UPC WIND MANAGEMENT, LLC
EVERGREEN WIND POWER, LLC
MARS HILL WIND FARM
MARS HILL, MAINE

SOUND LEVEL STUDY

AMBIENT & OPERATIONS SOUND LEVEL MONITORING

Maine Department of Environmental Protection Order No. L-21635-26-A-N

Prepared by:

Resource Systems Engineering
35 Church Road, P.O. Box K
Brunswick, Maine 04011-0835
207 725-7896 / Fax 207 729-6245
E-Mail rse@gwi.net

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Resource
Systems
Engineering

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LIST OF ACRONYMS

ANSI	American National Standards Institute
dB	Decibel (Unit of Sound Pressure Level)
dBA	Decibel A-weighted
Hz	Hertz (cycles per second)
ISO	International Organization for Standardization
kW	Kilowatt
L_{A1}	Sound Level Exceeded 1% of a Measurement Period
L_{A10}	Sound Level Exceeded 10% of a Measurement Period
L_{A50}	Sound Level Exceeded 50% of a Measurement Period
L_{A90}	Sound Level Exceeded 90% of a Measurement Period
L_{Aeq}	Equivalent Sound Level
MEDEP	Maine Department of Environmental Protection
mph	Miles per hour
MRSA	Maine Revised Statutes Annotated
MW	Megawatt
RSE	Resource Systems Engineering

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1.0 INTRODUCTION

The objective of this Sound Level Study is to compare sound levels from operation of the Mars Hill Wind Farm (Wind Farm) with predicted estimates of Wind Farm sound levels and ambient sound levels in the vicinity of the Wind Farm.

In December 2003, Resource Systems Engineering (RSE) completed a sound level analysis of the Wind Farm as part of the Site Location of Development Act Application submitted to the Maine Department of Environmental Protection (MEDEP). As part of the sound level analysis, RSE developed a sound level prediction model for the project for purposes of estimating future sound levels from routine operation of the proposed Wind Farm. The estimated sound levels were compared with relevant MEDEP sound level limits. As proposed, the Wind Farm consisted of 33 wind turbines and a total generating capacity of 49.5 megawatt (MW). In its as-built configuration, the Wind Farm consists of 28 wind turbines with a total generating capacity of 42 MW.

After much of the Wind Farm was constructed, RSE measured sound levels at several community locations in the vicinity of the Wind Farm to determine ambient sound levels prior to commercial operation of the Wind Farm, which was achieved on March 27, 2007. During these measurements in December 2006, the wind turbines were completely shut down. After startup and commissioning of the wind turbines, RSE measured sound levels at community locations during routine operation of the Wind Farm in May 2007. Except for unforeseen shutdowns for repair or maintenance, all wind turbines were generating electric power at rates determined by wind conditions at Mars Hill. Measurements of ambient (shutdown) and routine operations were conducted over several days under a variety of weather conditions.

The MEDEP regulates noise under authority of the Site Location of Development Law (38 M.R.S.A 481-490). MEDEP Chapter 375.10, Control of Noise, protects certain existing land uses, such as residential properties, schools, and recreation areas, from excessive sound levels generated by new or expanded developments. The Site Law noise regulation establishes a maximum wind speed of 12 mph for purposes of measuring ambient and operating sound levels.

The Wind Farm project received approval from the MEDEP on June 1, 2004 as Department Order No. L-21635-26-A-N. The MEDEP Order recognizes that full operation of a wind turbine requires wind speeds of approximately 22 mph, which are significantly above the maximum allowed wind speed of 12 mph for sound level measurements. Further, based on sound level model estimates of Wind Farm operation by RSE, the MEDEP determined that the Wind Farm would not have an unreasonable adverse impact on protected locations and, due to measurement issues related to wind speeds, granted a variance from the MEDEP noise standards (ref. Finding 4).

As pre-commercial operations of the Wind Farm began in late 2006, some residents began to voice concerns over the sound levels emitted by the wind turbines. The majority of these concerns came from persons residing at protected locations along East Ridge Road near the north end of the Wind Farm and along the northern half of Mountain Road east of the Wind Farm. The nearest residential land uses to the Wind Farm are located within these areas.

In response to these residents' concerns, UPC initiated a sound level study to determine ambient and operating sound levels in the vicinity of the Wind Farm. The objective of ambient monitoring was to

determine the community sound levels under various weather and wind conditions with the Wind Farm shut down. The objective of the operations monitoring was to determine by measurement, sound levels at community monitoring positions during various operating conditions of the Wind Farm and to compare those levels with the predicted sound levels upon which the MEDEP relied in granting the variance.

The following presents a brief description of the Wind Farm project, a summary of MEDEP noise regulation, and acoustic model estimates from 2003 predicting Wind Farm sound levels. Measurement results from ambient and operations sound level monitoring are presented. Measured sound levels during Wind Farm operation are compared to ambient sound levels and sound level estimates provided to the MEDEP as part of the Site Permit application.

2.0 Sound and Decibels

Sound is a rapid fluctuation in pressure that the human ear has the potential to detect. The decibel (dB) is the standard unit of sound measurement. The decibel scale is logarithmic to avoid very large numbers associated with units of pressure change. Figure 2-1 shows a comparison of sound pressure and decibel levels for some typical sound environments.

Sound level performance specifications often provide the sound power level emitted by a particular noise source such as a wind turbine. Similar to sound pressure level, the sound power level or L_w is a logarithmic measure of sound expressed in decibels compared to a specified reference level. The difference is that the reference level for sound power is 10^{-12} watts compared to the reference level for sound pressure which is in units of micropascals.

Undesirable sound is generally referred to as *noise*, however, the terms *sound* and *noise* are commonly used interchangeably. The effects of sound depend on its frequency (or pitch), decibel level, and duration, particularly in relationship to changes in existing sound levels. The frequency of a sound refers to the number of vibrations per second, measured in hertz (Hz). Sounds audible to humans range from about 20 Hz to 20,000 Hz, with greater sensitivity between 1,000 and 4,000 Hz. Sound is generally a disorderly mixture of many frequencies, but may consist of a single frequency known as a pure tone. A-weighted sound levels, expressed as dBA, simulate the hearing response of the human ear to varying sound level frequencies.

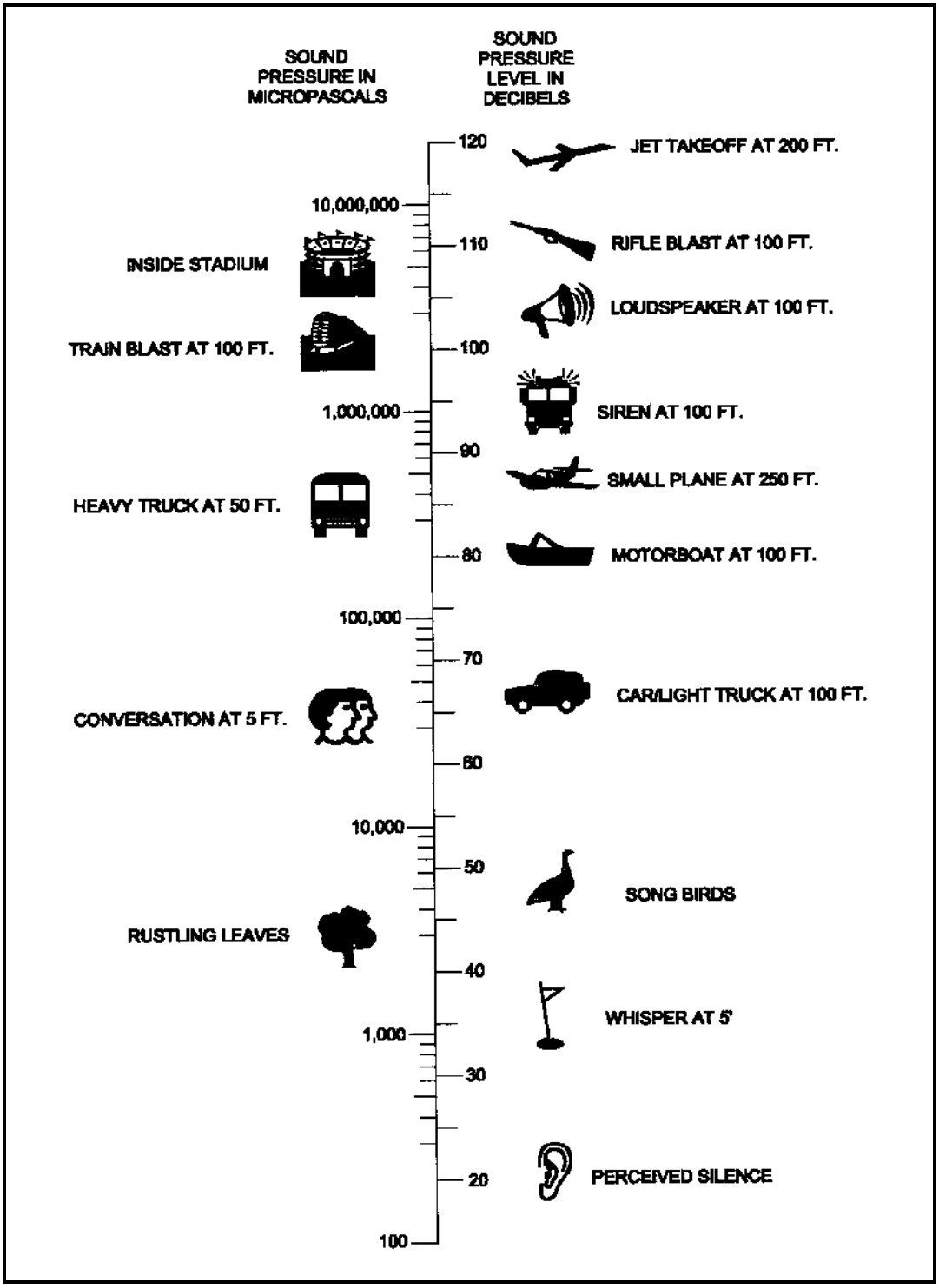
Sound propagation outdoors can be compared to ripples created by throwing a stone into a pond with a calm surface. The ripples spread out uniformly in all directions of the pond surface decreasing in amplitude as they move away from the source. For a stationary noise source outdoors, the sound level drops by 6 dB every time the distance from the source is doubled. Thus, if the sound level is 50 dBA at 500 feet, the sound level at 1000 feet will be 44 dBA and will be 38 dBA at 2000 feet. Obstacles in the sound path, such as intervening terrain or buildings, and weather conditions may affect outdoor sound propagation.

For constant sounds, a brief measurement close to the source can generally quantify the level of sound over both long and short periods. However, when sound sources vary, longer sampling periods are needed to accurately quantify the sound levels. Integrating sound level meters are commonly used to measure fluctuating sound sources. These meters record the sound level every 1/8 of a second when set to fast response and every one-second on slow response. When set to fast, the instrument measures 480 sound level readings every minute and 28,800 readings in an hour. Due to the large number of readings, statistical parameters are used for analysis and comparison of measurement data.

The most commonly used parameter for measuring outdoor sound is the A-weighted equivalent sound level or L_{Aeq}. The L_{Aeq} represents the sound energy during a given sampling period as a constant decibel level, taking all fluctuations into account similar to an averaging technique. Other common statistical

parameters include L_{A10}, L_{A50} and L_{A90}, which represent the sound level exceeded 10%, 50%, and 90% of the time during the measurement, respectively. The L_{A90} excludes most transient or intermittent sound sources and therefore, is commonly used to determine the value of constant or *background* sound during a measurement.

FIGURE 2-1
RELATION BETWEEN SOUND PRESSURE IN MICROPASCALS AND SOUND PRESSURE LEVEL IN DECIBELS



The MEDEP generally applies sound level limits based on characteristics of the site and vicinity such as existing land uses, local zoning designations and existing sound levels. The MEDEP limits are based primarily on hourly L_{Aeq} measurements. In addition, the Maine DEP applies specific limits for potentially disturbing types of sounds based on their frequency and duration.

In order to calculate sound levels resulting from multiple sound sources, such as an arrangement of wind turbines, it is necessary to combine decibel levels from each source. Decibels add exponentially to reflect their logarithmic nature. As a result, when two sounds of equal decibel levels are combined, the resulting sound level is 3 dB higher than the individual sound levels (e.g. 50 dBA + 50 dBA = 53 dBA).

3.0 SITE DESCRIPTION

Evergreen Wind Power constructed the Wind Farm along the ridgeline of Mars Hill and nearby agricultural fields. The Wind Farm site is located approximately 1½ miles east of the center of the Town of Mars Hill and less than a mile from the Canadian border. The Mars Hill ridge stretches approximately 3½ miles from north to south and is over a mile wide from east to west. There are public roads on all sides of the base of the Mars Hill ridge. These roads include East Ridge Road to the west and north, Mountain Road to the east, Mountain Road and East Blaine Road to the south.

Surrounding land uses include a combination of agricultural, undeveloped, residential, and recreation land uses. As previously noted, the nearest residences to the Wind Farm are located along East Ridge Road to the north and Mountain Road to the east. Recreational land uses include Mars Hill Golf Course, a public eighteen-hole course, and Big Rock Ski Area, both located on the west-southwest side of the Mars Hill ridge. Big Rock Ski Area has both downhill and cross county ski trails. An area map is shown as Figure 3-1.

The Wind Farm as constructed consists of 28 wind turbines, access roads, a power collection system, a substation, an operations/maintenance building, approximately 3.4 miles of power delivery line, and a switching station located at an existing transmission line. All project components are located in the Town of Mars Hill. The turbines are arranged in a north-south line along the Mars Hill ridgeline, down the north slope, and in open fields to the north. Spacing between turbines varies from two to four rotor diameters, giving a spacing distance of approximately 141 meters (463 feet) to 308 meters (1010 feet).

Originally, there were 35 potential wind turbine locations evaluated in order to select the final 28 turbine locations for construction of the Wind Farm. Figure 3-2 (attached), Wind Turbine Locations & Sound Level Contours, shows the original 35 possible sites evaluated in 2003 and the local tax map and lot numbers of surrounding parcels. Selection of the final 28 turbine sites was based on meteorological studies as well as other factors.

Wind Turbines - Evergreen Wind Power installed the widely-used General Electric (GE) 1.5sle model wind turbines with a rated electric generating capacity of 1500 kilowatts (kW) (1.5 megawatts (MW)). The turbines feature variable speed control for constant frequency power. Each turbine consists of a free-standing monopole tower, an enclosed nacelle mounted at the top of the tower, and an upwind-mounted, three-blade rotor.

The turbines have hub heights of 80 meters (262 feet) above the base elevation; and rotor diameters of 77 meters (253 feet). The maximum height, with one rotor blade straight up, is approximately 119 meters (389 feet). Ground elevations at the base of the wind turbine towers vary along the ridgeline of Mars Hill with the highest elevation reaching 1710 feet at Turbine 27 at the south end of the Wind Farm and the lowest elevation of 668 feet at Turbine 1 in the open fields down the north slope. A profile view of the wind turbines and other structures along the Mars Hill ridgeline is presented as Figure 3-3. The

turbines begin rotating (cut-in) at wind speeds of 3 to 4 meters/second (6.7 to 8.9 mph), and shutdown (cut-out) when winds reach 25 meters/second (56 mph). Rotation speed varies from about 10 to 22 rpm, or one rotation every three to six seconds. Tower oscillation is kept to a minimum through active damping of the entire turbine system.

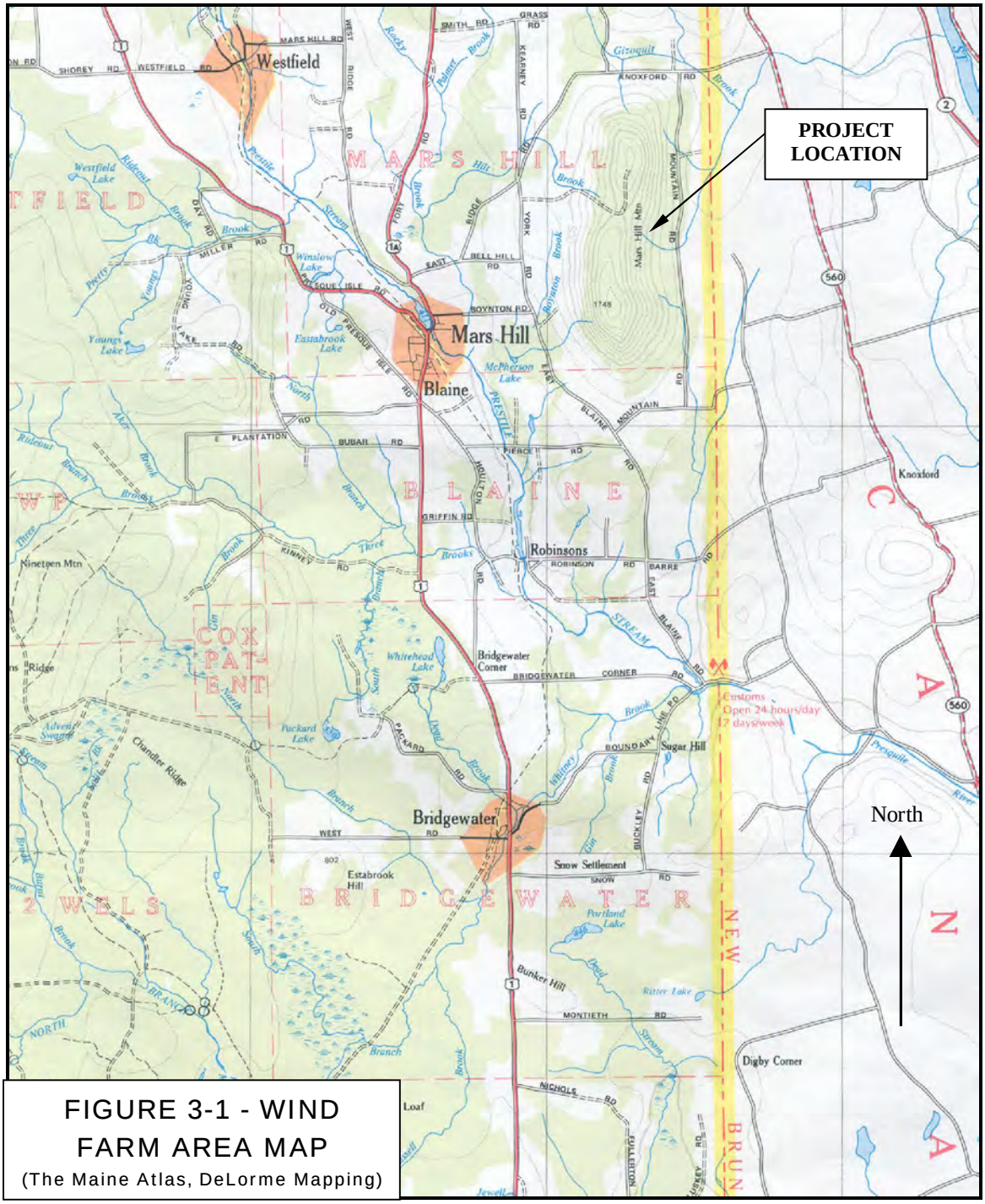
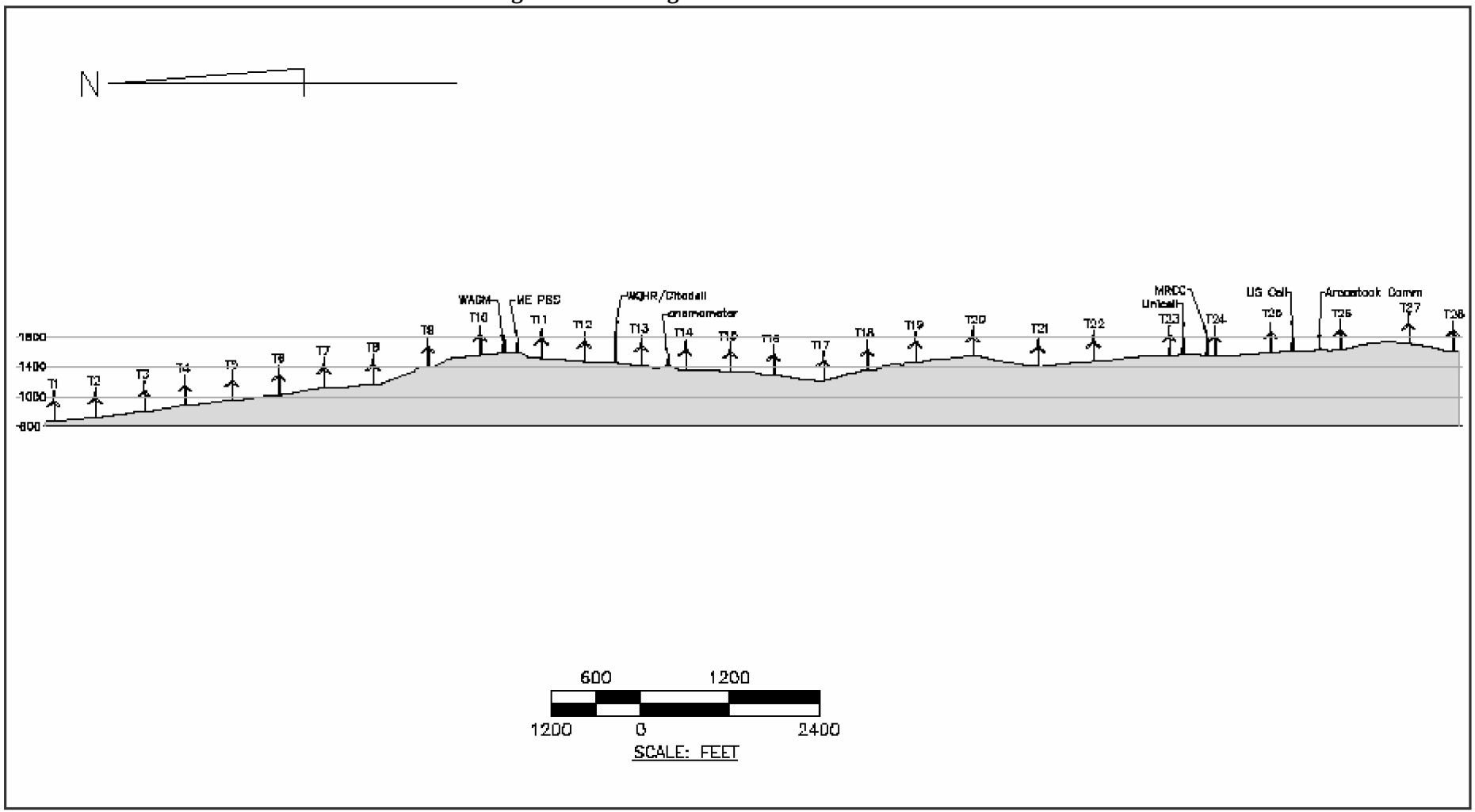


FIGURE 3-1 - WIND FARM AREA MAP
(The Maine Atlas, DeLorme Mapping)

Major components of the wind turbine are a three-blade rotor; main shaft, gear box, and generator installed inside the nacelle (enclosure) at hub height, and a pad-mount transformer at ground level. In addition to the nacelle enclosure, the gear box and generator are supported by elastomeric elements to minimize sound emissions Rotor blades with active blade pitch control are also designed to minimize sound emissions. (GEA-13550, 6/03 5M).

