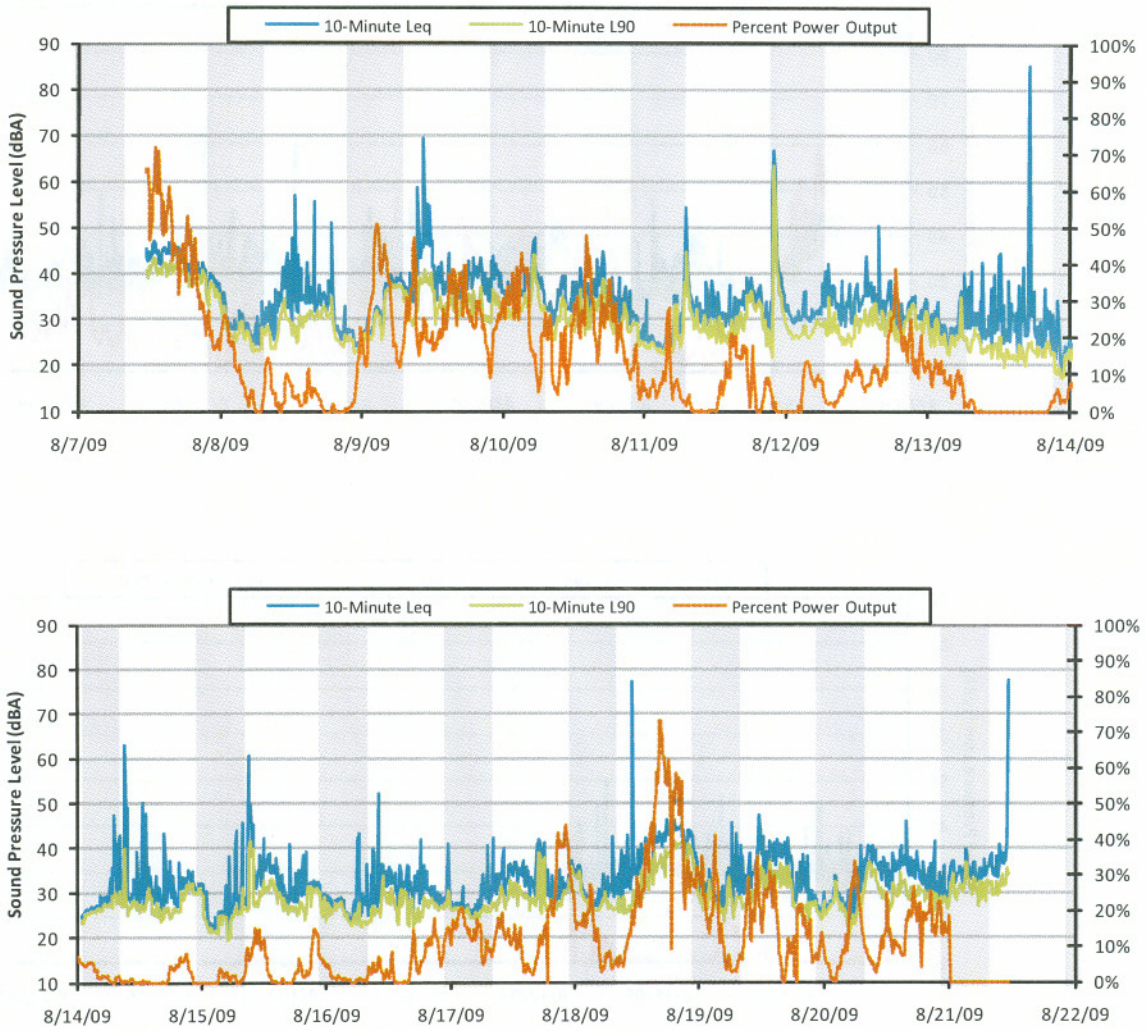


Figure 21: Ten Minute Leq and L90 at Position 2 Compared with Average Percent of Total Turbine Power Output