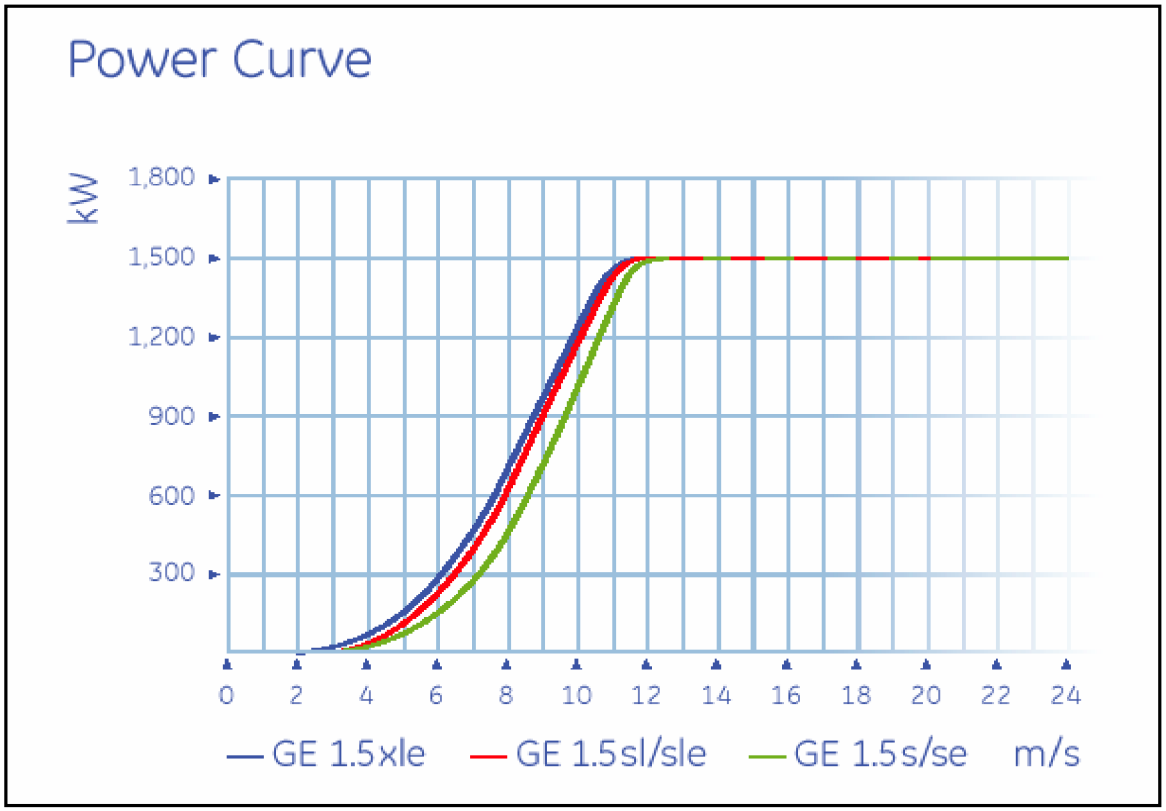
FIGURE 3-3. Profile View of Wind Turbines Along Mars Hill Ridgeline



Source: Devine-Tarbell Associates, June 2007

According to information from General Electric, the GE 1.5sle wind turbine reaches full power generation of 1500 kW at a wind speed of 11.5 m/s (25.7 mph) at the hub height. Figure 3-4 presents a power generation curve for the model 1.5sle and similar GE wind turbines.

Figure 3-4. Power Generation of GE 1.5 MW Wind Turbines in Relation to Wind Speed at the Hub Height



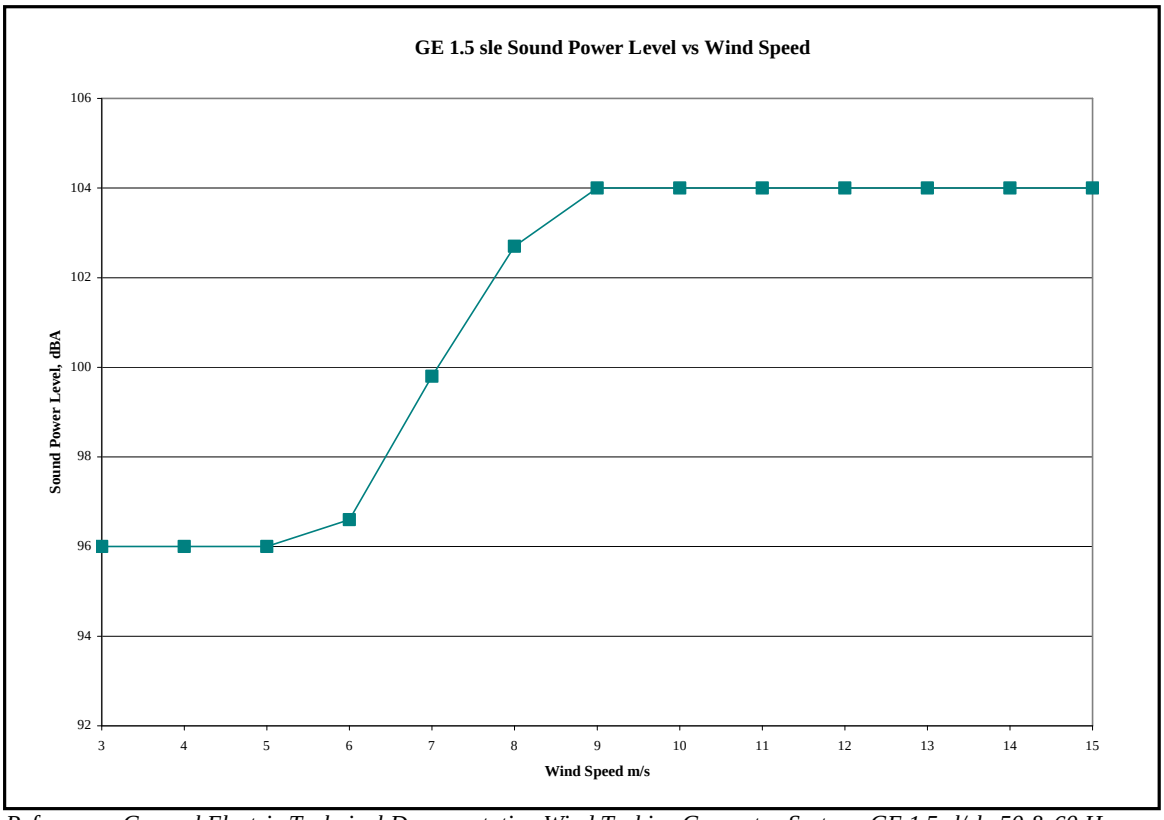
Reference: General Electric 1.5 MW Series Wind Turbine Brochure

Sound level performance specifications for the GE 1.5sle wind turbine provide information on how the sound power level emitted by the wind turbine varies with wind speed. The GE specification sound power levels represent the wind turbine as a point source at the hub (rotor center) and were determined in accordance with IEC International Standard 61400-11, Wind Turbine Generator Systems – Acoustic Noise Measurement Techniques. As discussed in Section 2.0, the sound power level or L_w is a logarithmic measure of sound expressed in decibels compared to a specified reference level of 10^{-12} watts. The sound pressure level at 50 feet is approximately 32 dBA less than the sound power level of a point source. A graph of sound power level in relation to wind speed at the hub height is presented as Figure 3-5. The maximum sound power level for the 1.5sle wind turbine is 104 dBA, which is equivalent to a sound pressure level of 72 dBA at 50 feet[1]. Typical uncertainty for the specification sound power level is plus or minus 2 dBA.

Comparing and combining the information from Figure 3-4 (Power Curve) and Figure 3-5 (Sound Power Levels) indicates that the GE 1.5sle reaches its maximum sound power level at an electric power output of approximately 900 kW or 60% of full generating capacity. This level of operation is achieved with a wind speed of 9 meters per second (20.1 mph) at the hub height of the wind turbine. The sound level specification indicates that the sound emissions do not increase once this rate of wind speed and electric power output occurs.

[1] From attenuation due to hemispherical radiation = 10 log ($2\pi R^2$) where R is the distance in meters.

Figure 3-5. Sound Power Level of GE 1.5 MW Wind Turbines in Relation to Wind Speed at the Hub Height



Reference: General Electric Technical Documentation Wind Turbine Generator Systems GE 1.5 sl/sle 50 & 60 Hz

4.0 MEDEP STANDARDS

Standards relevant to the Wind Farm are set forth in the Maine Site Location of Development Law (Site Law) and Maine DEP Regulations promulgated under authority of the Site Law. Section 484 (3) of the Site Law requires a developer to make adequate provision for fitting a development harmoniously into the existing natural environment and to demonstrate that the development will not unreasonably affect existing land uses and the natural environment. Site Law Regulation, MEDEP Chapter 375.10, *Control of Noise*, establishes sound level limits at property boundaries of a development and at nearby sensitive land uses referred to as *protected locations*.

The regulation defines a protected location as *"any location accessible by foot, on a parcel of land containing a residence or approved subdivision.…"* In addition to residential parcels, protected locations also include, but are not limited to, schools, state parks, and designated wilderness areas (ref. MEDEP 375.10.G.16).

Under the MEDEP regulation, the hourly L_{Aeq} resulting from routine operation of a development is limited to 75 dBA at any facility property boundary. Sound level limits at protected locations vary depending on local zoning or surrounding land uses and existing (pre-development) ambient sound levels.

At protected locations within commercially or industrially zoned areas, or where the predominant surrounding land use is non-residential, the hourly sound level limits for routine operation are 70 dBA daytime (7:00 a.m. to 7:00 p.m.) and 60 dBA nighttime (7:00 p.m. to 7:00 a.m.). At protected locations within residentially zoned areas or where the predominant surrounding land use is residential, the hourly

sound level limits for routine operation are 60 dBA daytime and 50 dBA nighttime. In addition, at any protected location where the daytime pre-development ambient hourly sound level at a protected location is equal to or less than 45 dBA and/or the nighttime hourly sound level is equal to or less than 35 dBA, the hourly sound level limits for routine operation are 55 dBA daytime and 45 dBA nighttime (ref. MEDEP 375.10.C.1).

In all cases, nighttime limits at a protected location apply up to 500 feet from sleeping quarters. At distances over 500 feet or where no sleeping quarters exist, daytime limits apply during all facility operating hours (ref. MEDEP 375.10.G.16).

For areas where pre-development ambient sound levels exceed the specified limits at a protected location, limits may be chosen as 5 dBA less than existing sound levels for new developments or 3 dBA more than the pre-development sound levels for modifications or expansions to existing developments (ref. MEDEP 375.10.C.1).

As set forth by MEDEP Chapter 375.10, ambient sound levels shall be measured at representative protected locations for periods of time sufficient to adequately characterize the ambient sound. Measurement locations shall be at nearby protected locations that are most likely affected by the sound from routine operation of the development. At a minimum, measurements shall be made on three different weekdays (Monday through Friday) during all hours that the development will operate. If the proposed development will operate on Saturdays or Sundays, measurements shall also be made during all hours that the development will operate. Among other criteria, Chapter 375.10 requires that:

1. Measurement periods with particularly high ambient sounds, such as during holiday traffic activity, significant insect activity or high coastline waves, should generally be avoided.

2. The microphone shall be positioned at a height of approximately 4 to 5 feet above the ground, and oriented in accordance with the manufacturer's recommendations.

3. Measurement periods shall be avoided when the local wind speed exceeds 12 mph and/or precipitation would affect the measurement results.

At any measurement location the daytime and nighttime ambient hourly sound level shall be computed by arithmetically averaging the daytime and nighttime values of the measured one hour equivalent sound levels. Multiple values, if they exist, for any specific hour on any specific day shall first be averaged before the computation described above.

The MEDEP regulation also establishes sound level limits for maintenance, and short duration repetitive and tonal sounds as follows:

Maintenance -- Sound from routine, ongoing maintenance activities are considered part of routine operations and subject to the daytime and nighttime limits for routine operation. Sound from occasional, major overhaul activities is regulated as construction activity (ref. MEDEP 375.10.C.3).

Short Duration Repetitive and Tonal Sounds - When routine operations produce a short duration repetitive or tonal sound, 5 dBA is added to the observed sound levels of these sounds for determining compliance. There is also a maximum sound level (L_{Amax}) limit for certain types of short duration repetitive sounds (ref. MEDEP 375.10.C.1.d and e).

Sounds associated with certain activities or at certain locations are exempt from regulation under MEDEP Chapter 375.10. Exempt activities and locations associated with the Wind Farm may include (ref. MEDEP 375.10.C.5):

- Snow removal, landscaping and street sweeping activities.

- Construction activity during daylight or daytime hours, whichever is longer;
- Registered and inspected vehicles operating on public ways or making deliveries or pickups that do not operate on site for more than 60 minutes at one time;
- Safety and protective devices installed in accordance with code requirements;
- Daytime testing of emergency equipment no more than once per week;
- Protected locations where a noise easement has been conveyed to the regulated development; and
- Emergency maintenance and repairs.

When a development is located in a municipality that has duly enacted a quantifiable noise standard that (1) contains limits that are not higher than the MEDEP limits by more than 5 dBA, and (2) limits or addresses the types of sounds regulated by the MEDEP, then the MEDEP is to apply the local standard rather than the MEDEP standard. Further, when noise produced by a facility is received in another municipality, the quantifiable noise standards of the other municipality must also be taken into consideration (ref. MEDEP 375.10.B.1). RSE understands that neither the Town of Mars Hill nor nearby Blaine, Maine to the south have enacted a quantifiable noise standard. Further, RSE understands that there are no international or Canadian noise standards applicable to the proposed wind farm.

Table 4-1 presents a summary of MEDEP sound level limits.

TABLE 4-1

MEDEP SOUND LEVEL LIMITS

Location	Daytime Limit (Hourly L_{Aeq})	Nighttime Limit (Hourly L_{Aeq})	Tonal Sounds	Short Duration Repetitive Sounds (SDRS)
Facility Property Line	75 dBA	75 dBA	No 5 dBA assessment	No 5 dBA assessment or L_{Amax} limit
Protected Location zoned Commercial, Industrial or Transportation	70 dBA	60 dBA within 500 feet of sleeping quarters otherwise 70 dBA	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS
Protected Location zoned Residential, Rural or Similar Land Use	60 dBA	50 dBA within 500 feet of sleeping quarters otherwise 60 dBA	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS
Quiet Area - Protected Location where existing daytime sound level is 45 dBA and/or less and nighttime sound level is 35 dBA or less	55 dBA	45 dBA within 500 feet of sleeping quarters otherwise 55 dBA	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS
Noisy Area - Protected Location where existing daytime or nighttime sound level exceeds standard daytime and/or nighttime limits	Pre-development daytime sound level minus 5 dBA (per election of applicant)	Pre-development nighttime sound level minus 5 dBA (per election of applicant)	5 dBA assessment applies to Tonal Sounds	5 dBA assessment and possible L_{Amax} limit for SDRS

Note: Department Order No. L-21635-26-A-N grants a variance to the Mars Hill Wind Farm from the MEDEP noise standards.

The Wind Farm project received approval from the MEDEP on June 1, 2004 as Department Order No. L-21635-26-A-N. The MEDEP Order acknowledges that full operation of wind turbines requires a wind speed of approximately 22 miles per hour. This poses a dilemma with the Site Law noise regulation which specifies a maximum wind speed of 12 mph for measurement of ambient and operating sound levels at protected locations. Based on sound level model estimates of the Wind Farm, the MEDEP found that the Wind Farm would not have an unreasonable adverse impact on protected locations. Based on these findings, the MEDEP granted a variance from the MEDEP noise standards

(ref. Finding 4). Excerpts from relevant portions of MEDEP Site Location Order are provided in Appendix I.

5.0 SOUND LEVEL MODEL ESTIMATES FOR WIND FARM OPERATION

In 2003, prior to construction and operation of the Wind Farm, RSE developed a sound level prediction model for the Wind Farm, as proposed. The acoustic model was developed using the CADNA/A software program to map area terrain in three-dimensions, locate the proposed wind turbines, and calculate outdoor sound propagation to the surrounding area. Area topography and base tower elevations, for entry to CADNA, were provided to RSE by Devine Tarbell based on USGS topographic maps and the proposed site layout.

Although 33 wind turbines were proposed, preliminary sound level estimates for the Wind Farm were calculated as if wind turbines would operate on all 35 sites that were under consideration. Further, sound levels were calculated as if all 35 turbines were operating simultaneously at 95% of rated power as defined by General Electric (GE). These near-full load conditions exist at a wind speed of 10 meters per second (22.4 miles per hour) at a height of 10 meters above grade. RSE modeled the wind turbines as point sources at a hub height of 65 meters (212 feet) above base/grade elevation using a sound power specification from GE (Sound Emission Characteristic Values for the GE Wind Energy 1.5s, GE Wind Energy, September 18, 2003). As constructed, the Wind Farm consists of 28 GE wind turbines with a hub height of 80 meters.

The results of the CADNA acoustic model predictions for operation of the wind turbines are shown as sound level contour lines on the Wind Farm site map (see Figure 3-2, Wind Turbine Location & Sound Level Contours). The predicted sound levels on Figure 3-2 are depicted at 5 dBA intervals ranging from 30 to 55 dBA. A 5 dBA interval was chosen to emphasize sound levels from the wind turbines that correspond to MEDEP sound level limits (*i.e.*, 45, 50, and 55 dBA) that were potentially applicable at nearby protected locations. The results shown by Figure 3-2 were used to identify parcels where the Wind Farm, as proposed, had the potential to exceed MEDEP limits for protected locations. Further, the model estimates showed that sound levels from the Wind Farm would exceed 50 dBA at the nearest protected locations at the north end of the project.

During recent work to monitor ambient and operating sound levels, Figure 3-2 was updated to add the as-built wind turbine locations and map nearby protected locations as they currently exist. An aerial image of the Mars Hill site was also added. The revised site map is presented as Figure 5-1, Vicinity Site Plan and Sound Level Monitoring Positions, December 2006 and May 2007.

A significant factor in sound emissions and outdoor propagation from the Wind Farm is the effect of wind speed on turbine operations and ambient, non-turbine sound levels. There are likely to be significant fluctuations in wind speed from the hub height of the wind turbines to the regulated height of 4 to 5 feet above ground level. The quietest periods of the day or night generally occur when the winds are light or calm. In addition, as the wind speed incident on a wind turbine drops, sound levels from the turbine are generally reduced. The wind turbines do not operate at wind speeds below 3 meters per second (6.7 mph). Thus, during periods of light or calm winds at heights of the wind turbines, sound level emissions from the Wind Farm will be virtually non-existent.