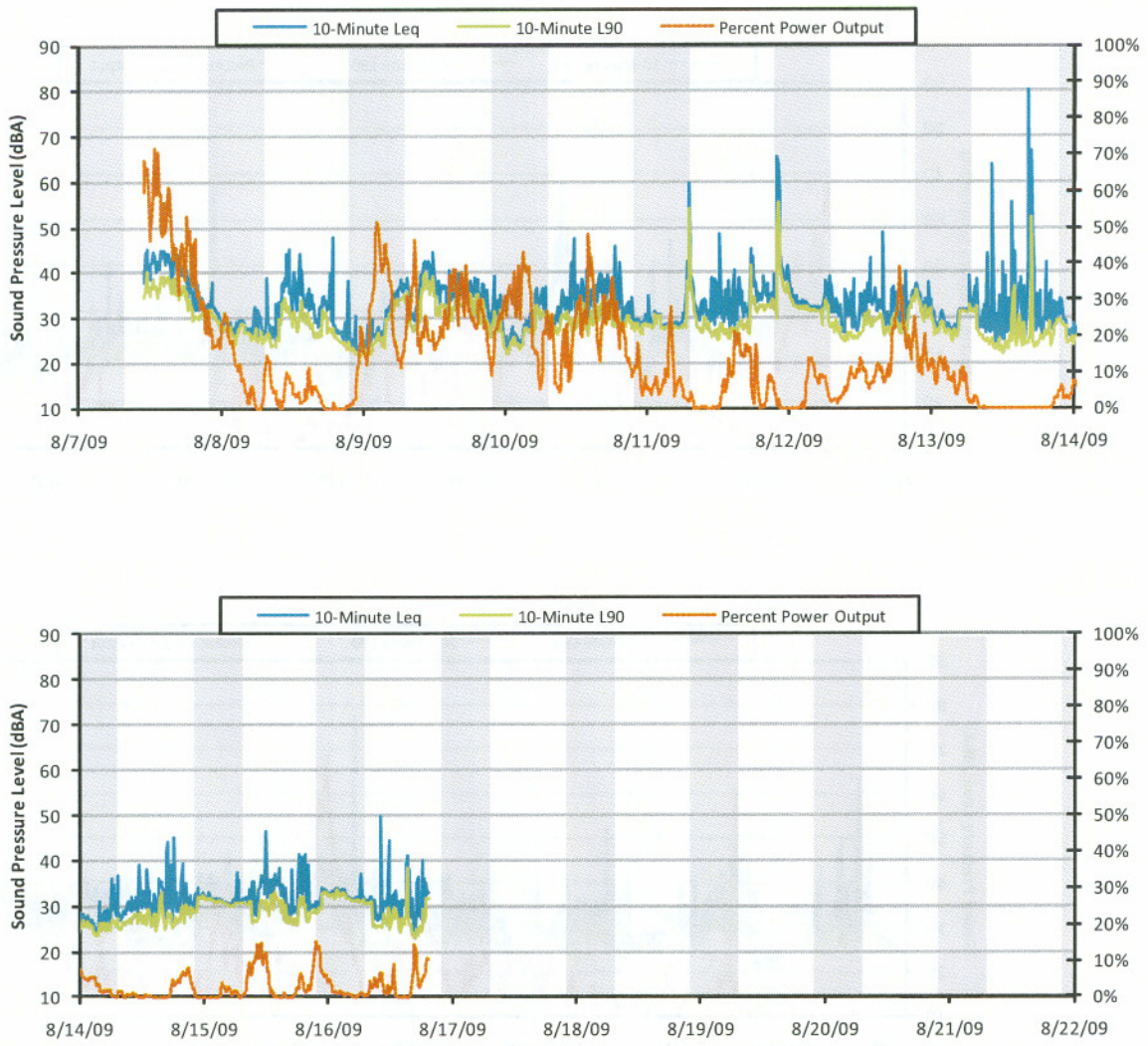


Figure 22: Ten Minute Leq and L90 at Position 3 Compared with Average Percent of Total Turbine Power Output

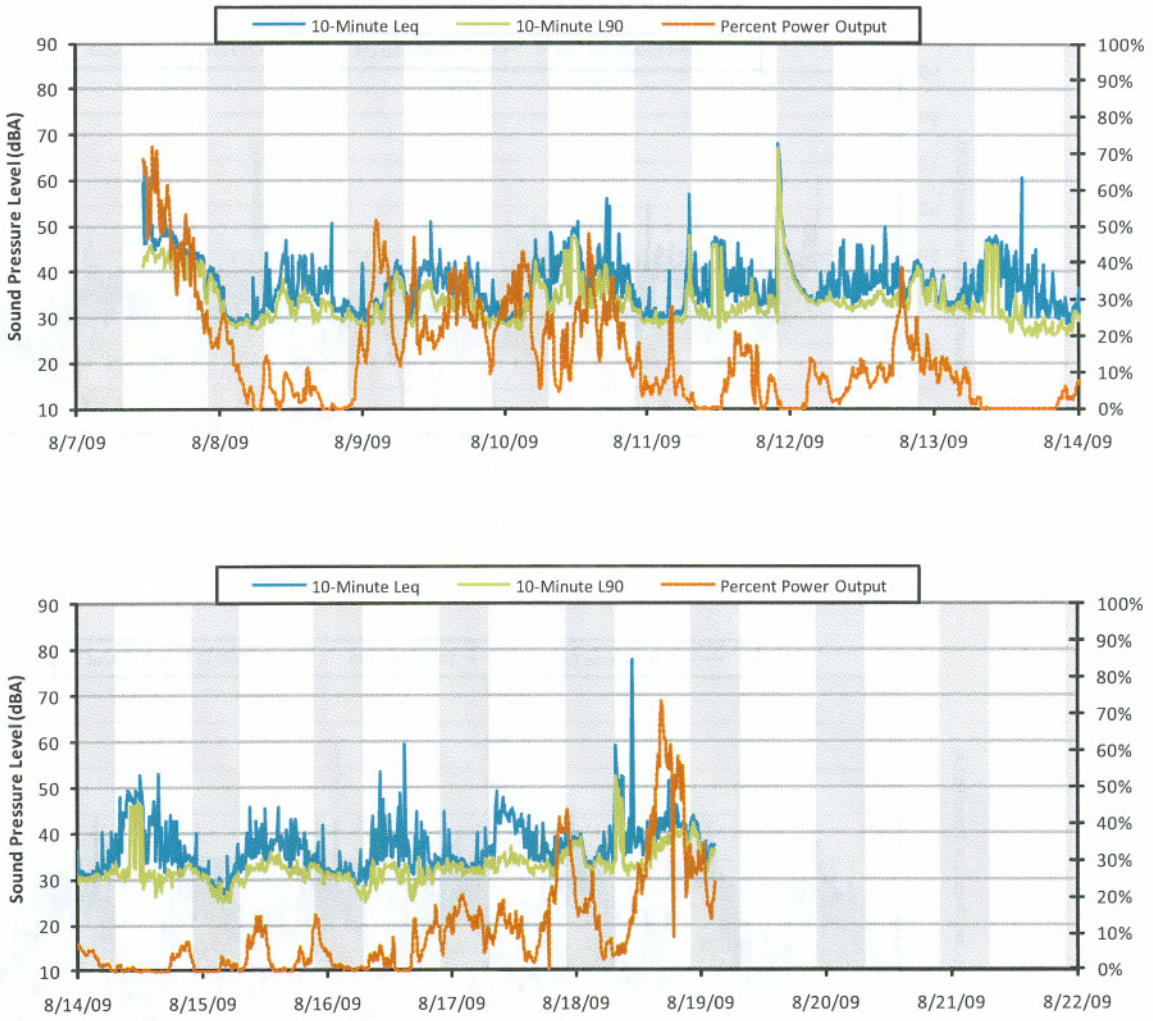


Figure 23: Ten Minute Leq and L90 at Position 4 Compared with Average Percent of Total Turbine Power Output