Garrad Hassan America (GHA) completed an assessment of wind conditions at the Mars Hill site for use in evaluating potential energy production of the Wind Farm. This assessment provides predictions of wind conditions that can be expected during operation of the Wind Farm. The wind predictions by GHA were based on analysis of extensive meteorological data for the Wind Farm site. Wind data from the GHA study is presented in Figures 5-2 to 5-4.

Figure 5-2 presents a statistical distribution of the predicted wind speed at the hub elevation near wind turbine nos. 15 and 16. This figure shows that the predicted wind speed at turbines 15 and 16 will be 9

meters per second (20.1 mph) or greater approximately 38% of the time. According to the sound power curve (Figure 3-5), maximum sound power is emitted from the wind turbines when the wind speed at the hub reaches 9 meters per second. At this wind speed, the electric power output from the wind turbine approaches 900 kW or 60% capacity.

FIGURE 5-2. Predicted Wind Speed at Hub Elevation Near Turbines 15 and 16

Wind Speed (m/s)	% Distribution	% Cummulative
0	0.59	0.6
1	1.94	2.5
2	3.05	5.6
3	4.53	10.1
4	6.24	16.4
5	7.79	24.1
6	8.86	33.0
7	9.41	42.4
8	9.82	52.2
9	10.21	62.4
10	9.74	72.2
11	8.58	80.8
12	6.23	87.0
13	4.36	91.4
14	3.00	94.4
15	1.95	96.3
16	1.27	97.6
17	0.85	98.4
18	0.56	99.0
19	0.34	99.3
20	0.27	99.6
21	0.09	99.7
22	0.13	99.8
23	0.02	99.8
24	0.005	99.8
25	0.01	99.8
26	0.01	99.9
27	0.005	99.9

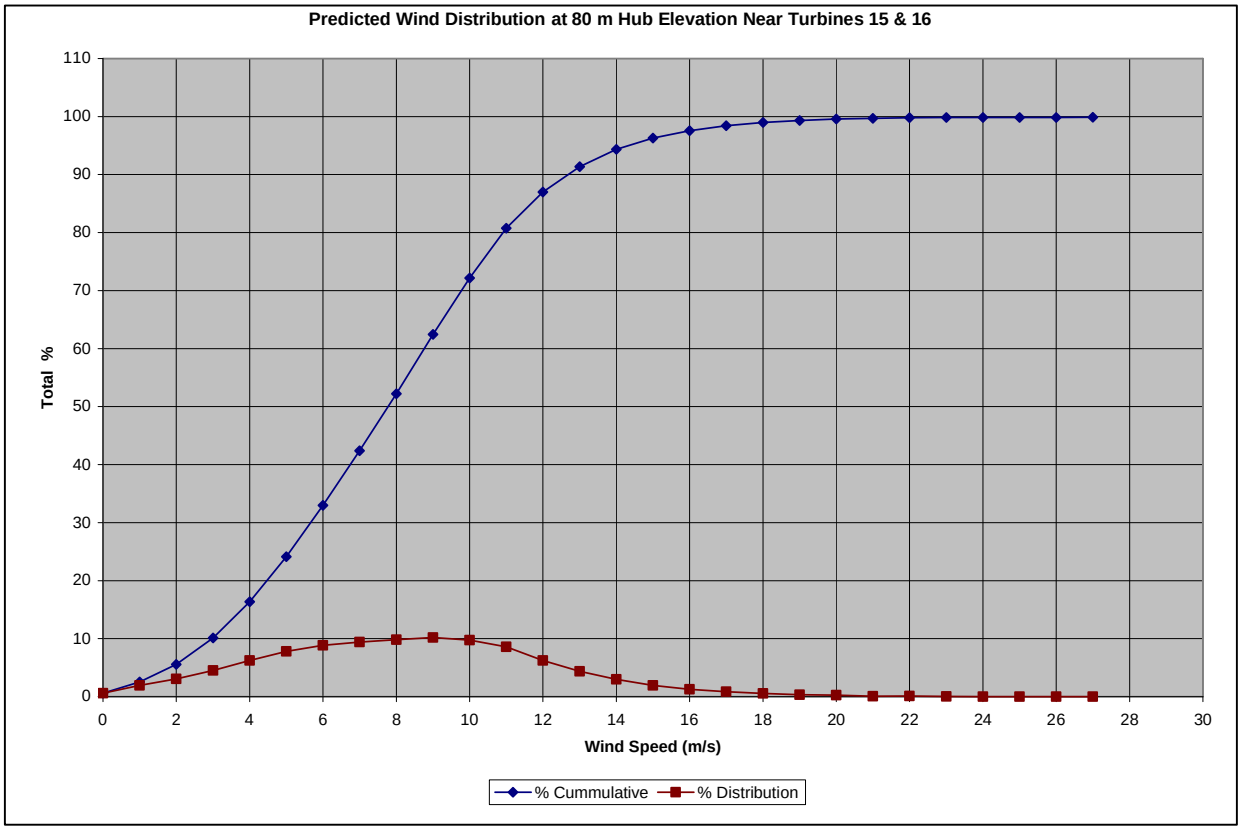


Figure 5-3 provides the predicted mean wind speed for each of the 28 wind turbines operating at Mars Hill. The mean wind speeds vary due to the elevation of the wind turbine hub and its height above existing vegetation According to the GHA study, the mean wind speeds are expected to range from 6.1 m/s (13.6 mph) at Turbine 1 to 9.9 m/s (22.1 mph) at Turbine 27.

Figure 5-3. Predicted Mean Wind Speeds at the Hub Elevation of Each Wind Turbine

Turbine No.	Mean Wind Speed at Hub Height (m/s)	Average Mean Wind Speed by Turbine Group
1	6.1	
2	6.3	
3	6.5	6.52
4	6.8	
5	6.9	
6	7.2	
7	7.5	
8	7.4	7.96
9	8.5	
10	9.2	
11	9.0	
12	8.7	
13	8.5	8.42
14	8.1	
15	7.8	
16	7.7	
17	7.3	
18	7.8	8.08
19	8.5	
20	9.1	
21	8.3	
22	8.0	
23	8.9	8.58
24	8.8	
25	8.9	
26	9.1	
27	9.9	9.5
28	9.5	

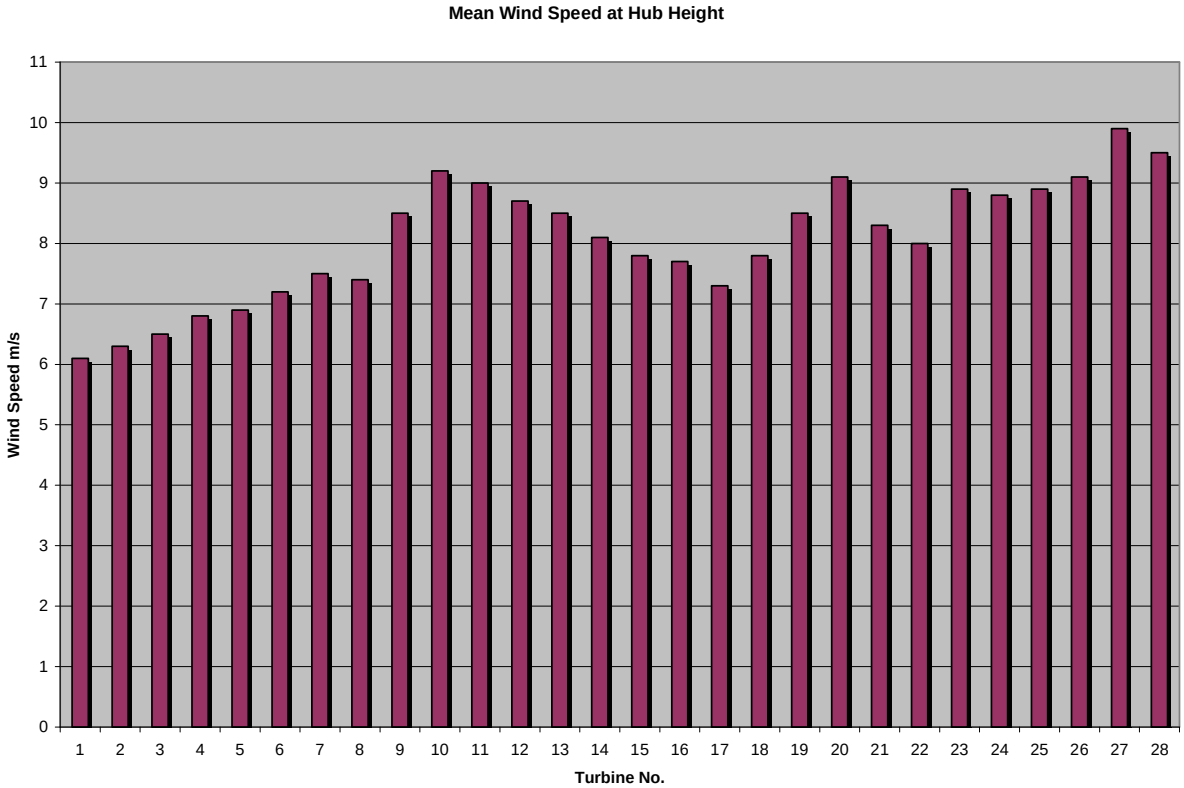
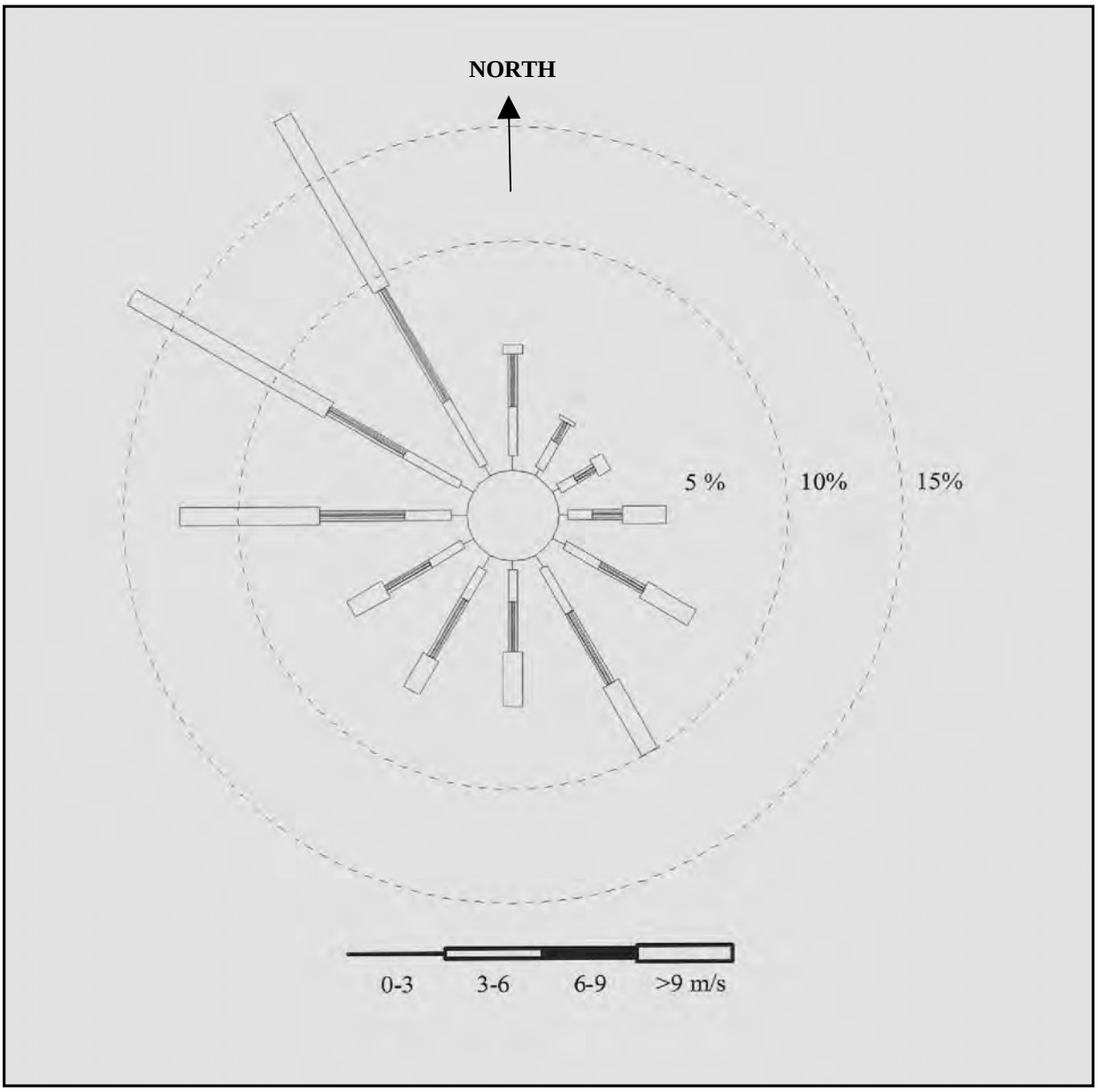


Figure 5-4 provides an annual wind rose of predicted long-term wind conditions at a height of 50 meters along the ridge line near Turbines 15 and 16. The wind rose indicates the expected annual distribution of both wind speed and direction and shows a predominance of winds from the northwest and west, with a significant portion from the southeast.

Figure 5-4. Annual Wind Rose at 50m Near Turbines 15 and 16



6.0 AMBIENT SOUND LEVELS

RSE measured ambient sound levels at various community locations near the Wind Farm site over a 48-hour period between December 20 and 22, 2006. During this period, ambient sound levels were monitored at six positions (MP-1 through MP-6) as shown on Figure 5-1 (attached), Vicinity Site Plan and Sound Level Monitoring Positions, December 2006 and May 2007. The wind turbines were not operating and locked in a set position during the ambient monitoring period and were observed not to contribute to the measured ambient sound levels.

The monitoring positions were selected based on tax maps, aerial photographs and field observations to represent ambient conditions at nearby protected locations to the Wind Farm. The ambient monitoring positions are as follows:

Position	Description
MP-1	Property line of the Wind Farm and abutting residential parcel off East Ridge Road at the north end of the Wind Farm.
MP-2	Along the main Wind Farm access road and nearby a residential parcel off East Ridge Road and west of the Wind Farm.
MP-3	At the base of Big Rock Ski Area and at the residential lot within the Big Rock Subdivision nearest to the Wind Farm.
MP-4	At the Mars Hill Country Club and nearby residential parcels.
MP-5	At a residential property along Mountain Road east of the southern portion of the Wind Farm .
MP-6	Residential parcel near the north end of Mountain Road and to the east of the Wind Farm.

Instrumentation consisted of Larson-Davis Model 812 Integrating Sound Level Meters, which were programmed to continuously measure A-weighted sound pressure levels and calculate statistics at both hourly and ten-second intervals. A Larson-Davis Model 824 Sound Level Meter and Real Time Analyzer was used to measure A-weighted and linear one-third octave band sound levels at position MP-6. It also was programmed to continuously measure A-weighted and octave-band sound levels, and calculate statistics at both hourly and ten-second intervals.

The sound level meters meet Type 1 (precision) performance requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4-1983. The microphones were fitted with standard windscreens and mounted on tripods at a height of four to five feet above the ground. The sound level meters were calibrated before and after each twenty-four hour monitoring period using a Bruel & Kjaer 4231 Sound Level Calibrator. Additionally, a certified laboratory performs a calibration within the 12 months of the measurements. Calibration certificates are available upon request.

On December 20, 2006, temperatures ranged from 10 to 25 degrees F; winds were primarily from the south at 8 to 14 mph in the afternoon and subsiding to less than 5 mph overnight. Winds picked up from the west during the day on December 21reaching average speeds up to 22 mph during the afternoon and evening periods. Temperatures also increased reaching 37 degrees F during the day. Skies ranged from clear to overcast on both days. Winds diminished overnight and through the morning of December 22 ranging from 6 to 11 mph. Overnight temperatures dropped to 18 degrees F with mostly clear skies.

Measurement graphs of ambient sound level readings taken at the Wind Farm site are presented in Figures 6-1 through 6-6. These figures present the equivalent sound level (L_{Aeq}) and L_{A50} (50^{th} percentile) sound level for each hour of sound level measurement. The L_{A50} was selected to show the variability of the average sound energy with the median sound level. The average speed and direction for surface winds (non-ridgeline) are also shown for each hour based on observations at Northern Maine Regional Airport in Presque Isle, Maine (ref. www.wunderground.com). Each figure also provides a

graph showing the relationship of surface wind speed and ambient hourly sound level. Tables and graphs of ambient sound level measurements can be found in Appendix II. The readings include hourly L_{Aeq}, L_{A1}, L_{A10}, L_{A50} and L_{A90} values for each measurement position. The L_{Aeq} represents the average energy level of all sounds present during the measurement period. The one-hour L_{Aeq} is the parameter specified for use by the MEDEP for establishing pre-development ambient sound levels. L_{A1} is the sound level exceeded 1% of the time during the measurement period. Likewise, L_{A10}, L_{A50} and L_{A90} are the sound levels exceeded 10%, 50% and 90% of the time during the measurement period.

At Position MP-1, hourly L_{Aeq}s ranged from 33 to 56 dBA with higher readings noted during daytime periods and when wind speeds increased. Wind sound was observed to be a primary source during periods of higher readings. Other ambient sound sources at MP-1 were local traffic on East Ridge Road, daytime construction traffic and equipment along the north access road, occasional aircraft, and natural sounds such as birds.

At MP-2, hourly L_{Aeq}s ranged from 28 to 60 dBA with higher readings noted during daytime periods and when wind speeds increased. Wind sound was observed to be a primary source during periods of higher readings. Other ambient sound sources at MP-2 were construction vehicles along Tower Road, local traffic on East Ridge Road, occasional aircraft, and natural sounds such as birds.

At Position MP-3, hourly L_{Aeq}s ranged from 35 to 51 dBA with higher readings noted during daytime periods and when wind speeds increased. Wind sound was observed to be a primary source during periods of higher readings. Other ambient sound sources at MP-3 were local traffic and snow grooming equipment in the vicinity of Big Rock Ski Area, occasional aircraft, and natural sounds such as birds.

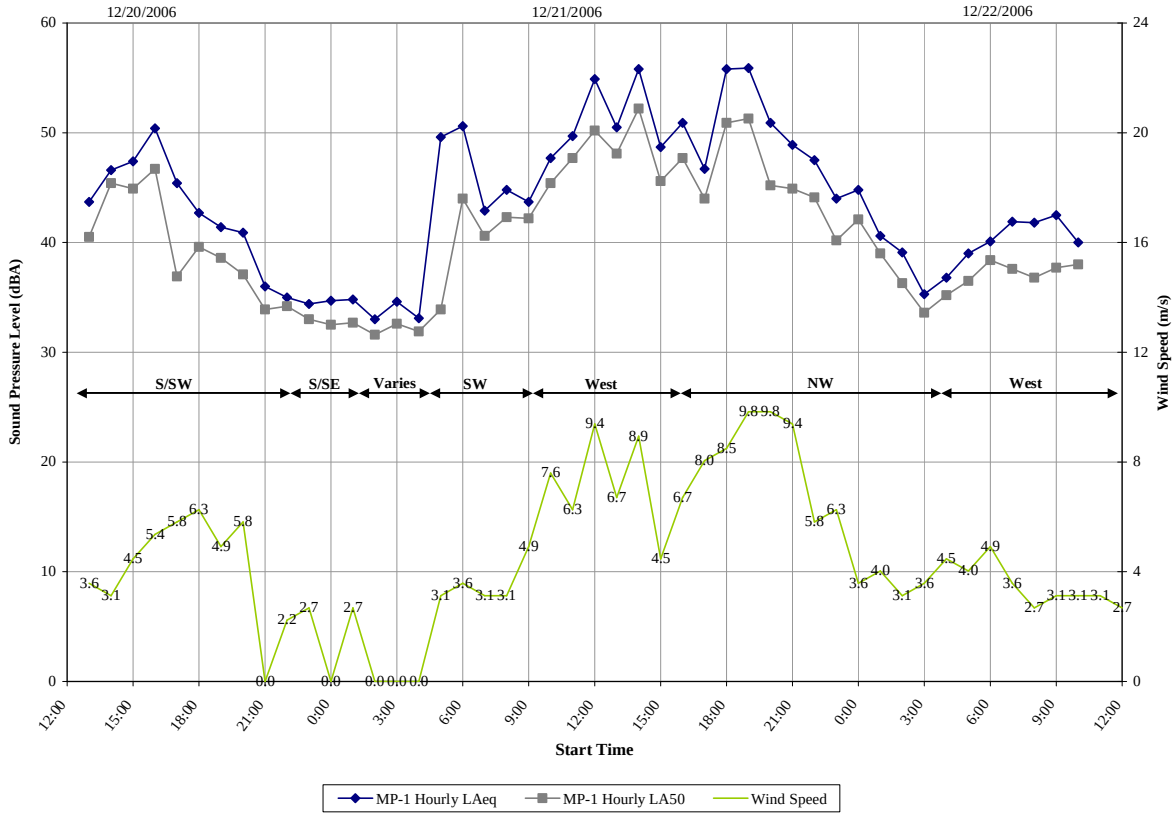
At Position MP-4, hourly L_{Aeq}s ranged from 29 to 59 dBA with higher readings noted during daytime periods and when wind speeds increased. Wind sound was observed to be a primary source during periods of higher readings. Other ambient sound sources at MP-4 were local traffic, occasional aircraft and distance traffic from Route 1/1A, and natural sounds such as birds.