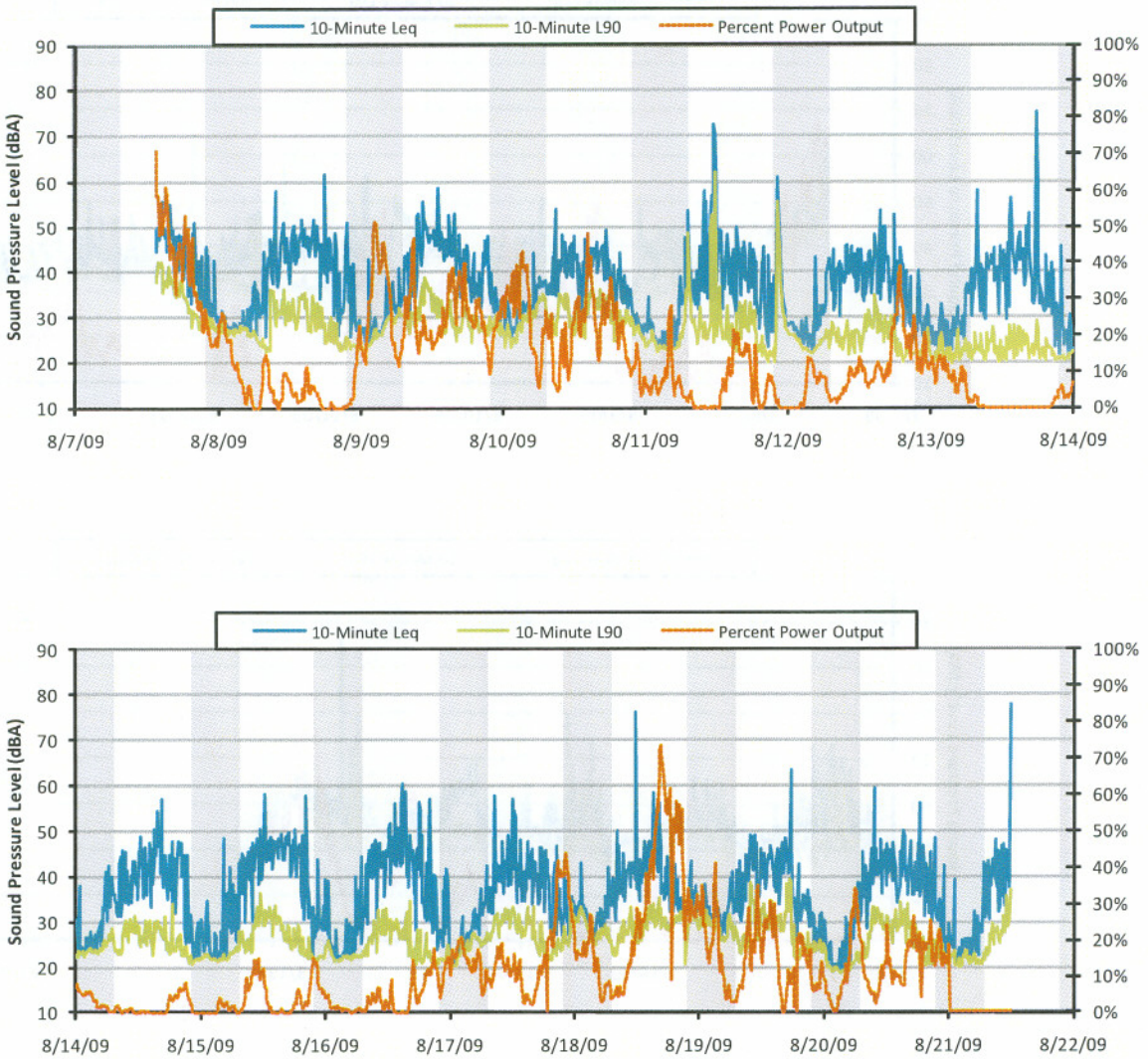


Figure 24: Ten Minute Leq and L90 at Position 5 Compared with Average Percent of Total Turbine Power Output

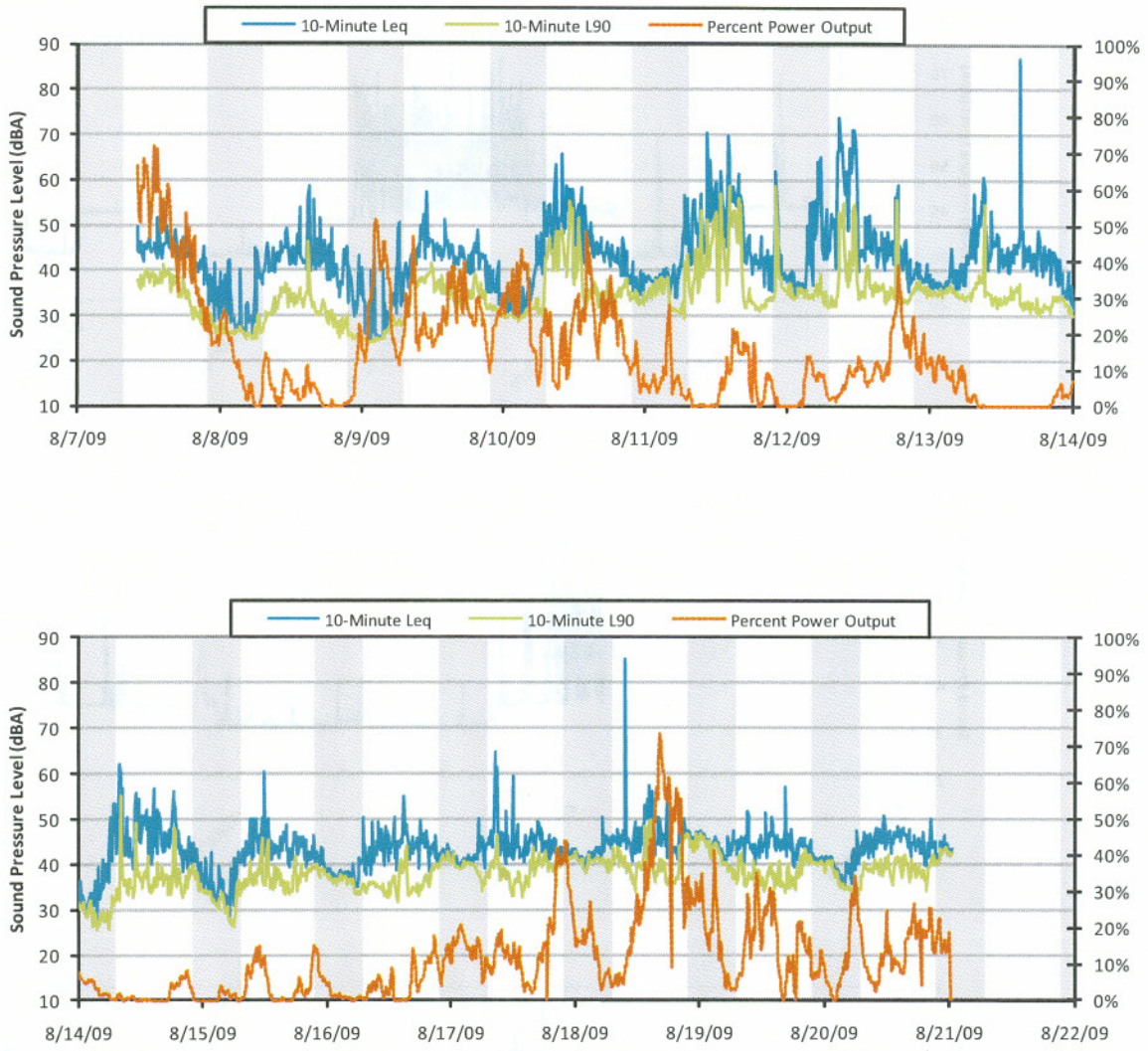
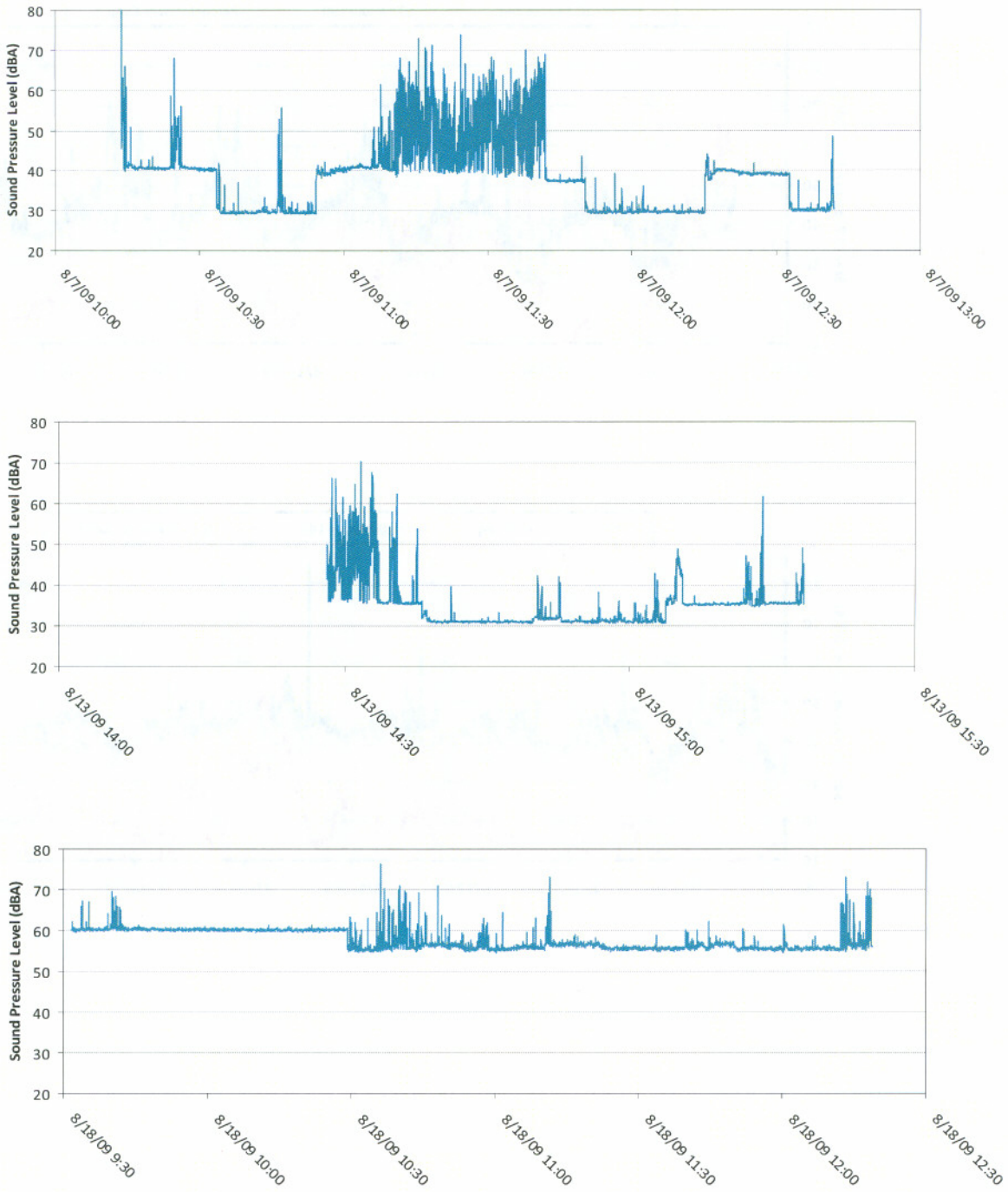