At Position MP-5, hourly L_{Aeq}s ranged from 30 to 53 dBA with higher readings noted during daytime periods and when wind speeds increased. Wind sound was observed to be a primary source during periods of higher readings. Other ambient sound sources at MP-5 were local traffic on Mountain Road, residential activity, occasional aircraft, and natural sounds such as birds. During certain periods of moderate winds, sound levels were low compared to other monitoring positions suggesting that proximity to Mars Hill ridge may have provided some shielding from the wind.

At Position MP-6, hourly L_{Aeq}s ranged from 27 to 55 dBA with higher readings noted during daytime periods and when wind speeds increased. Wind sound was observed to be a primary source during periods of higher readings. Other ambient sound sources at MP-6 were local traffic on Mountain Road, distant construction activity along the ridgeline, occasional aircraft, and natural sounds such as birds. During certain periods of moderate winds, sound levels were low compared to other monitoring positions suggesting that proximity to Mars Hill ridge may have provided some shielding from the wind.

When wind speeds dropped to less than 10 mph (4.5 m/s), typical hourly L_{Aeq} readings were less than 40 dBA at the community monitoring positions. An extended period of sound levels at or below 35 dBA occurred at MP-1, MP-5, and MP-6 during an overnight period (12/20 to 12/21) of light or calm winds. During periods when the wind speeds reached or exceeded 15 mph (6.7 m/s). as required to achieve approximately 25% electric power production, typical hourly L_{Aeq} readings were 45 dBA or greater at most community monitoring positions and above 50 dBA at position MP-2 and MP-4. A few hourly L_{Aeq} readings at positions MP-3 and MP-5 were less than 45 dBA with 15 mph or greater wind speeds indicating some shielding or blocking of wind from terrain or vegetation. The results also show that the difference between the LA_{eq} and L_{A50} generally increases with wind speed and is likely the result of wind gusts contributing to the L_{Aeq}. At positions MP-3 and MP-5, the differences between the L_{Aeq} and L_{A50} readings are generally less where observations indicated shielding from the wind.

Figure 6-1. Hourly Ambient Sound Levels at MP-1 in Relation to Surface Wind



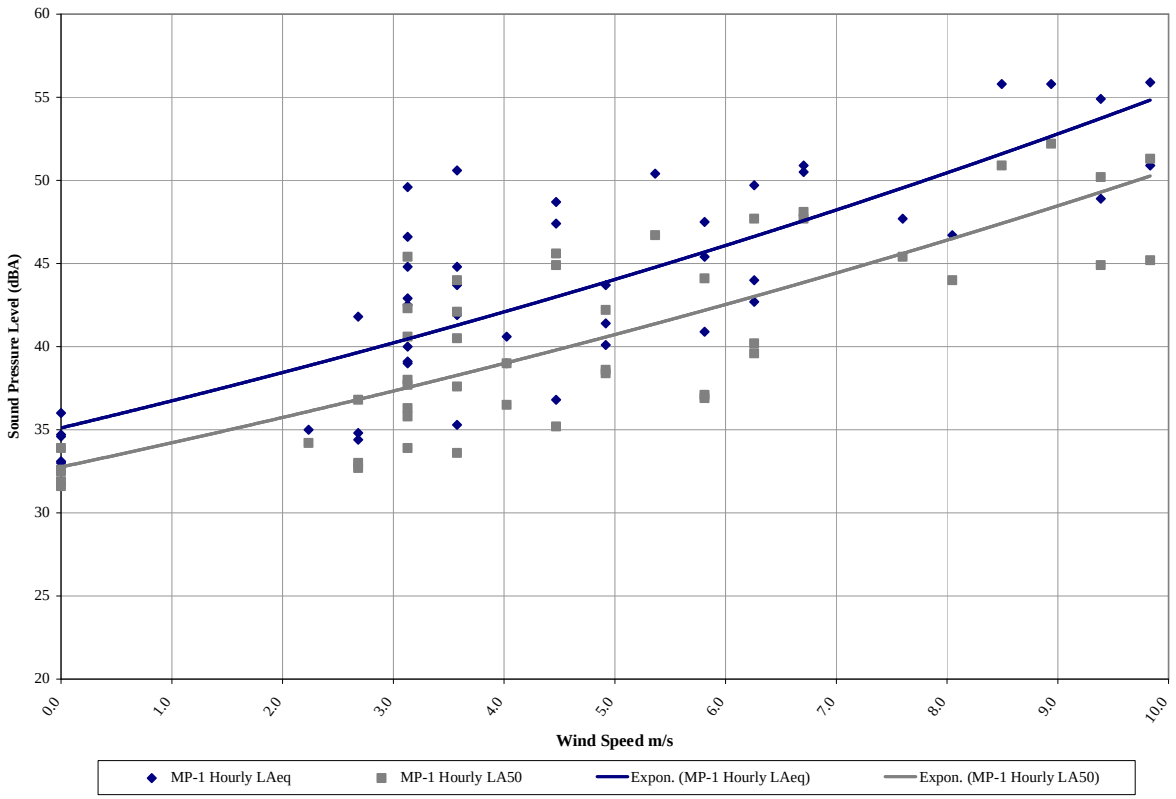
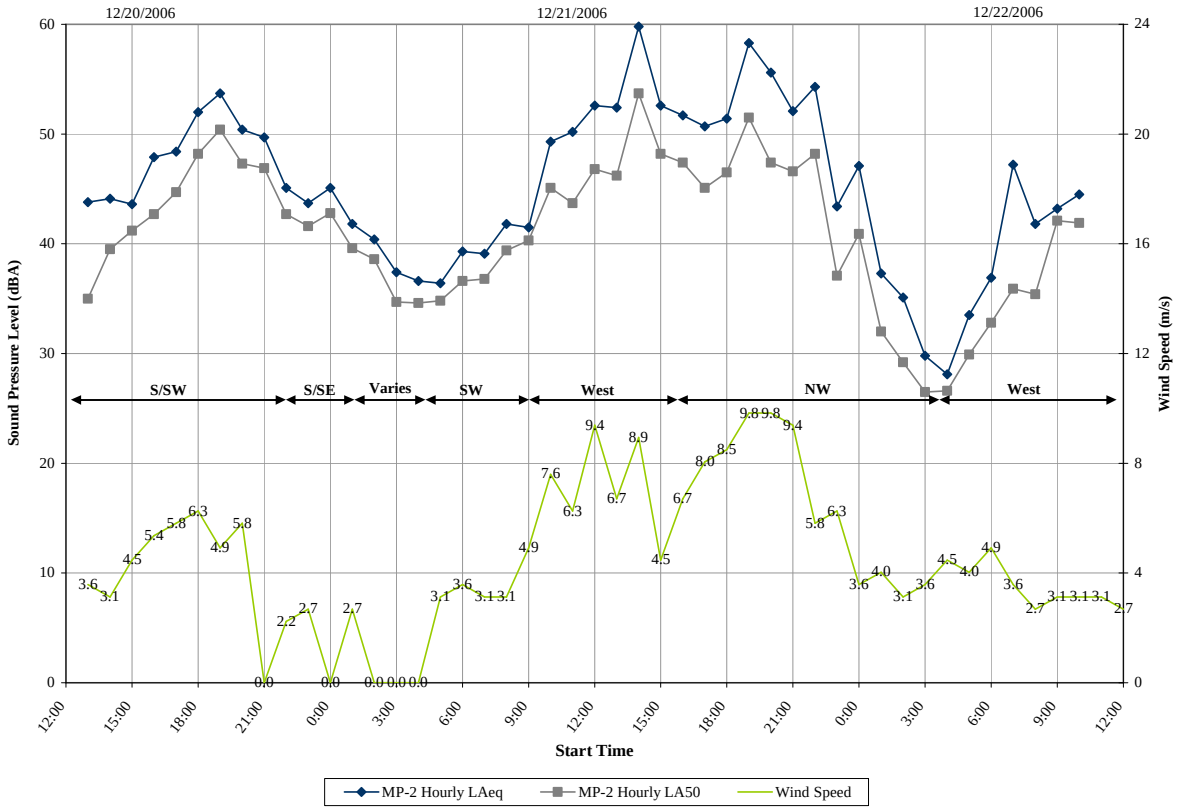


Figure 6-2. Hourly Ambient Sound Levels at MP-2 in Relation to Surface Wind



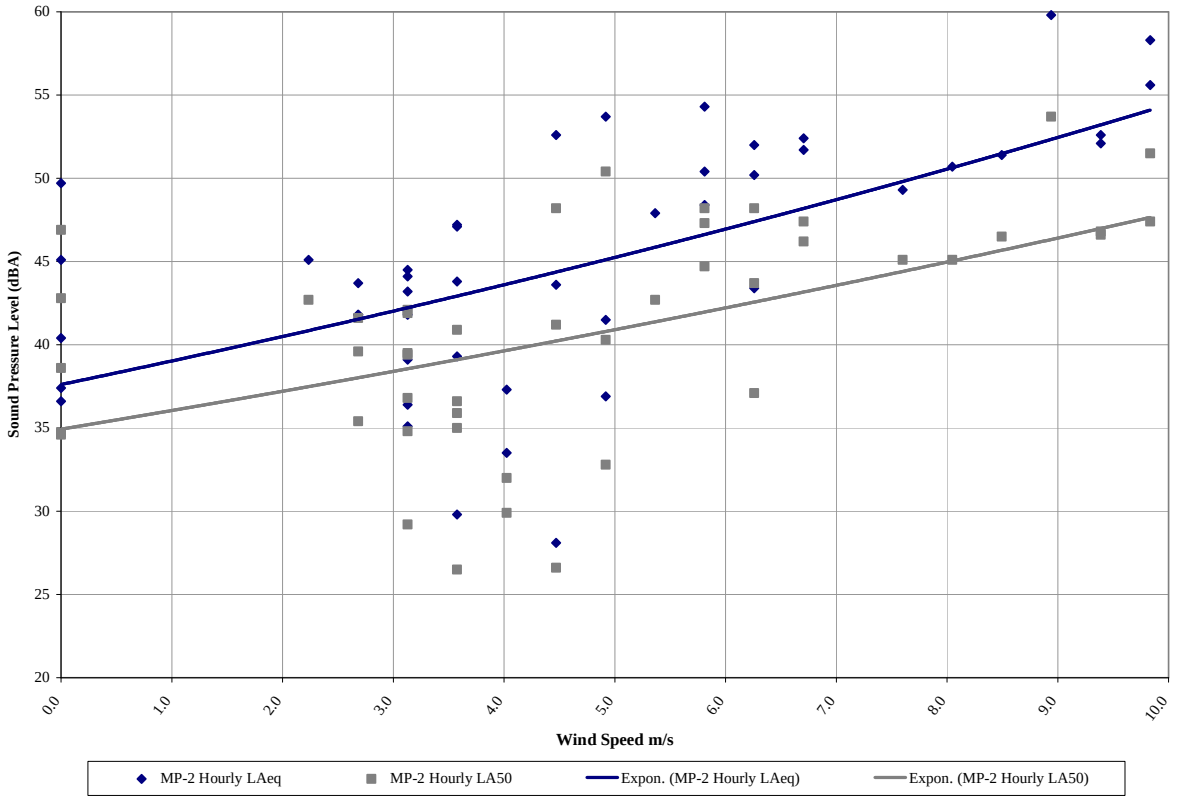
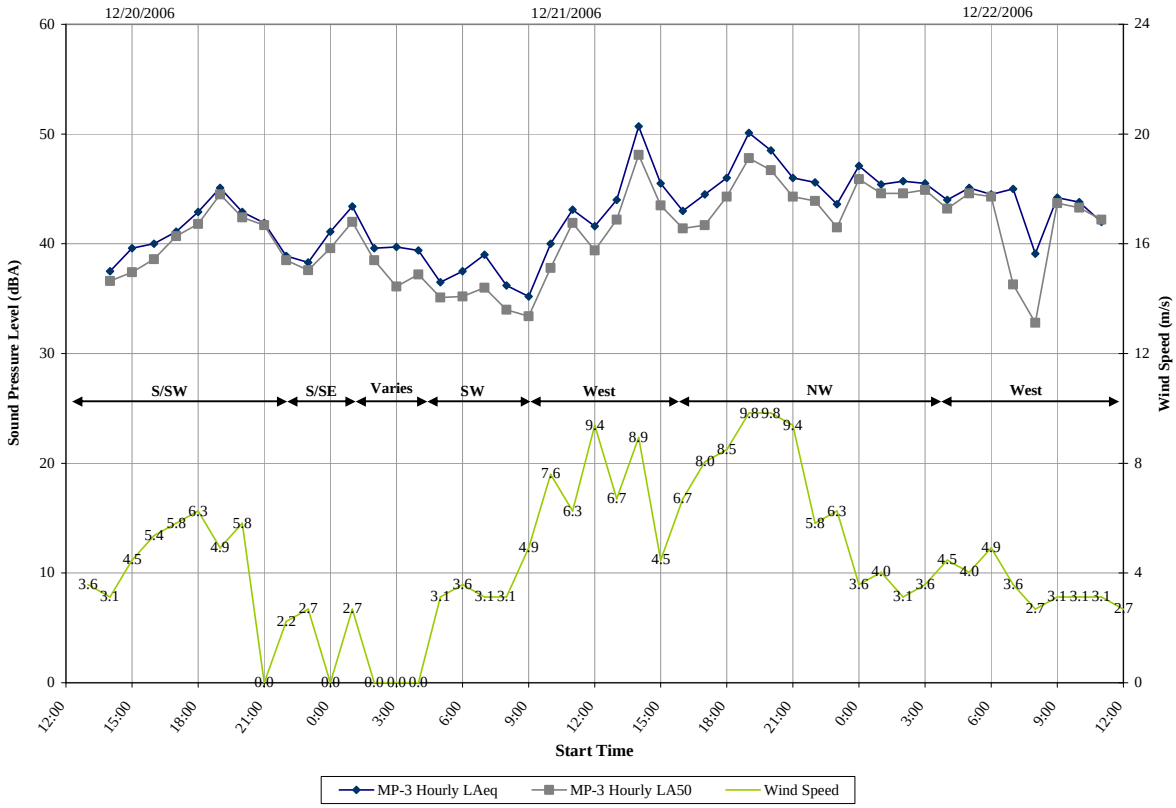


Figure 6-3. Hourly Ambient Sound Levels at MP-3 in Relation to Surface Wind



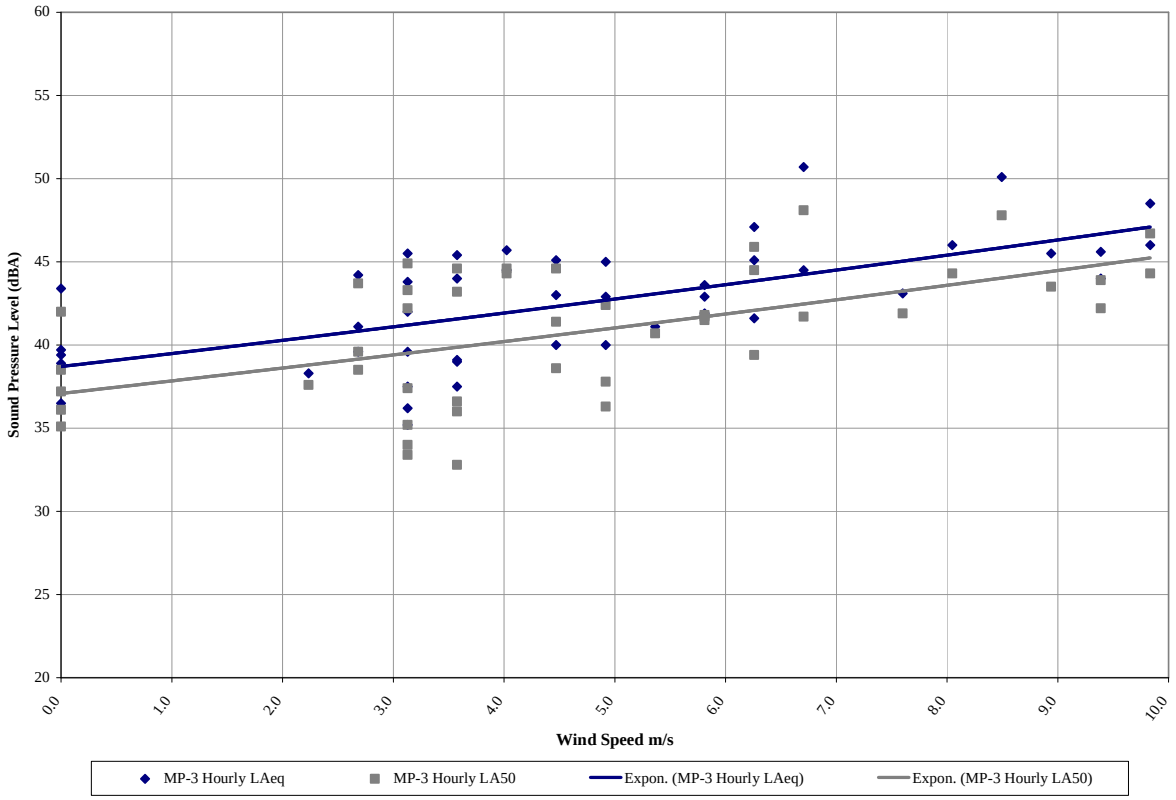
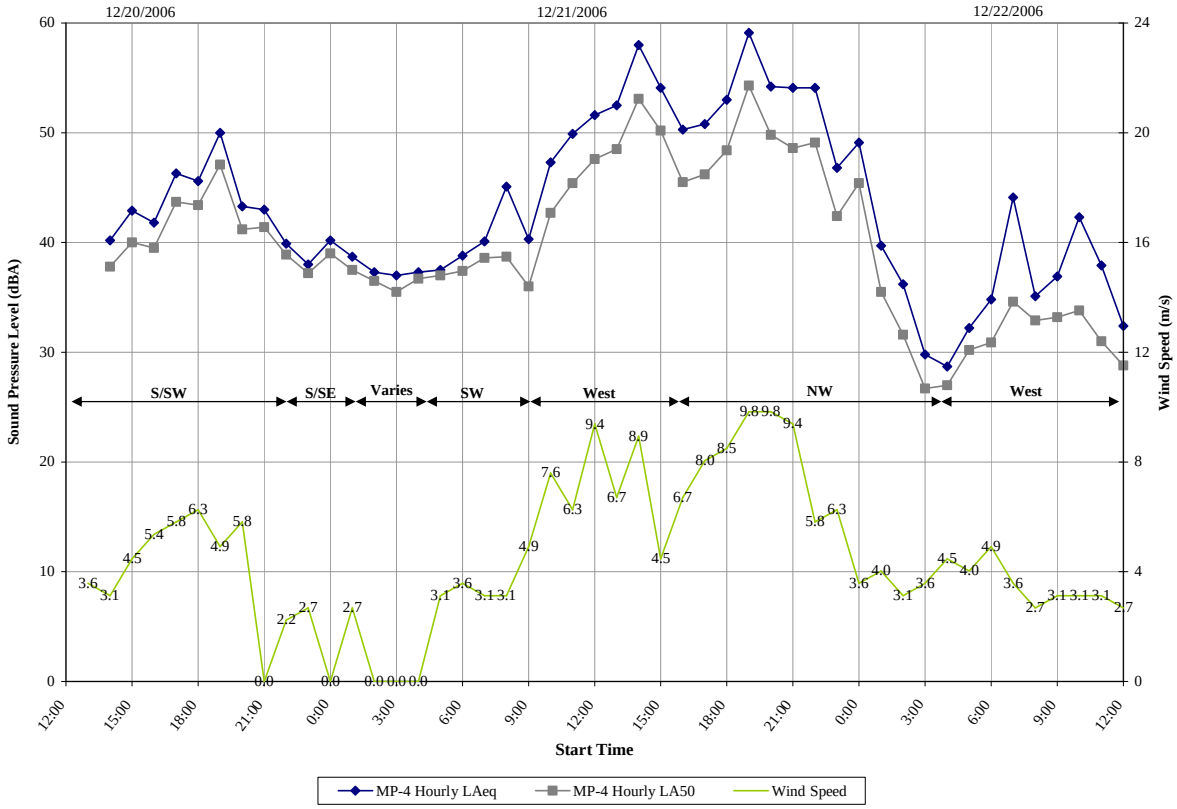


Figure 6-4. Hourly Ambient Sound Levels at MP-4 in Relation to Surface Wind



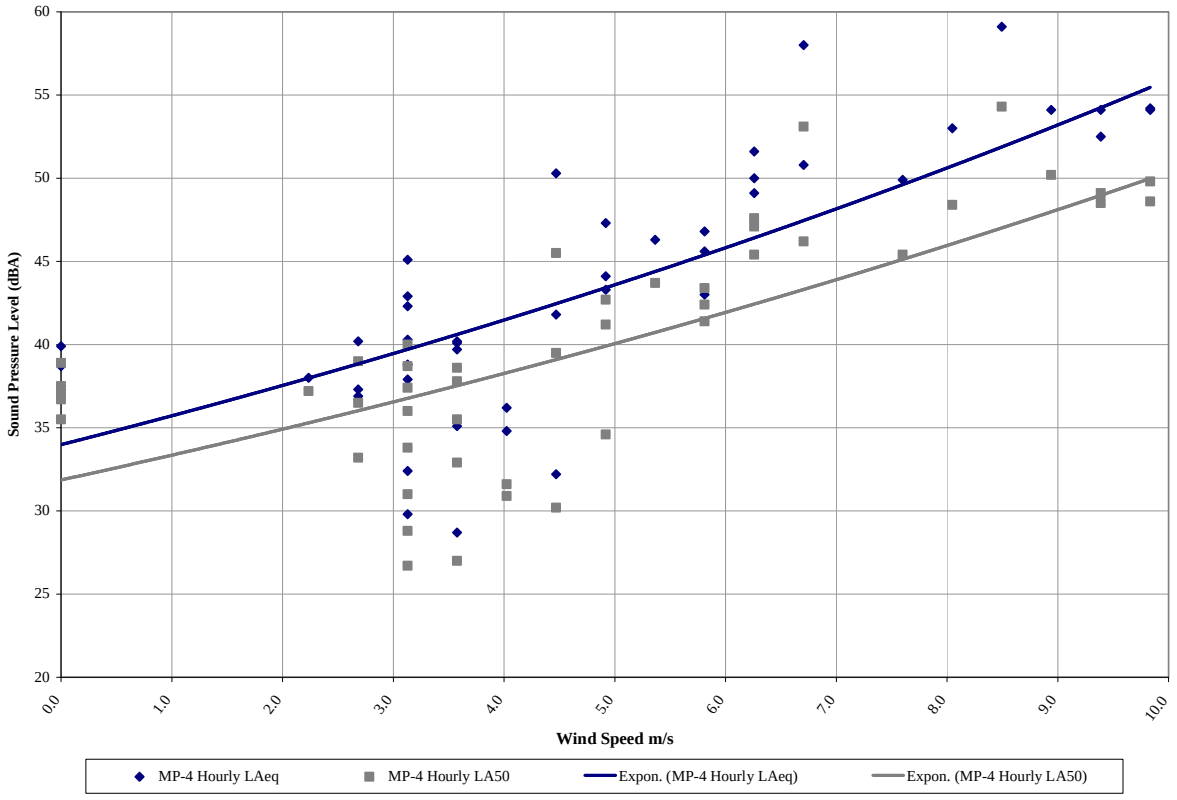
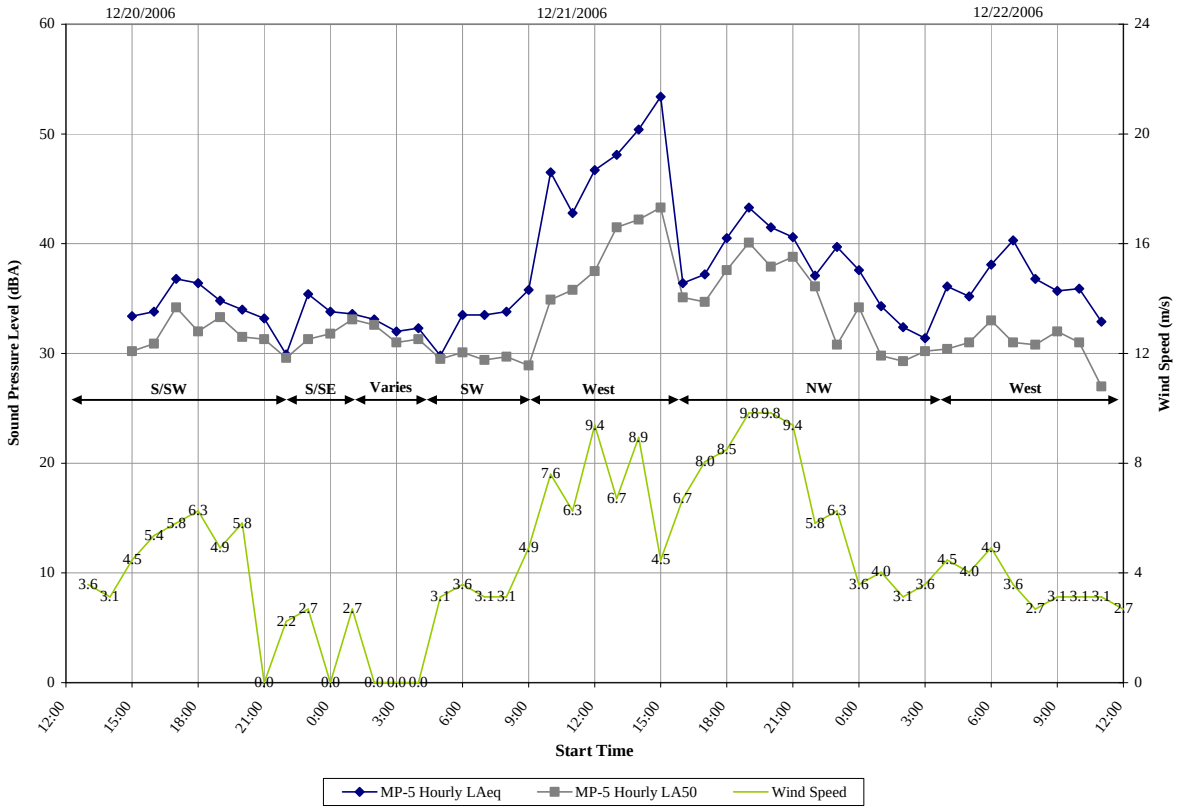


Figure 6-5. Hourly Ambient Sound Levels at MP-5 in Relation to Surface Wind



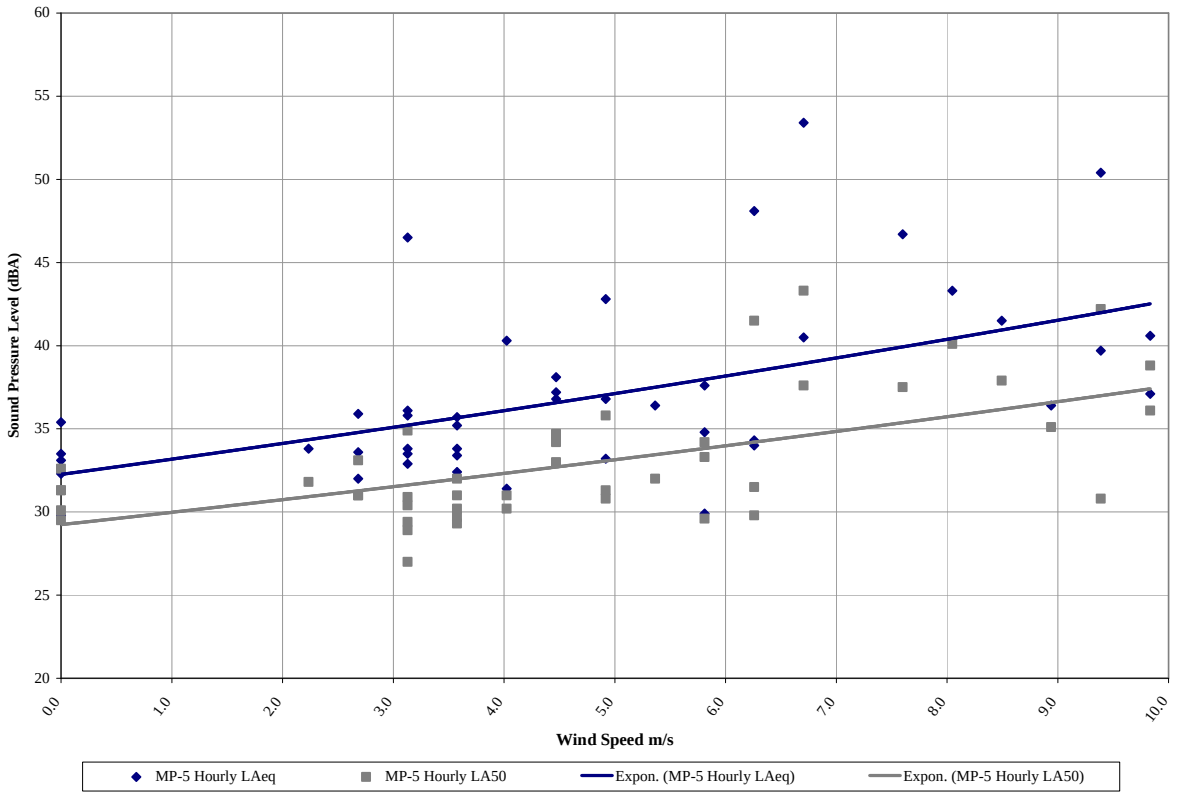
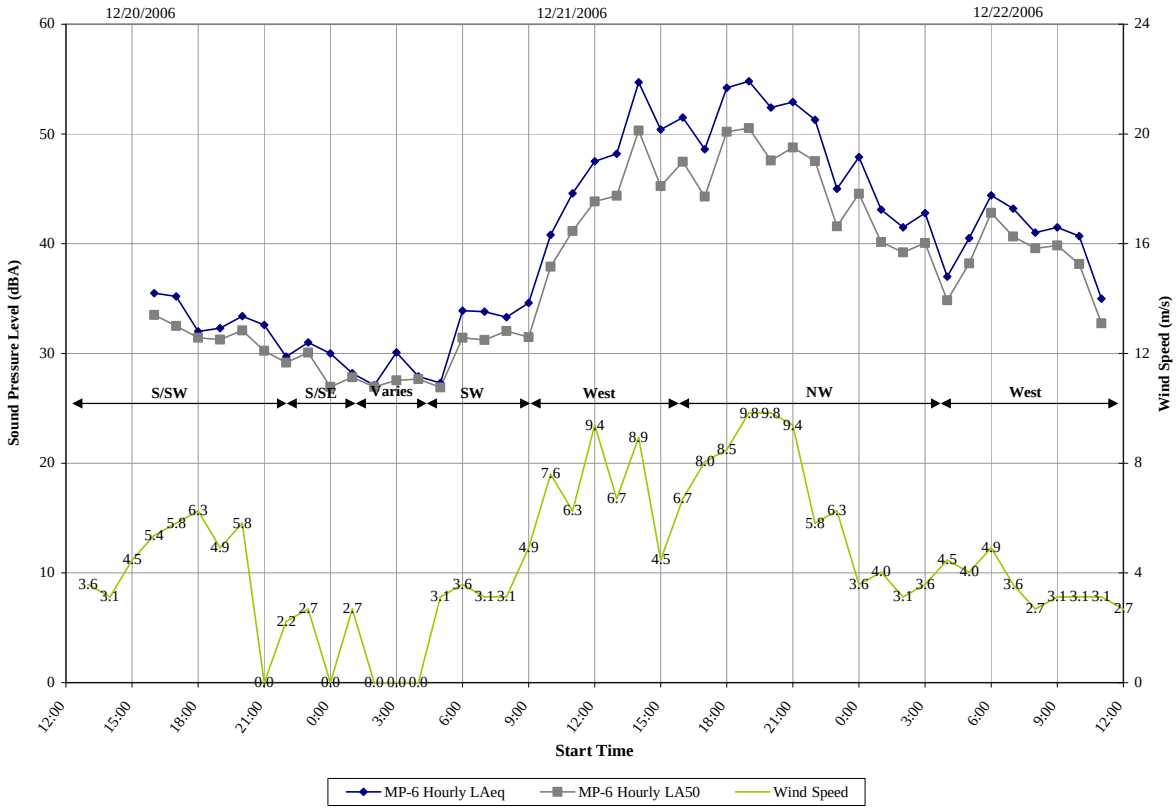
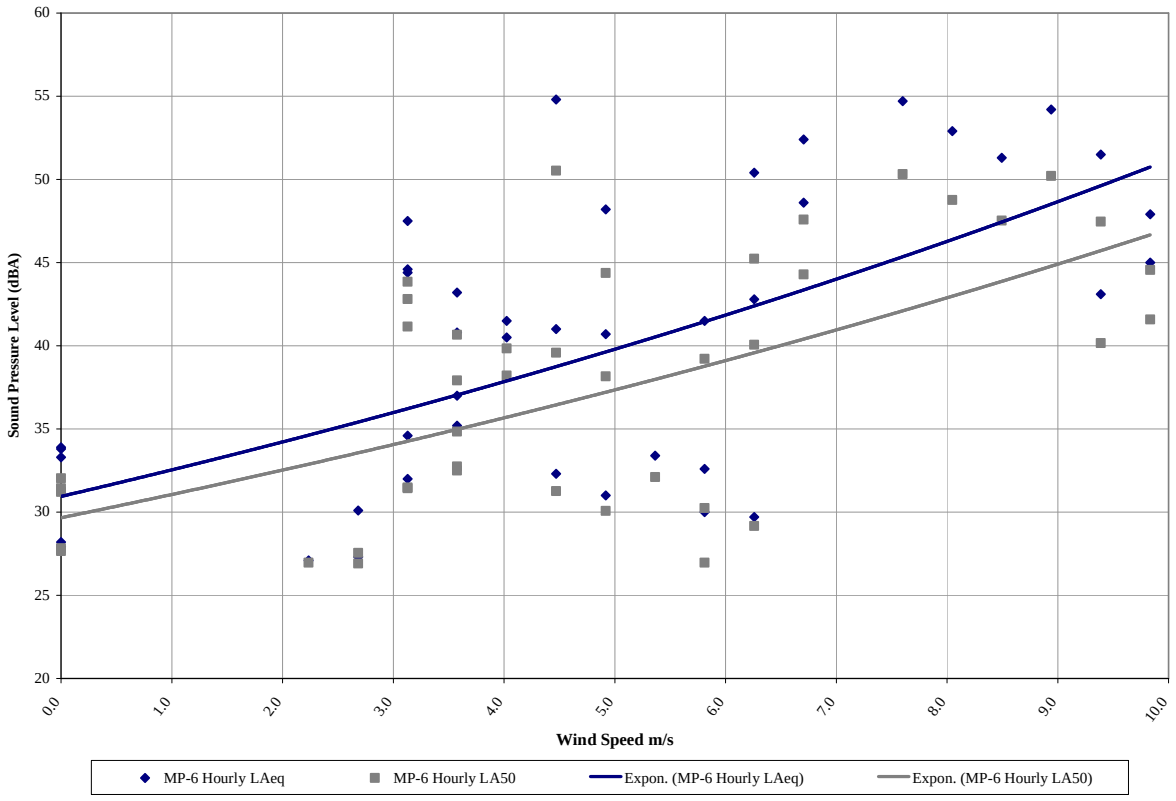


Figure 6-6. Hourly Ambient Sound Levels at MP-6 in Relation to Surface Wind





7.0 OPERATING SOUND LEVELS

RSE conducted operations sound testing starting the afternoon of May 8, 2007 and continuing until the afternoon of May 12, 2007. The monitoring extended over a 96-hour period, exceeding the minimum 24-hour period prescribed under the sound level monitoring plan approved by MEDEP. This Sound Level Monitoring Plan can be found in Appendix I. Sound levels were measured under a variety of wind and operating conditions in order to determine by measurement, sound levels at community monitoring positions during routine operation of the Wind Farm. Measured sound levels are compared to ambient sound levels and predicted sound levels of Wind Farm operation provided to the MEDEP as part of the Site Permit application.

The predicted sound levels were based on operation of 35 wind turbines compared to the 28 wind turbines operating in the as-built configuration of the Wind Farm. Six of the possible locations where wind turbines were not erected are near the north end of the Wind Farm and over 3,000 feet west of the as-built turbine locations. The seventh possible location is also toward the north end and approximately 1,200 feet west of as-built turbines. A review of these possible turbine sites relative to the sound level prediction model indicates that operation of the seven additional wind turbines would provide a minimal sound level contribution to the monitoring positions. This finding is based on the closer proximity of multiple wind turbines to monitoring positions.

7.1 Measurement Procedures

To the extent practicable, measurements were conducted in accordance with Maine DEP Chapter 375.10 Section H.4, Measurement of Sound from Routine Operation of Developments. Consequently, a primary objective is to measure Wind Farm sound levels at nearby protected locations during conditions when the sound from the Wind Farm is most noticeable. This requires ample wind speeds at higher elevations for the wind turbines to operate at or near full power with less wind at the lower elevation, community monitoring positions. Much of the wind forecasting upon which field planning was based proved to be inaccurate. In response to changing weather and production forecasts, RSE frequently adjusted its field plans and schedules.

Based on their proximity to wind turbines and accessibility, nine monitoring positions were selected to represent protected locations in the vicinity of the Wind Farm. The monitoring positions are either within the boundaries of the Wind Farm or permission to conduct measurements was granted by the landowner. Figure 5-1 provides a map of the monitoring positions used during both ambient and operations sound level testing. The following provides a description of monitoring positions utilized during operations sound level testing and provides a distance to the nearest wind turbine:

Position	Description
MP-1	Same as ambient monitoring position. Property line of the Wind Farm and abutting residential parcel off East Ridge Road at the north end of the Wind Farm. MP-1 is approximately 800 feet west of turbine nos. 1 and 2.
MP-2	Same as ambient monitoring position. Along the main Wind Farm access road and nearby a residential parcel off East Ridge Road and west of the Wind Farm. MP-2 is approximately 5900 feet west of turbines no. 17.
MP-3	Same as ambient monitoring position. At the base of Big Rock Ski Area and at the residential lot within the Big Rock Subdivision nearest to the Wind Farm. MP-3 is approximately 3400 feet west of turbine no. 28.
MP-4A	Relocation of ambient position MP-4 approximately 2000 feet east toward the Wind Farm. Near golf course hole no. 12 approximately 3250 feet west of turbine no. 22.

MP-5	Same as ambient monitoring position. At a residential property along Mountain Road east of the southern portion of the Wind Farm . MP-5 is approximately 3400 feet east of turbine no. 19.
MP-6	Residential parcel near the north end of Mountain Road and to the east of the Wind Farm. MP-6 is approximately 2050 feet east of turbine no. 6.
MP-6A	Position added for operations sound level testing. Approximately 1200 feet south of position MP-6 and 2100 feet east of turbine no. 7.
MP-7	Position added for operations sound level testing. Near residential parcel off Mountain Road approximately 2500 feet east of turbine no. 11.
MP-8	Position added for operations sound level testing. Near property line an abutting residential parcel off East Ridge Road at the north end of the Wind Farm. Approximately 1200 feet east of turbine nos. 1 and 2.

Instrumentation consisted of six Larson-Davis Model 812 Integrating Sound Level Meters, three Larson-Davis Model 824 Sound Level Meter/Real Time Analyzers and a CEL 593 Sound Level Analyzer. The LD 812s, two LD 824s and the CEL 593 were used for continuous sound level measurements at the nine community monitoring positions. In addition to overall broadband sound levels, the LD 824s and CEL 593 measure one-third octave band levels. The other LD 824 was used to conduct spot measurements at the positions on a rotating basis. The sound level meters meet Type 1 (precision) performance requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4-1983. The microphones were fitted with standard windscreens and mounted on tripods at a height of approximately five feet above the ground. The sound level meters were calibrated before and after the monitoring period.

Sound levels were simultaneously measured at all nine monitoring positions over a period of approximately 96 hours representing a range of weather and Wind Farm operating conditions. Over this period, sound levels were measured every 1/8 second to record both short-term and hourly statistics at each position. A project engineer and field technician recorded field observations and weather conditions, and measured one-third octave band sound levels at each monitoring position on a rotating basis. Field observations supplement sound level data to determine the primary contributors to the measured sound levels. These contributors included sound from wind turbines and non-Wind Farm sources such as wind sound, wind-induced sound from trees, road traffic, residential activity, aircraft traffic and natural sounds particularly frogs and birds.