Figure 25: 1-sec Leq Inside Teacher's Lounge at the Goshen Lempster School



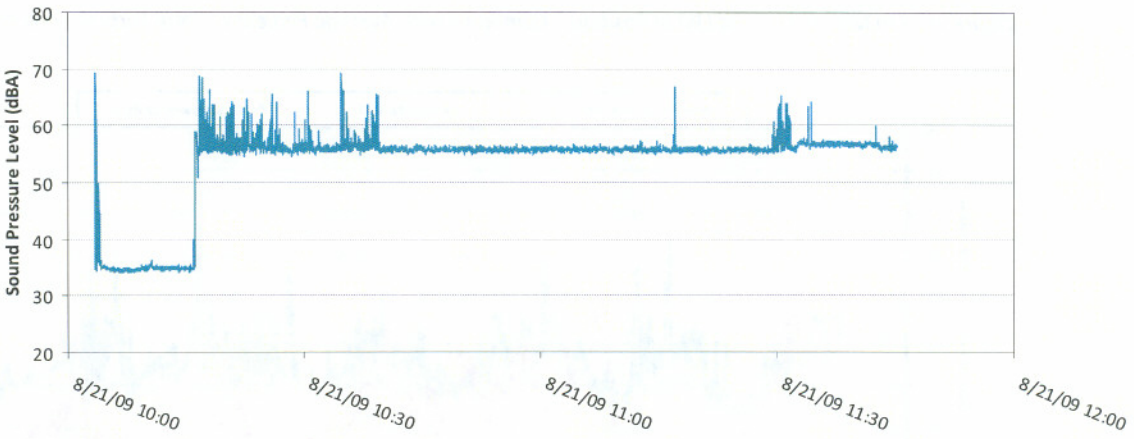

Sound Pressure Level (dBA)
80
70
60
50
40
30
20
8/21/09 10:00
8/21/09 10:30
8/21/09 11:00
8/21/09 11:30
8/21/09 12:00

Figure 26: Ten Minute Leq and L90 at Position 6 Compared with Average Percent of Total Turbine Power Output