UPC Operations recorded operating and meteorological data from each turbine every ten seconds and reported the average readings at ten-minute intervals. Data includes power production, wind speed, wind direction, and rotor rpm. Graphs showing power production and wind speed data for each wind turbine can be found in Appendix III. A graph showing both the measured wind speed and direction for Turbine no. 15 is also provided in Appendix III.

The following describes the measurement parameters, field observations, Wind Farm operating data, and meteorological data recorded during the measurement period at each monitoring position.

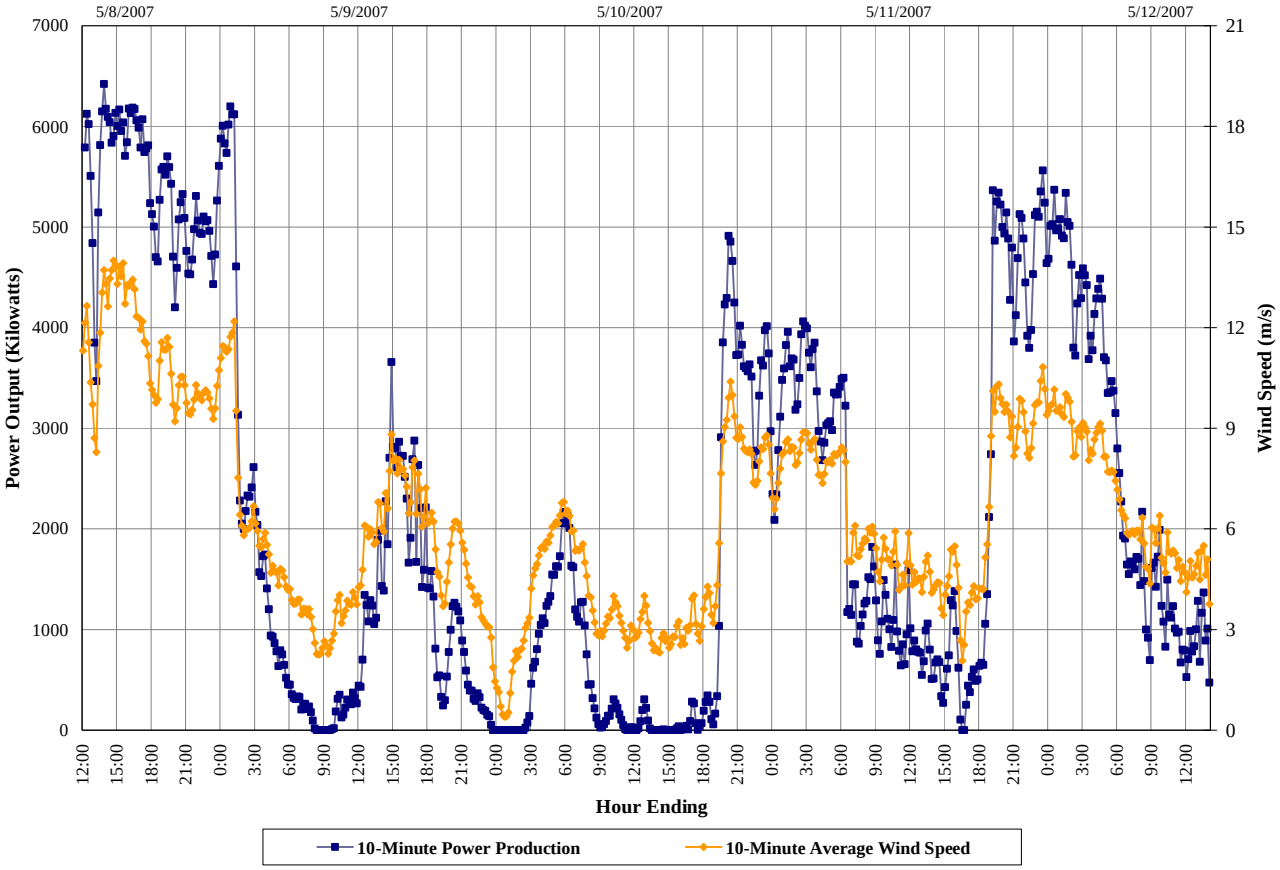
7.2 Measurement Results

During the 96-hour test period, sound levels were measured under a variety of wind and operating conditions. Wind turbine operating levels ranged from full power production during periods of strong wind to no power production during periods of light or calm winds. The highest wind speeds and turbine operations occurred during the afternoon of May 8 and the overnight period of May 8-9. Winds were from the southwest and reached speeds over 15 meters/second (34 mph) at the turbine hubs. Winds were light and variable for a 36-hour period beginning in the early morning of May 9 and continuing until the evening of May 10. At that time, winds increased from the southeast and generally ranged from 6 to 10 m/s (13 to 22 mph) at the turbine hubs during the overnight period. Winds diminished and

were light during the daytime on May 11 and increased after heavy rain showers moved through just after dark. Monitoring was suspended during this period of precipitation. During the overnight period of May 11-12, winds were from the north-northwest with higher winds at 8 to 14 m/s (17.9 to 31.3 mph) at the upper wind turbines near the center and south end of the Wind Farm and 5 to 8 m/s (11.2 to 17.9 mph) at the lower wind turbines at the north end of the Wind Farm.

To provide an overview of Wind Farm operations during the 96-hour monitoring period, Figure 7 presents a graph showing the overall average wind speed at the turbine hubs and average power production of the Wind Farm. Each data point represents a ten minute period of Wind Farm operation. Electric power production is presented in kilowatts (kW). With all 28 turbines operating at full load, the Wind Farm has the capacity to generate 7,000 kW of electric power during a 10-minute period.

Figure 7. Wind Farm Power Generation and Average Wind Speed during the 96-Hour Operations Test Period



Three of the four overnight monitoring periods provided moderate to full levels of wind power production and several hours of representative measurements of wind turbine sound at several positions. During most other periods, power production was low resulting in a blending of turbine and other sound sources making it difficult to isolate wind turbine sound levels. During periods of light to calm winds for the 24-hour period beginning at 2100 on May 9 the Wind Farm was essentially shut down. Consequently, sound level measurements during this period represent ambient sound levels without Wind Farm operation. A small number of the 28 wind turbines experienced periodic shutdowns for maintenance or repair (see Appendix III), as has been typical during the first several months of project operation. Notable non-wind turbine sound sources included wind, wind on trees, birds, and frogs.

Figures 7-1 through 7-8 present measured hourly L_{Aeq} and L_{A50} readings at each position in relation to the average power output of nearby wind turbines, the average wind speed at the hub of the nearest turbine and surface wind speed and direction. MEDEP regulations are based on the L_{Aeq} parameter which includes all sound energy from wind turbine and other sound sources such as wind, birds, and frogs. Field observations and measurements suggest that the L_{A50} parameter effectively reduces the contribution of non-wind turbine sounds during many measurement periods while providing a statistical approximation of overall wind turbine sound levels. Appendix IV contains tables and graphs of sound level measurements during Wind Farm operations. The readings include hourly L_{Aeq}, L_{A1}, L_{A10}, L_{A50} and L_{A90} values for each measurement position. Figures 7-9 through 7-12 present measured hourly L_{Aeq} readings at selected pairs and groups of turbines that have similar wind conditions and nearby turbine operations. When measurement results show that sound level fluctuations at similar positions do not coincide, periods of sound contributions from non-Wind Farm sources (*e.g.*, frogs and birds) are likely to have occurred. Field observations at similar positions are also compared to determine the relative contributions of various sound sources.

The overall A-weighted sound level measurements, as presented in Figures 7-1 through 7-12, were supplemented with measurements of one-third octave band (third octave) sound levels and field observations by RSE personnel. At positions MP-1, MP-4A and MP-7, third octave levels were measured on a near-continuous basis throughout the 96-hour monitoring period. At other positions, octave levels were measured on a rotating basis coinciding with field observations. Appendix V contains a series of graphs presenting third octave sound levels measured during field observations at each monitoring position. In addition to third octave sound levels, each graph provides the overall A-weighted sound level, a summary of field observations, and turbine power production and wind speed data.

The results presented in Figures 7-1 through 7-12, third octave sound level measurements (Appendix V), and field observations were used to determine the contribution of turbine sound levels at each monitoring position and evaluate the presence of short duration repetitive sounds. Measurements of third octave sound levels and field observations were also used to determine the presence of tonal sounds from the Wind Farm. An evaluation of short duration repetitive and tonal sounds in accordance with MEDEP 375.10 can be found in Section 7.2.

To determine the sound level contribution of the Wind Farm alone, non-Wind Farm sound must be subtracted from measured sound levels at each position. These sounds include wind sound, wind-induced sound in trees, frogs, birds and local traffic. The contribution of frogs and birds can be identified from third octave band sound level measurements (see Appendix V). The contribution of wind related sounds is difficult to identify due to similarities with the frequency spectra of Wind Farm sound.

Much like the sound from wind turbines, wind-induced sound changes with wind conditions. Shielding from vegetation and terrain varies with wind direction and gradients, and can fluctuate significantly over brief periods due to wind gusts and flow patterns around the ridge. Without specific wind data for each monitoring position, it was necessary to estimate the contribution of ambient sound levels from measurements during periods of the May 2007 operations testing when winds were light or calm and wind turbines were not operating. This is a very conservative approach to estimating ambient sound levels that are likely to occur during periods of significant Wind Farm operation. Sound level monitoring results and field observations from both December 2006 and May 2007 indicate that ambient sound levels during wind conditions required for significant Wind Farm operation are generally higher than estimated by this method. As a result, it is likely that the sound contribution due to Wind Farm operation has been slightly over-estimated in some cases, despite the correction for ambient.

Figure 7-1. Sound Levels at MP-1 in Relation to Wind Turbine Power Output and Wind Speed

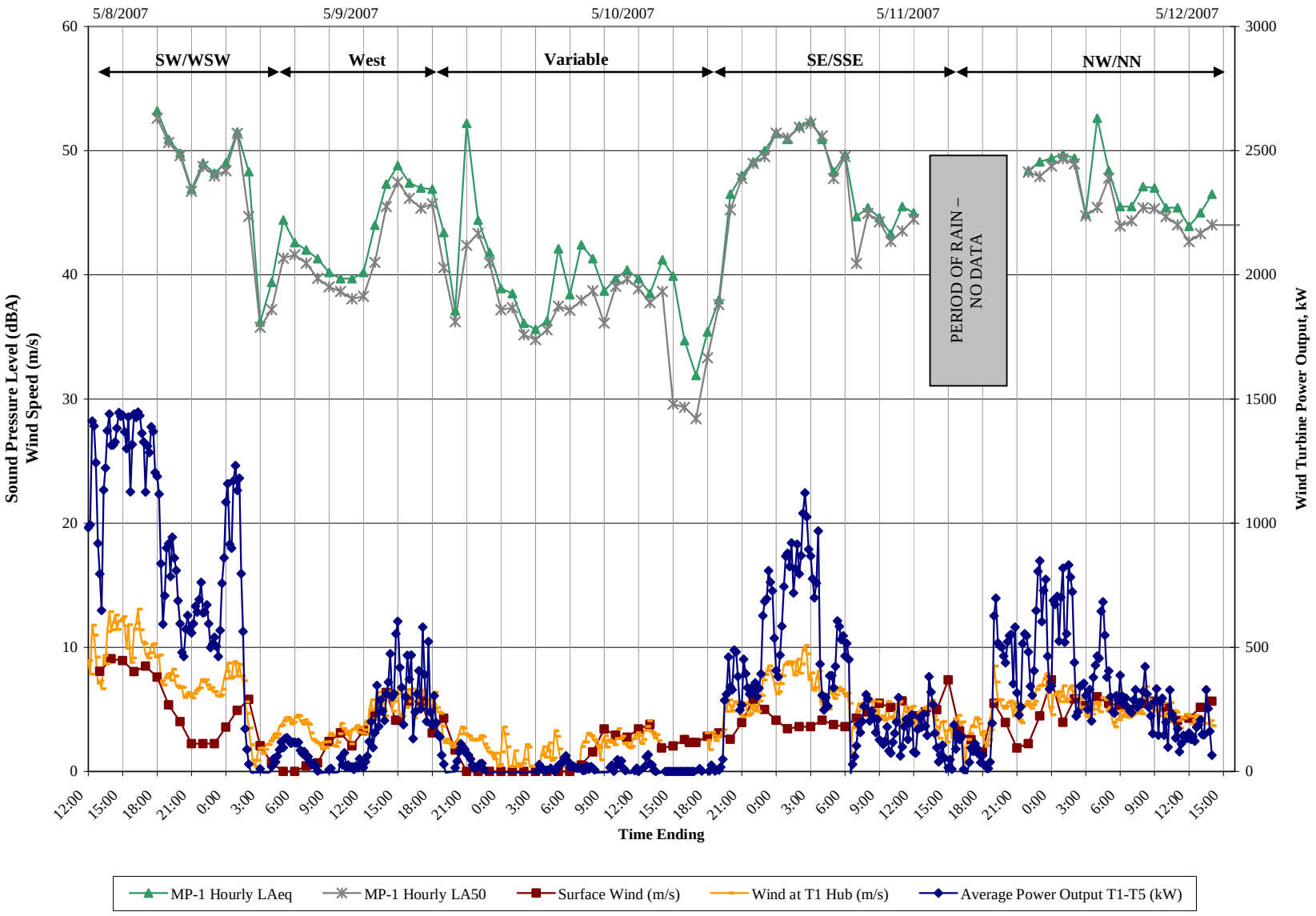


Figure 7-2. Sound Levels at MP2 in Relation to Wind Turbine Power Output and Wind Speed

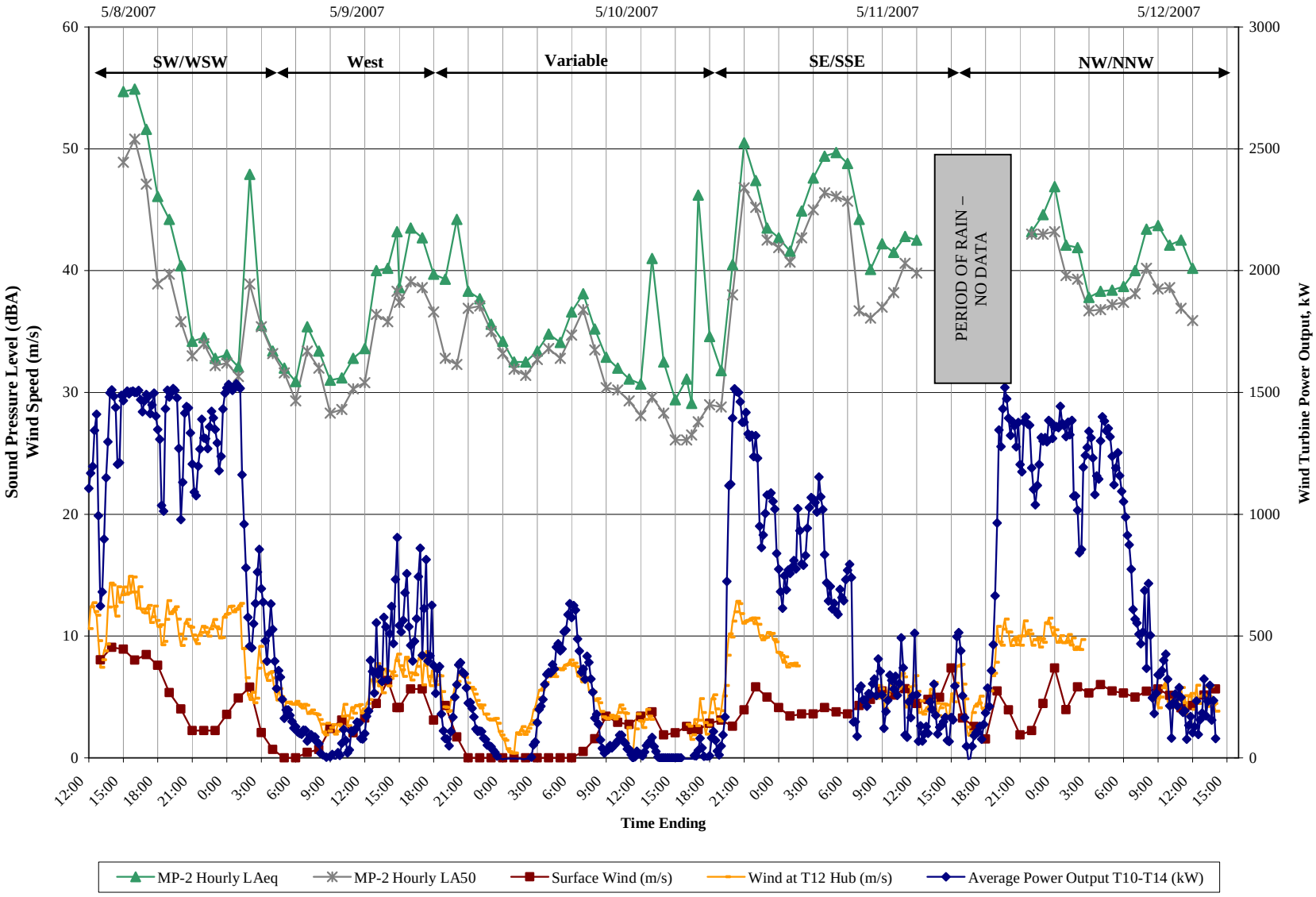


Figure 7-3. Sound Levels at MP-3 in Relation to Wind Turbine Power Output and Wind Speed