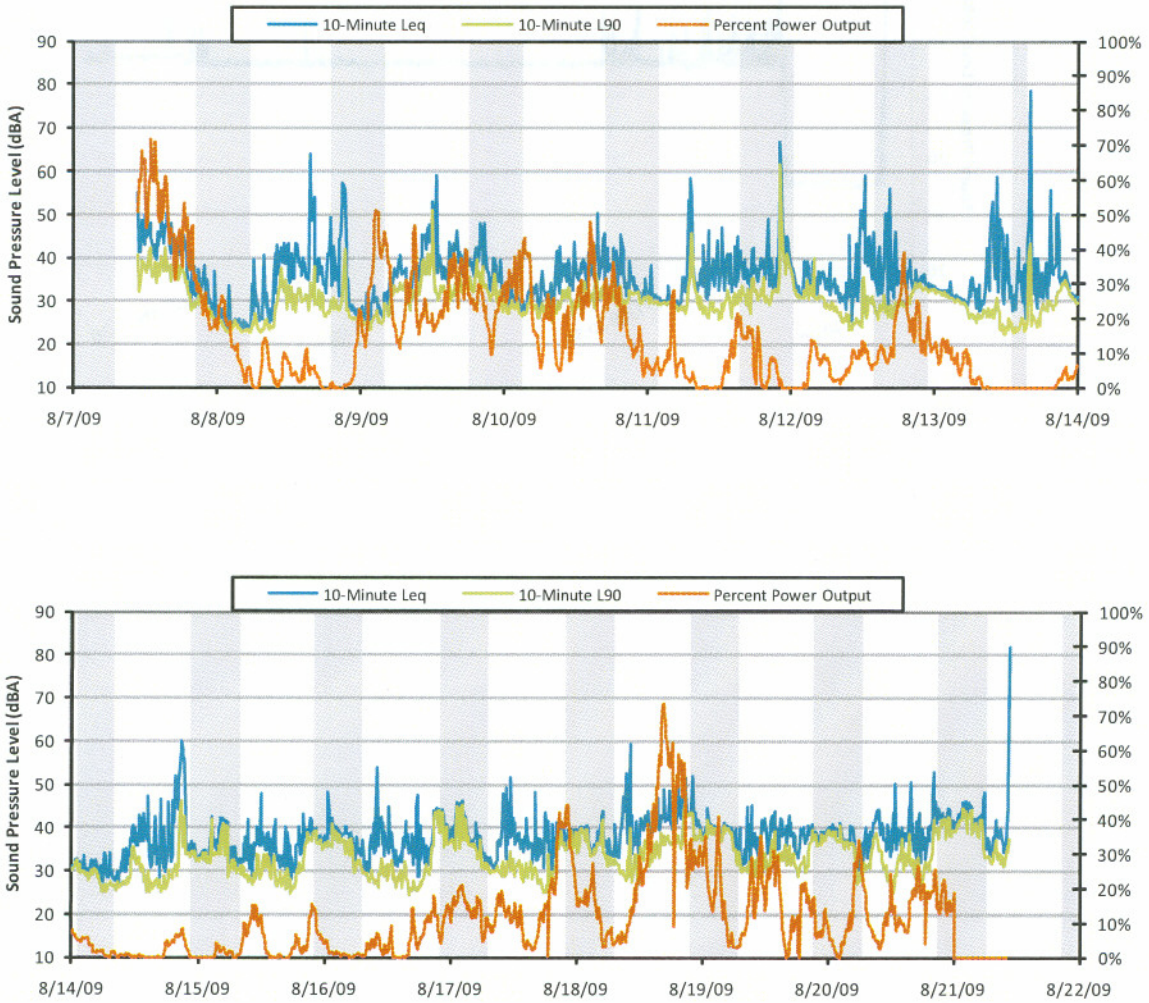


Figure 27: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 1

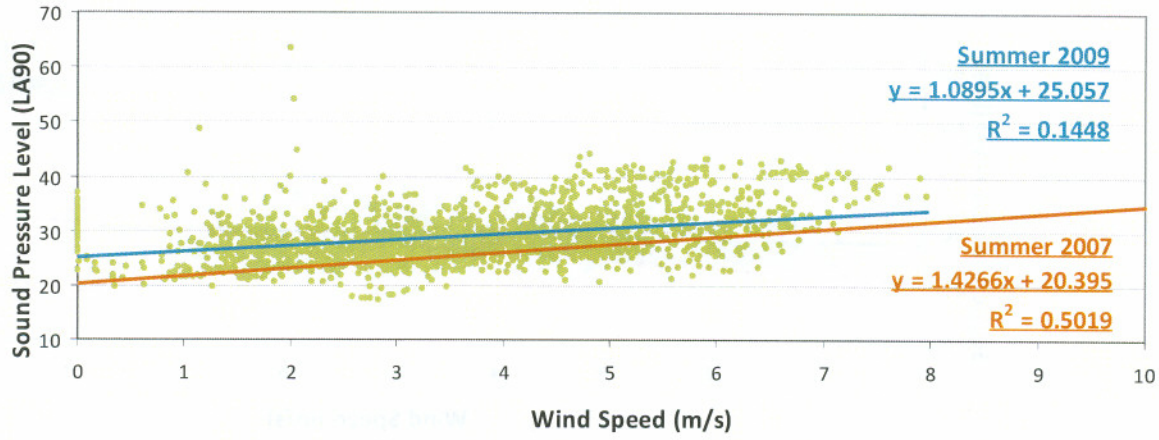


Figure 28: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 1

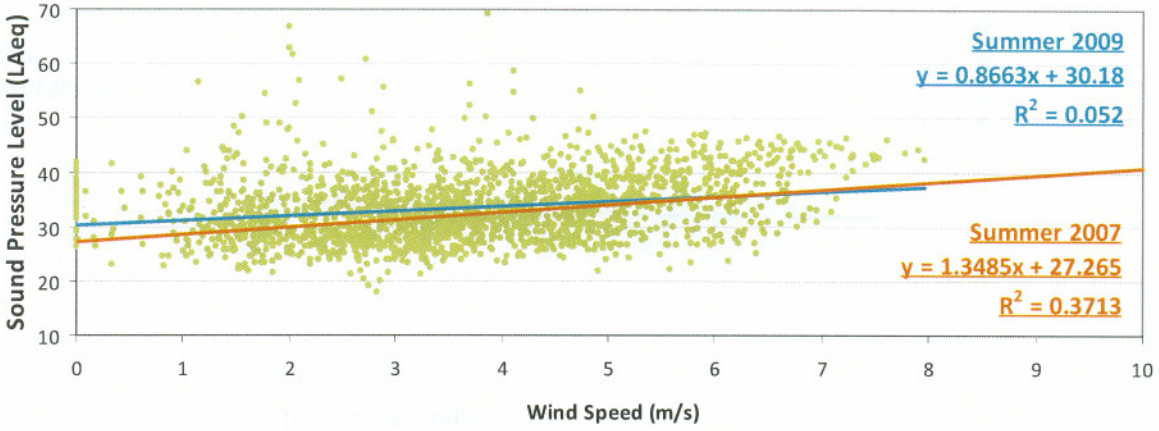


Figure 29: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 2

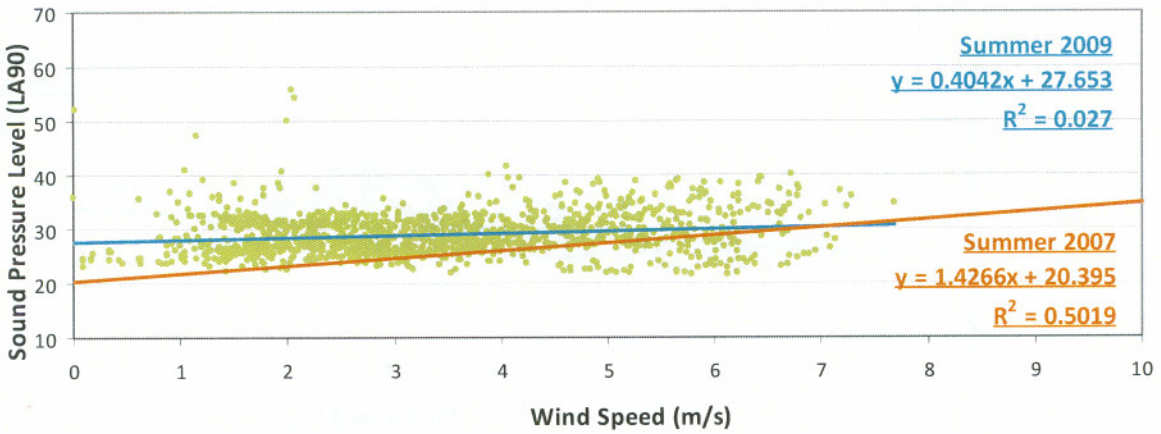


Figure 30: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 2

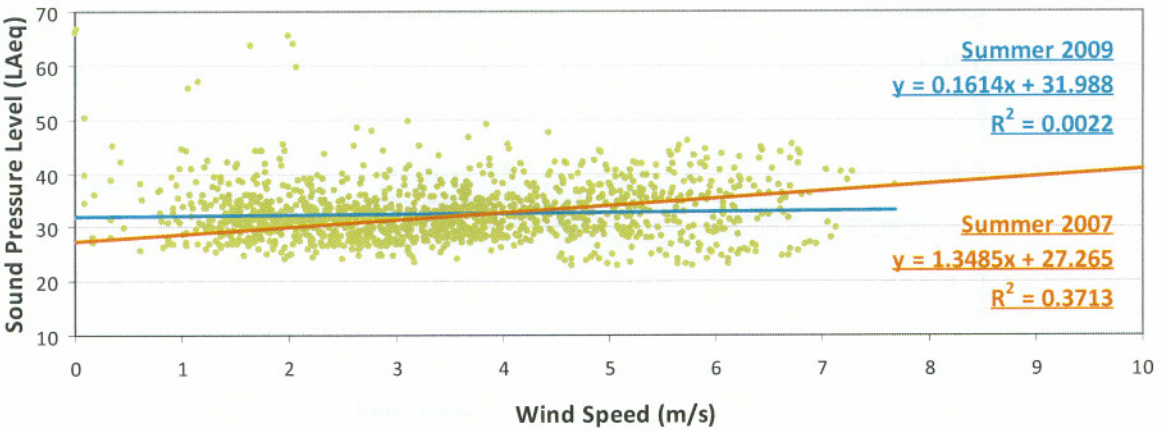


Figure 31: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 3

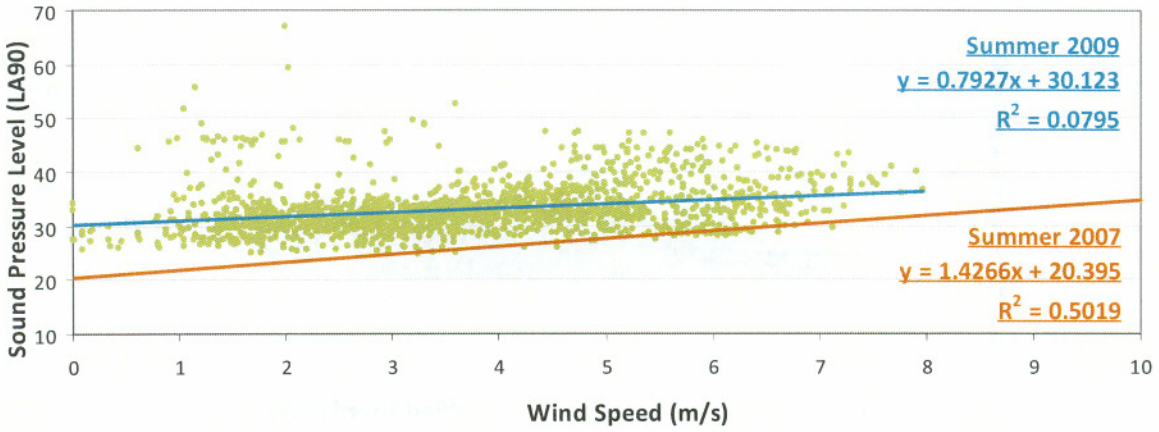


Figure 32: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 3

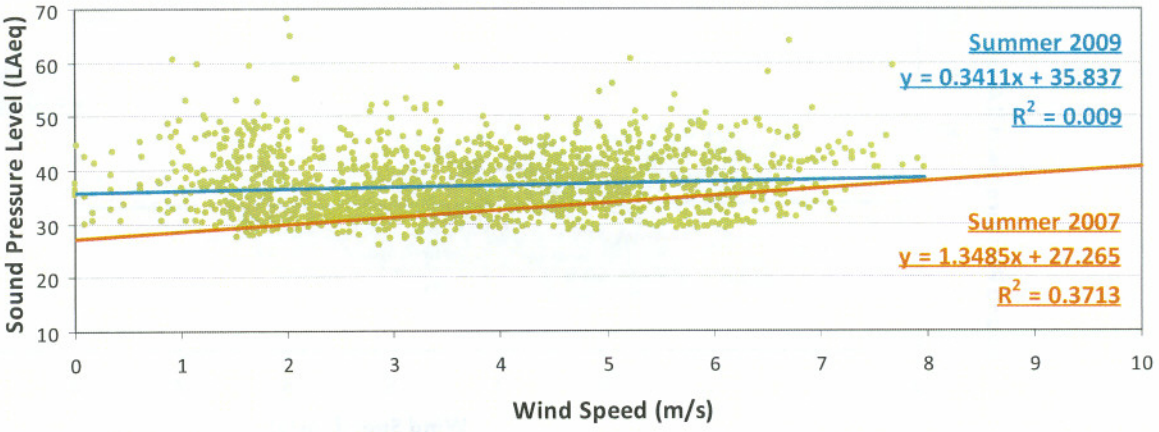


Figure 33: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 4

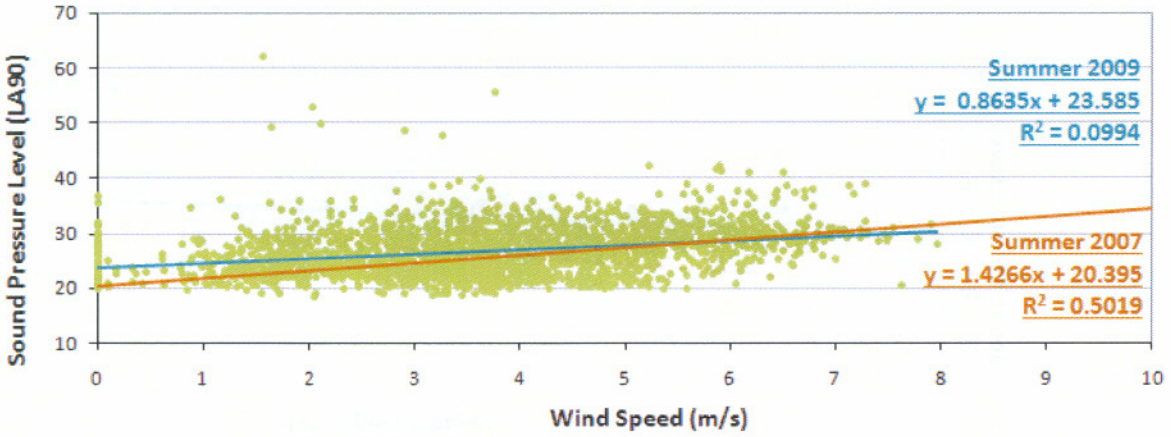


Figure 34: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 4

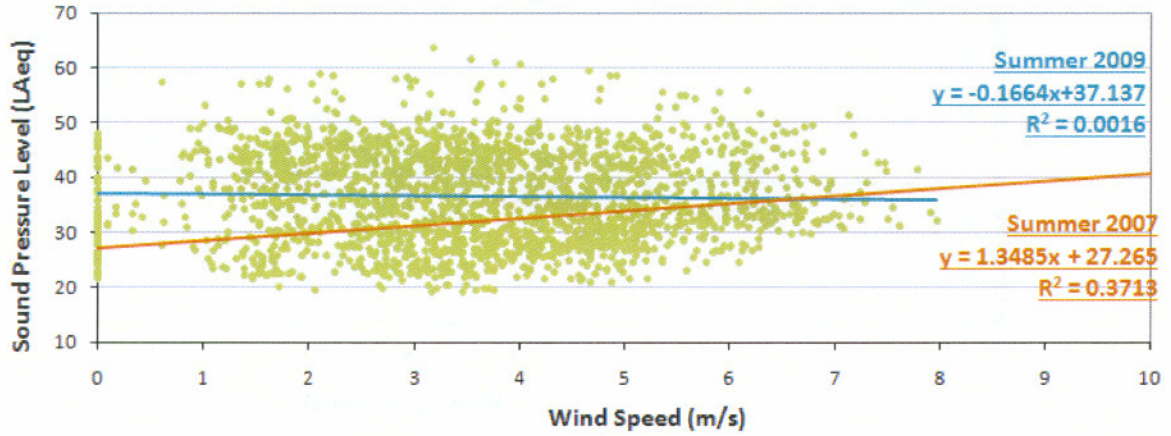