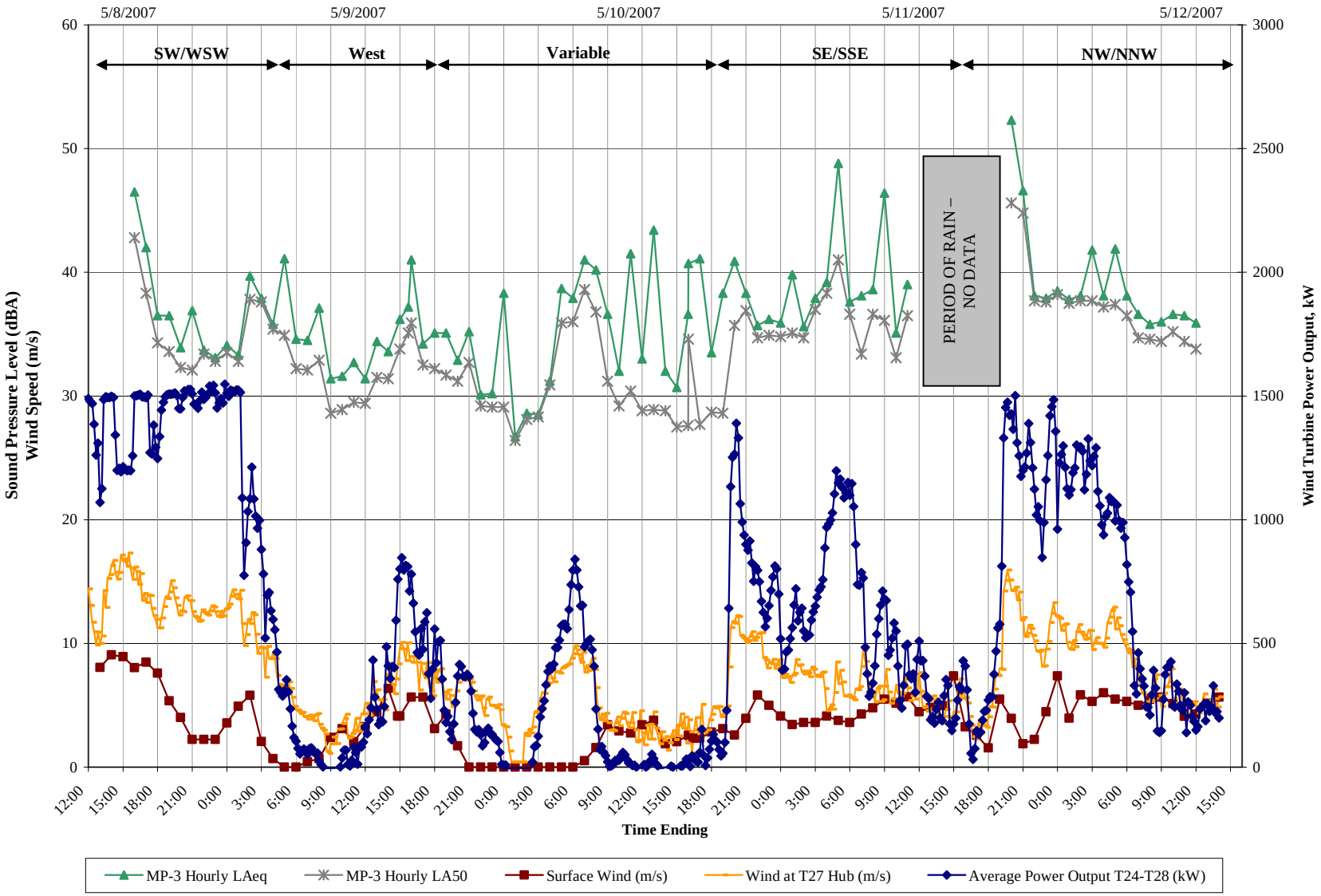
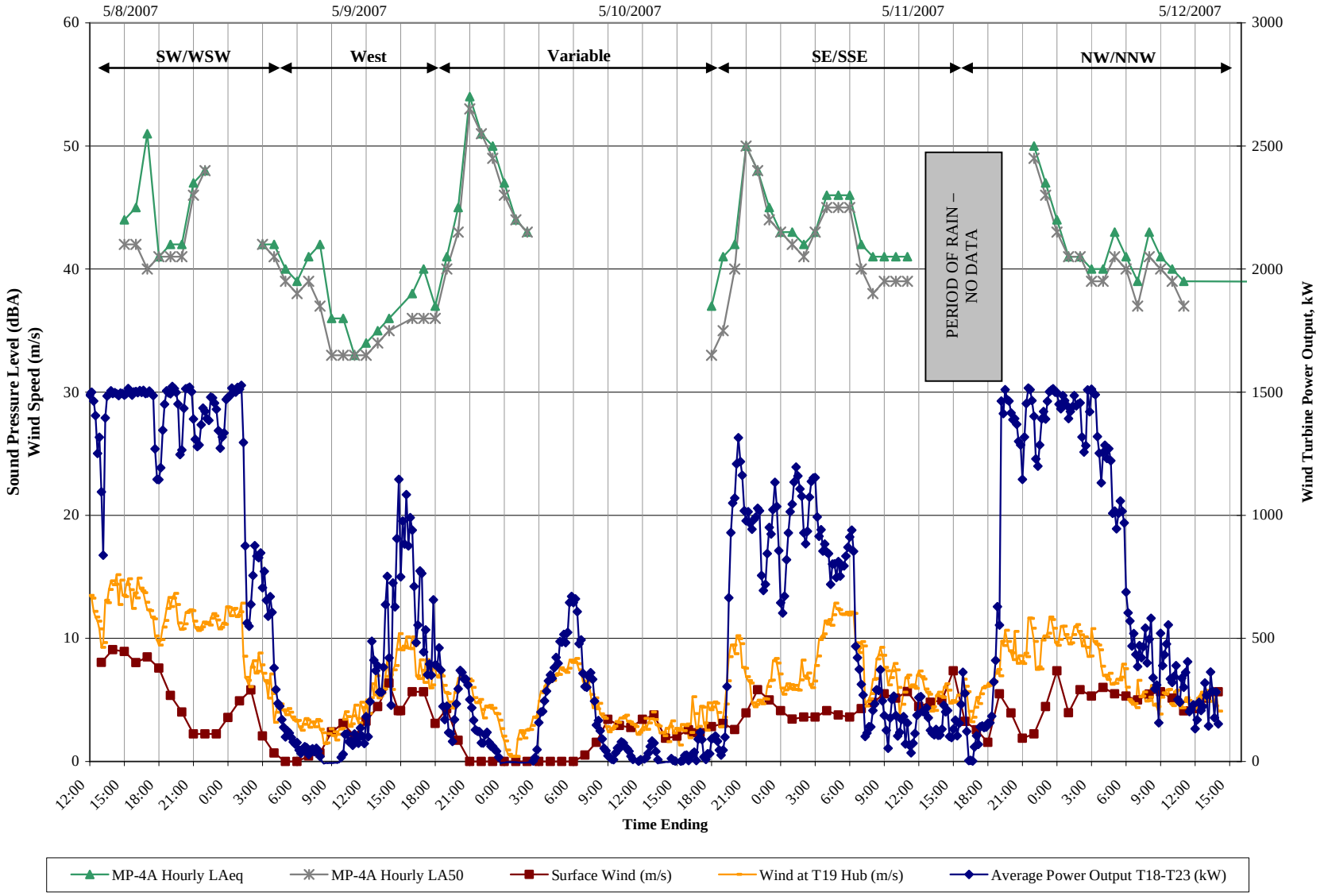


Figure 7-4. Sound Levels at MP-4A in Relation to Wind Turbine Power Output and Wind Speed



Note: Data Gaps Other Than Rain Due to Battery Failure

Figure 7-5. Sound Levels at MP-5 in Relation to Wind Turbine Power Output and Wind Speed

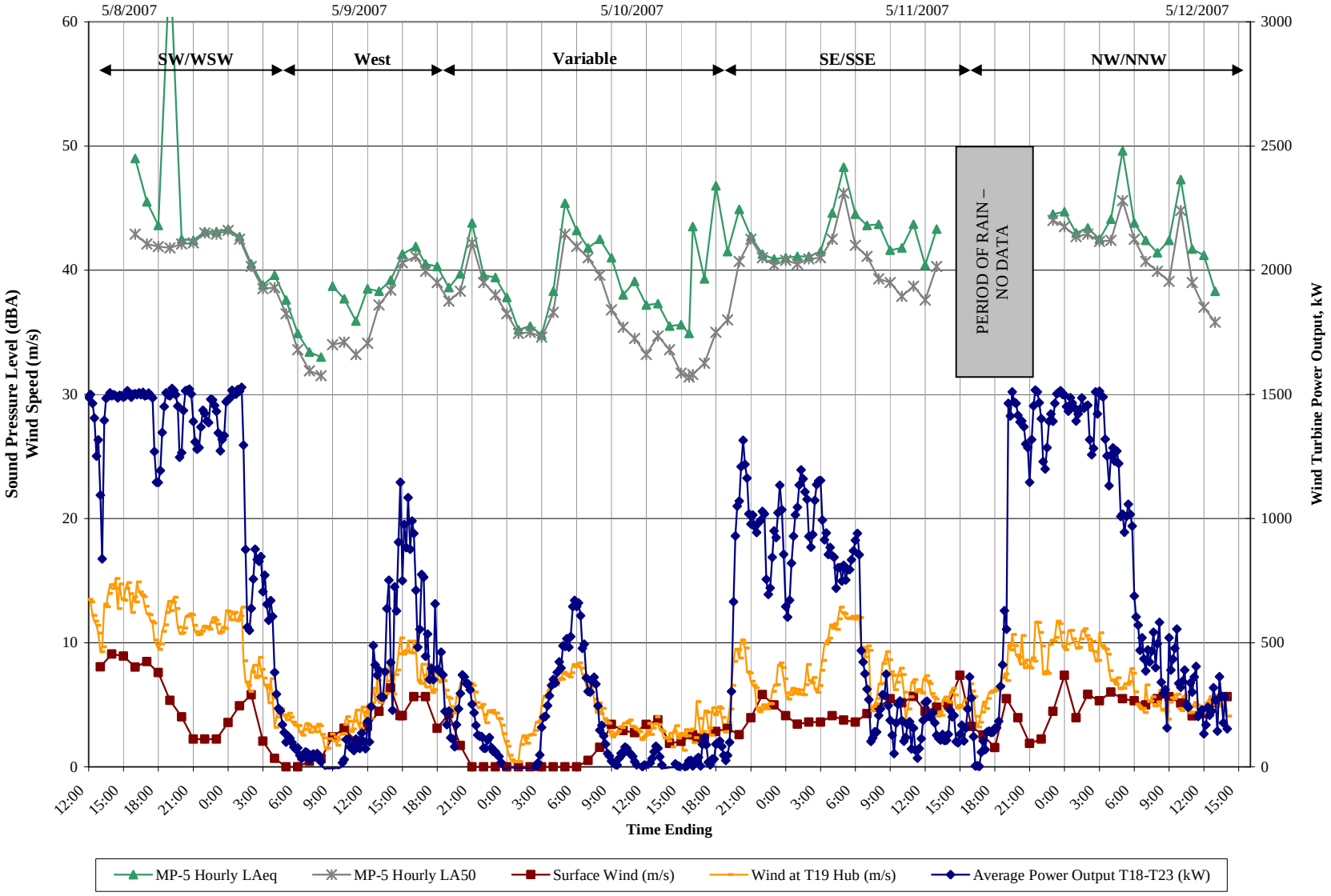


Figure 7-6. Sound Levels at MP-6 in Relation to Wind Turbine Power Output and Wind Speed

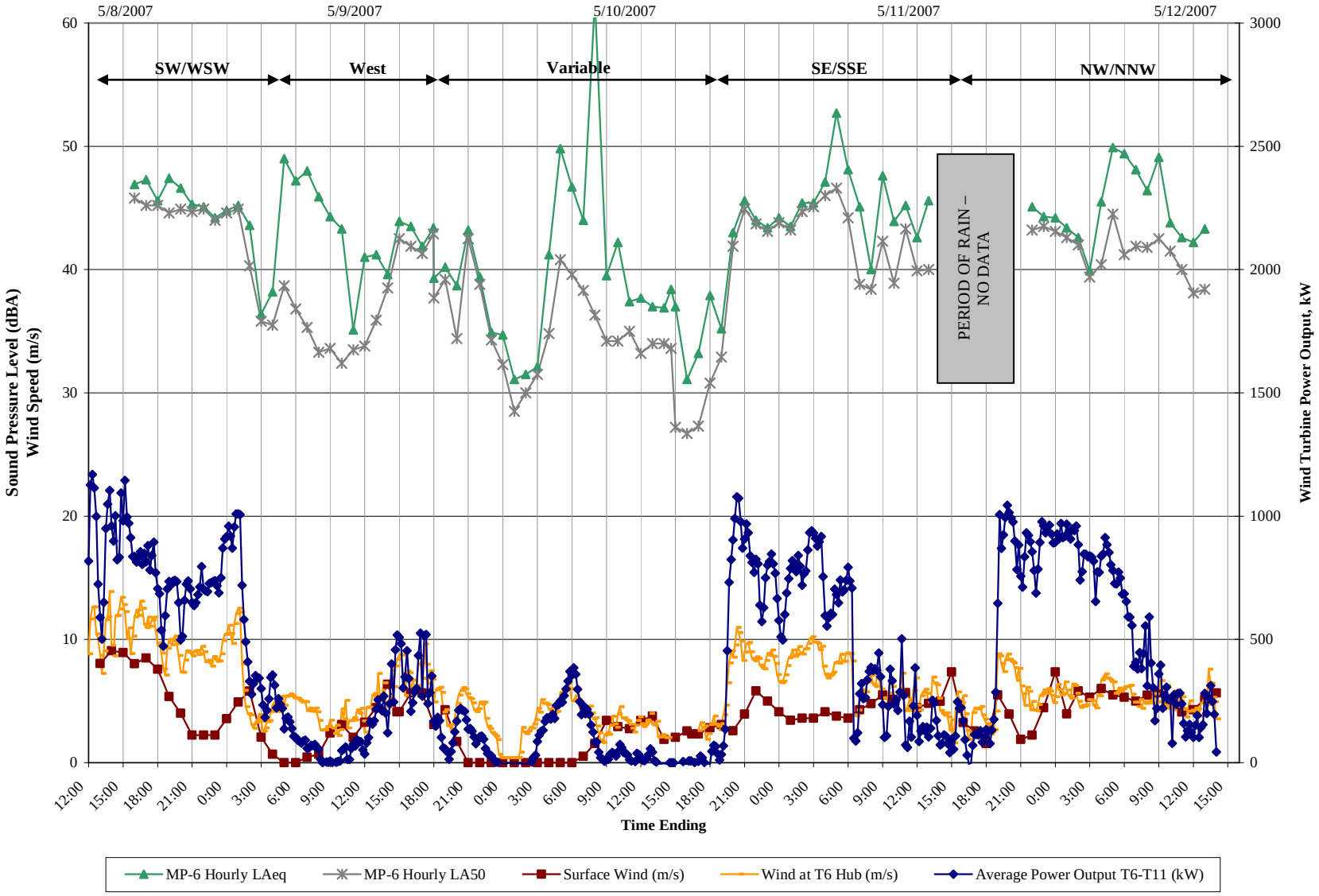


Figure 7-6A. Sound Levels at MP-6A in Relation to Wind Turbine Power Output and Wind Speed

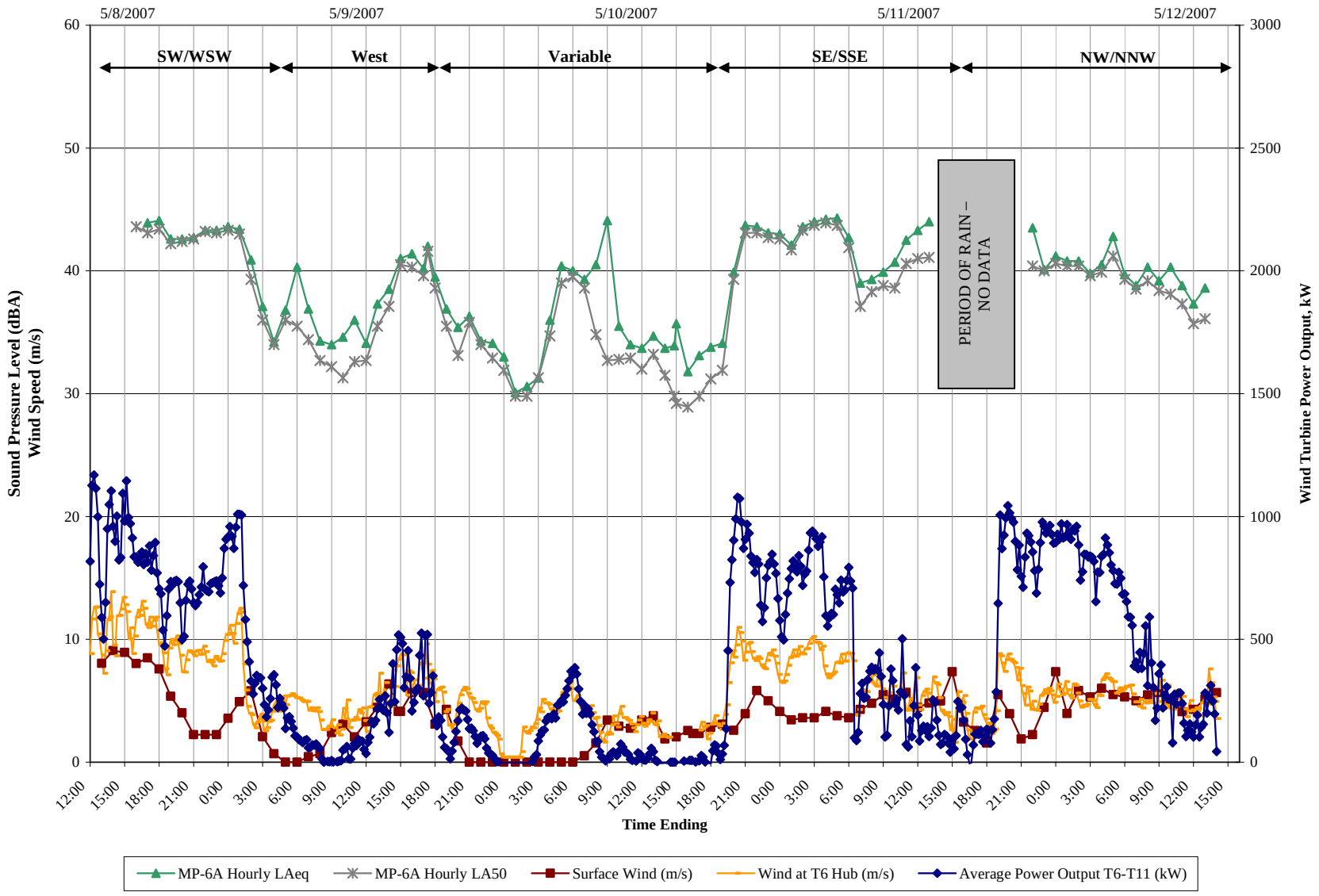


Figure 7-7. Sound Levels at MP-7 in Relation to Wind Turbine Power Output and Wind Speed

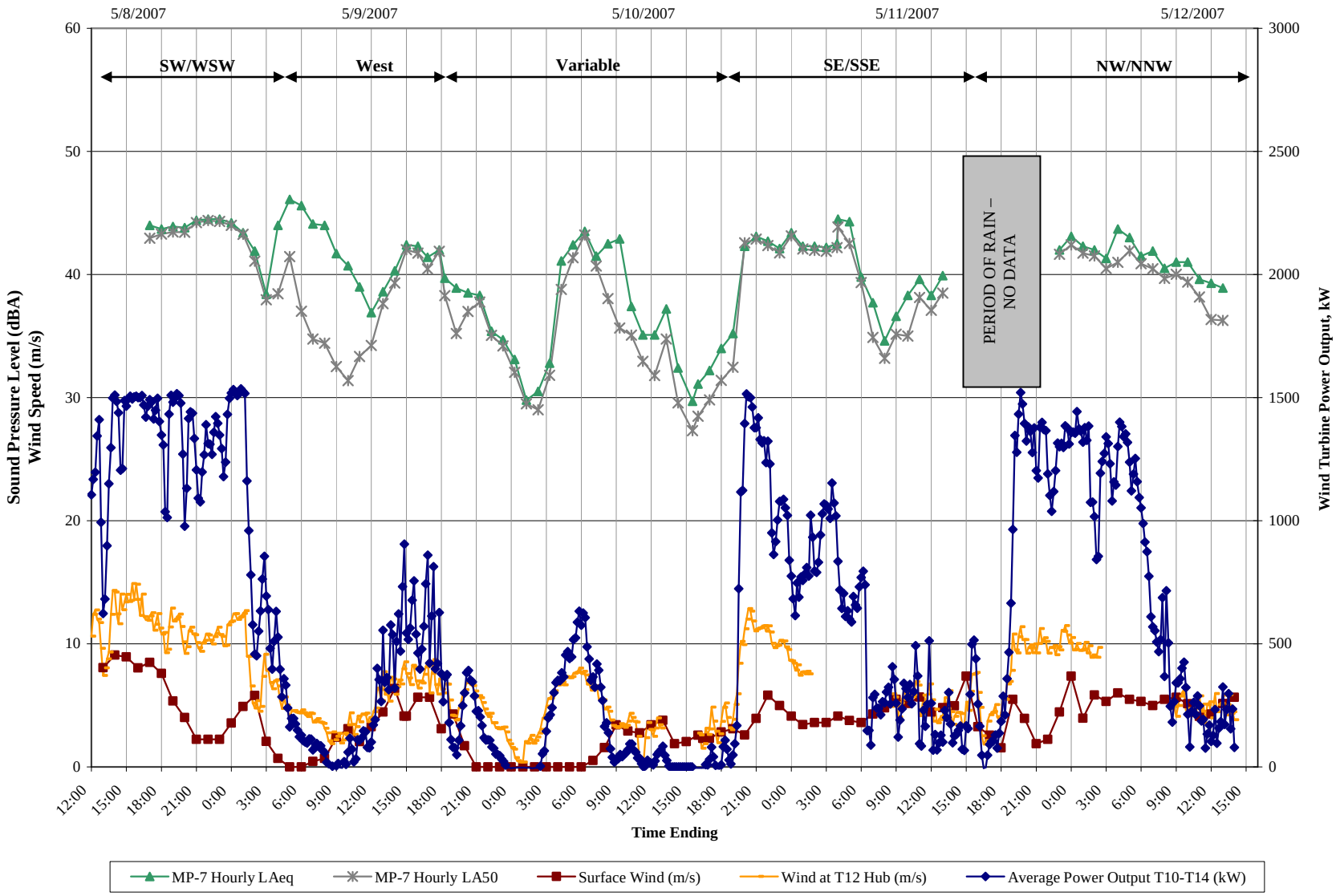


Figure 7-8. Sound Levels at MP-8 in Relation to Wind Turbine Power Output and Wind Speed