Figure 35: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 5

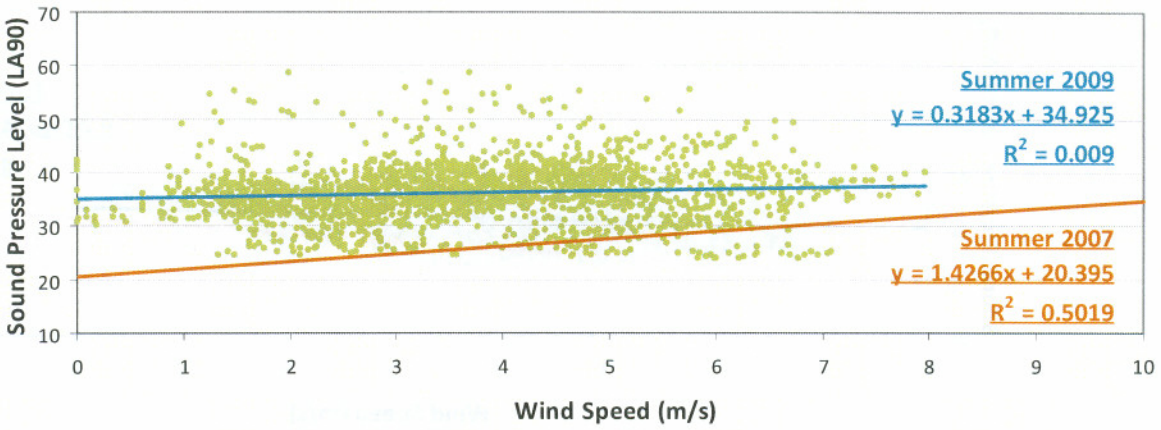


Figure 36: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 5

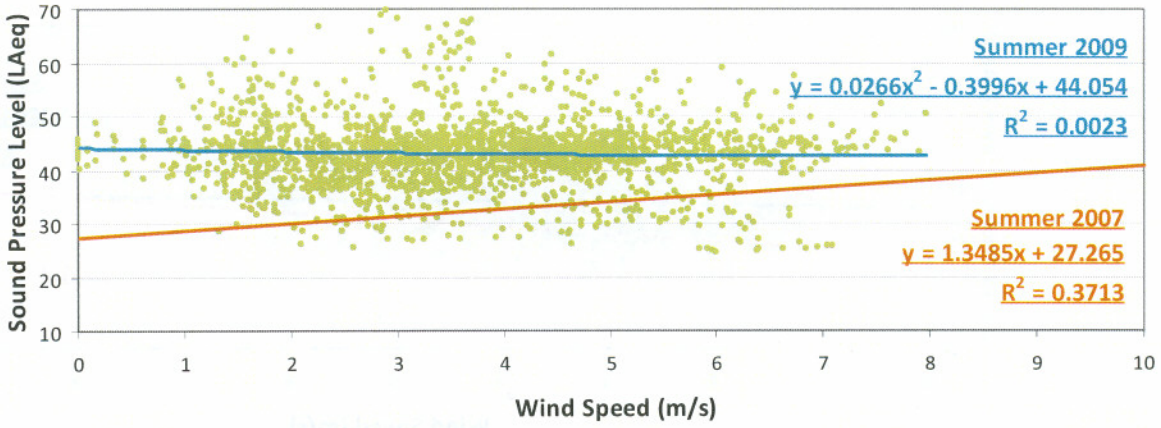


Figure 37: Regression Analysis of 10 Minute L90 Sound Pressure Level versus Normalized Wind Speed at Position 6

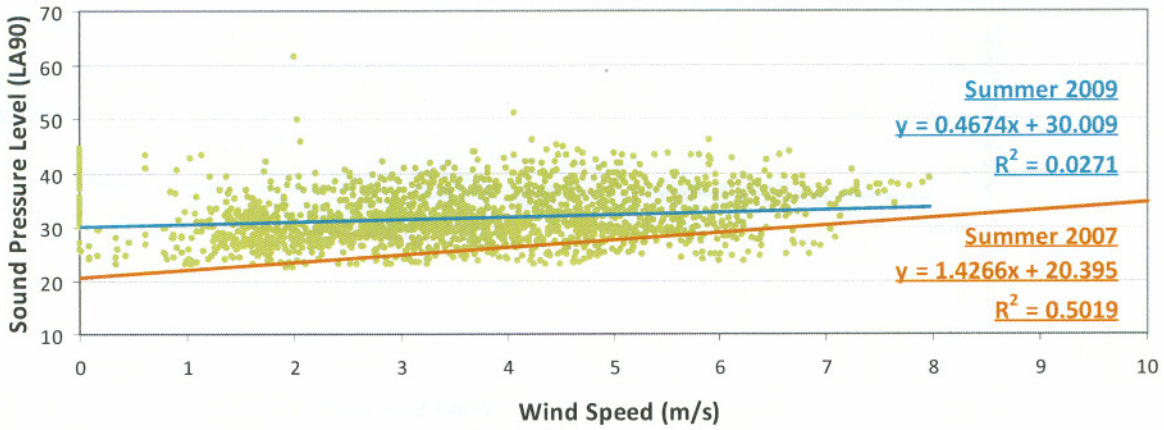


Figure 38: Regression Analysis of 10 Minute Leq Sound Pressure Level versus Normalized Wind Speed at Position 6