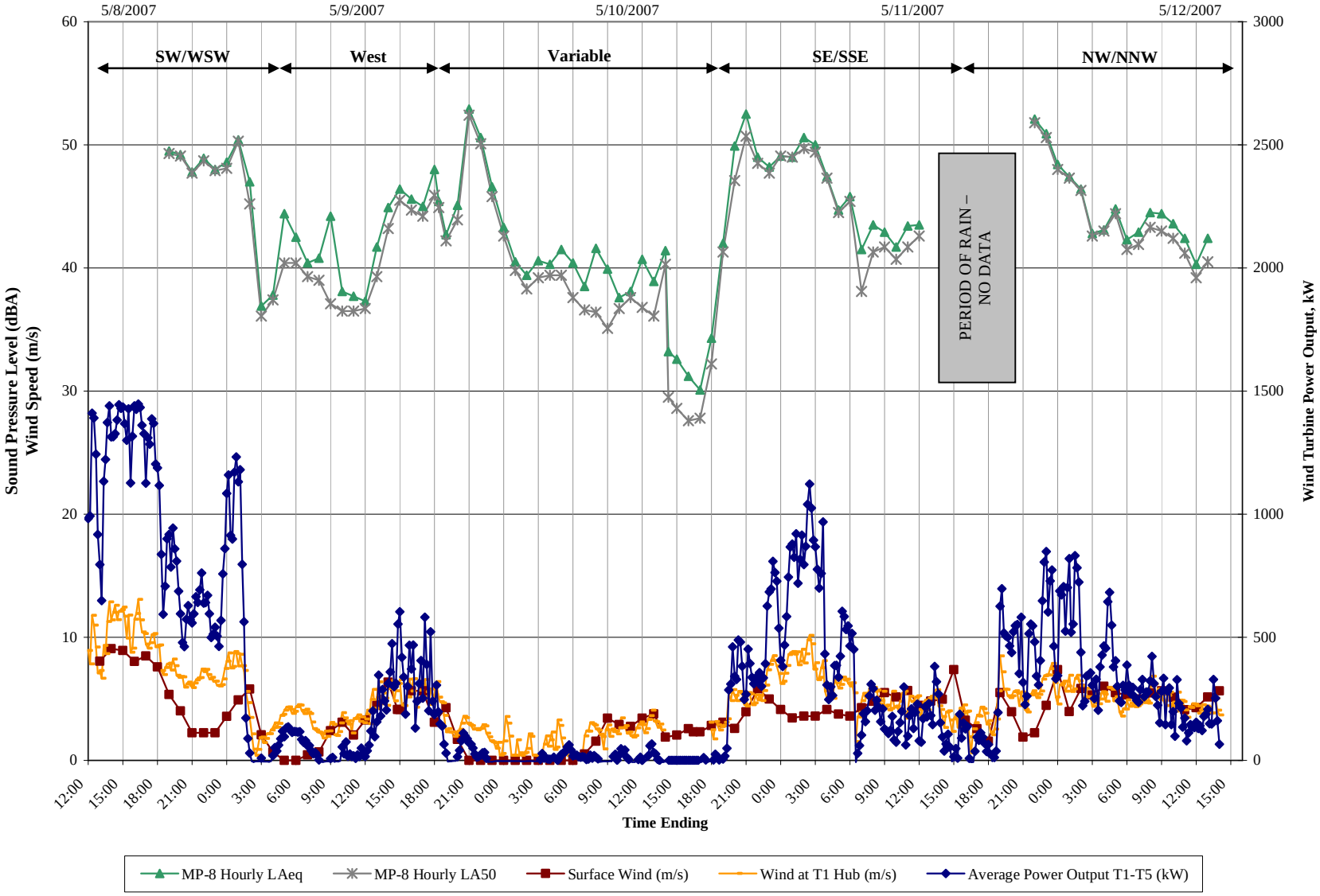


Figure 7-9. Sound Levels at MP-1 and MP-8 in Relation to Wind Turbine Power Output and Wind Speed

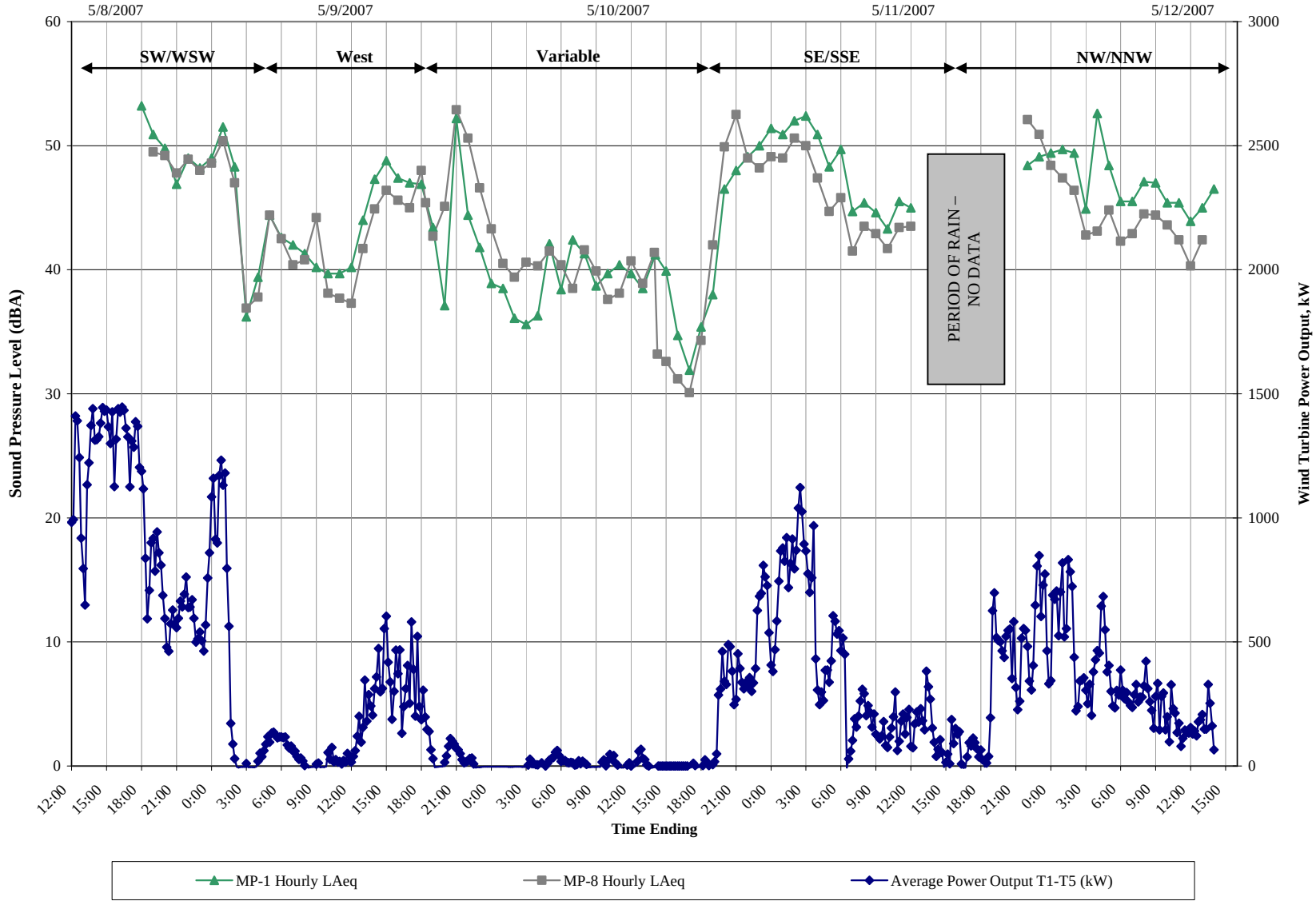


Figure 7-10. Sound Levels at MP-6 and MP-6A in Relation to Wind Turbine Power Output and Wind Speed

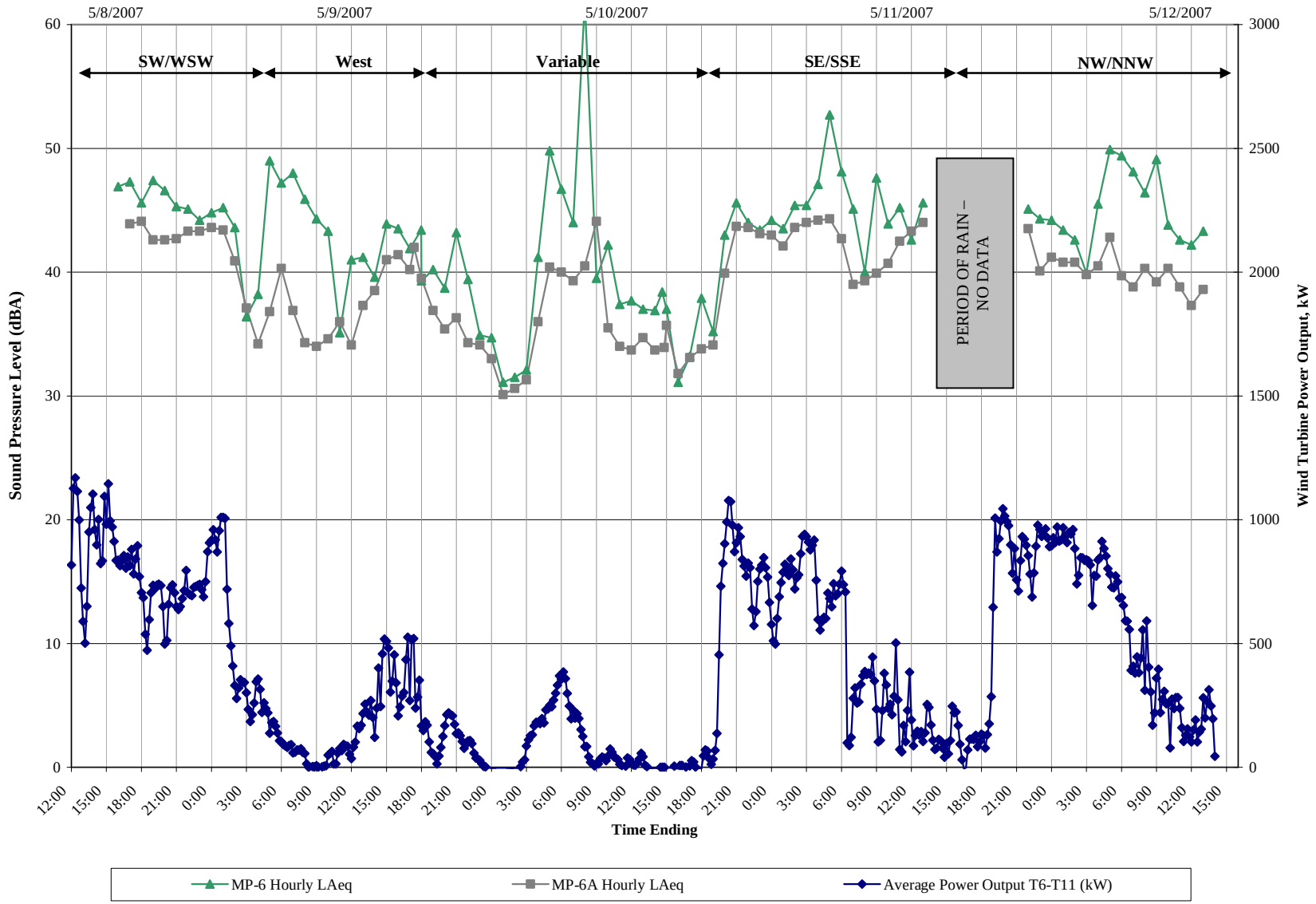


Figure 7-11. Sound Levels at MP5 and MP-7 in Relation to Wind Turbine Power Output and Wind Speed

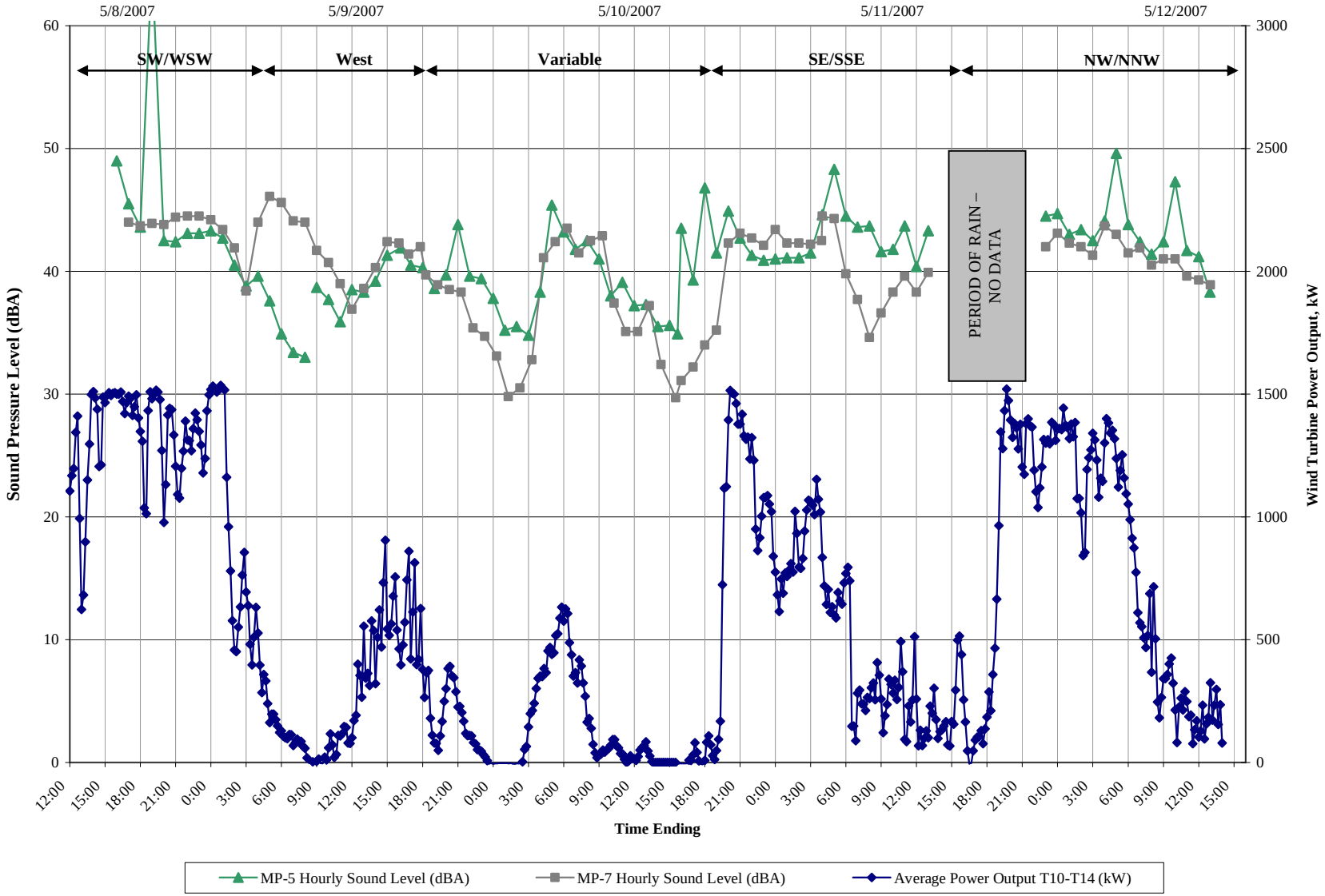
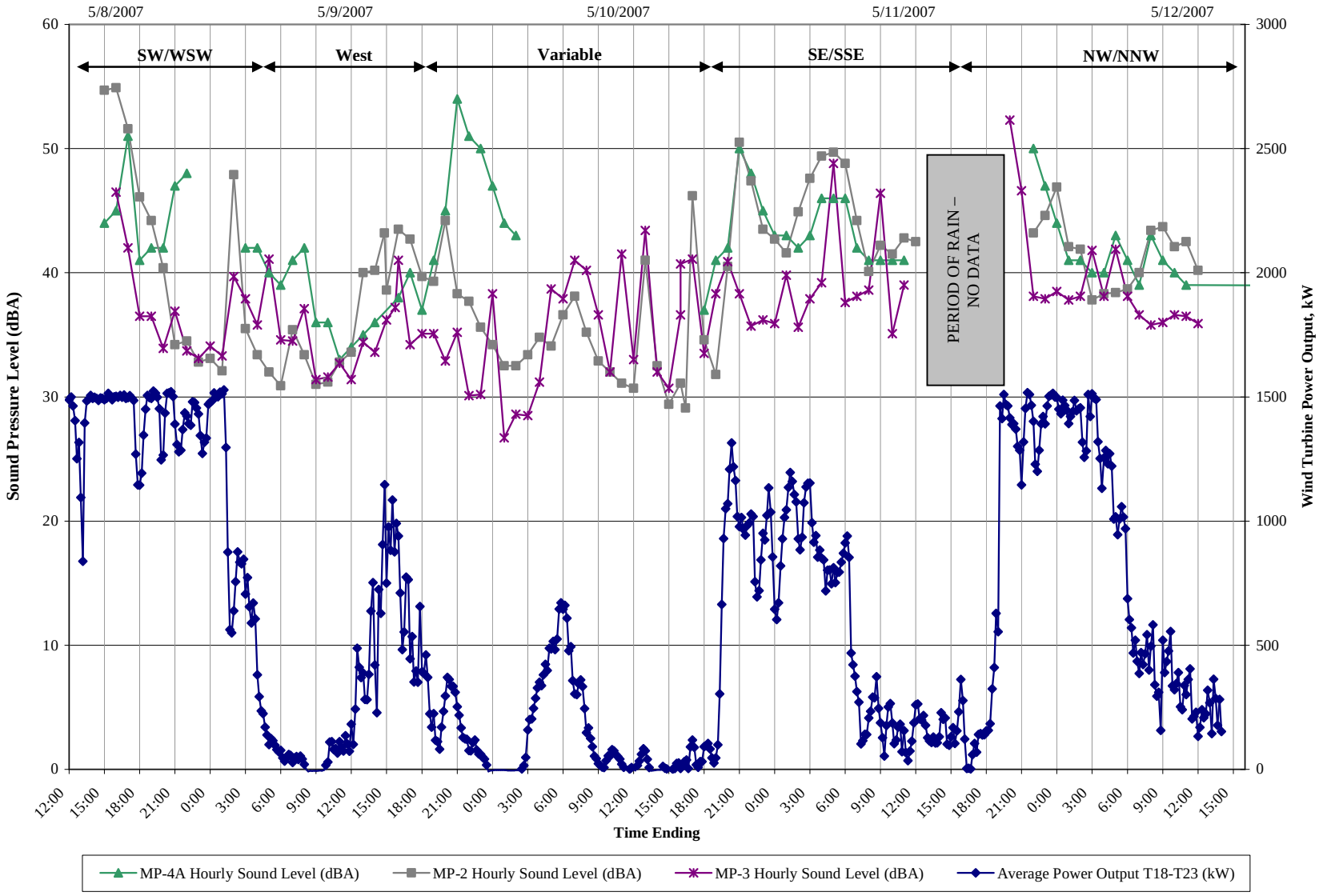


Figure 7-12. Sound Levels at MP-2, MP-3 and MP-4A in Relation to Wind Turbine Power Output and Wind Speed



Field observations and measurements indicate that during periods when the difference between the L_{Aeq} and L_{A50} readings were small, sound from the Wind Farm was a primary source at the monitoring positions. To calculate the wind farm sound level at each position, the estimated ambient sound level from non-Wind Farm sounds was subtracted from measured L_{A50} sound level readings for these periods.

The following provides a summary of operating conditions and measurement results at each monitoring position and comparisons of operations test data with ambient conditions and sound level model estimates.

At Position MP-1 hourly sound levels from representative Wind Farm operations ranged from 47 to 51 dBA with SW wind and near full operations, ranged from 48 to 52 with SE wind and variable operation (50 to 75% power output) and 42 to 47 dBA with NNW wind and nearby power output of 50 to 60%. The estimated contribution of ambient, non-Wind Farm sounds was 40 dBA. Sound level model estimates at this location were 50 dBA at 95% operation. Ambient sound levels measured at MP-1 in December 2006 ranged from 33 to 56 dBA with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-2 hourly sound levels from representative Wind Farm operations were approximately 30 dBA with SW wind and near full operations, could not be isolated from non-turbine sound sources with SE wind and variable operation (50 to 75% power output) and were 36 dBA with NNW wind and power output of 75 to 100%. The estimated contribution of ambient, non-Wind Farm sounds was 30 dBA. Sound level model estimates at this location were 35 dBA at 95% operation. Ambient sound levels measured at MP-2 in December 2006 ranged from 28 to 60 dBA with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-3 hourly sound levels from representative Wind Farm operations were approximately 30 dBA with SW wind and near full operations, 33 dBA with SE wind and variable operation (50 to 75% power output) and 37 dBA with NNW wind and power output of 75 to 100%. The estimated contribution of ambient, non-Wind Farm sounds was 31 dBA. Sound level model estimates at this location were 36 dBA at 95% operation. Ambient sound levels measured at MP-3 in December 2006 ranged from 35 to 51 dBA with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-4A hourly sound levels from representative Wind Farm operations were difficult to isolate from other sound sources due to frogs and wind. A possible exception was with NNW wind and power output of 75 to 100% when wind farm sound levels were approximately 37 dBA compared with sound level model estimates of 37 dBA at this location during 95% operation. The estimated contribution of ambient, non-Wind Farm sounds was 34 dBA. Ambient sound levels at MP-4A are represented by measurements at MP-4 where hourly L_{Aeq}s ranged from 29 to 59 dBA with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-5 hourly sound levels from representative Wind Farm operations were difficult to isolate from other sound sources due to sounds from frogs and wind. With SW wind and near full operations, RSE observed approximately equal contributions from wind turbines and non-Wind Farm sources. With combined sound levels of 42 to 43 dBA, this would result in a sound level from the Wind Farm of 39 to 40 dBA. With SE wind and variable operation (50 to 75% power output) Wind Farm sound levels were the predominant sound source measuring approximately 39 dBA. Sound level model estimates at this location were 39 dBA during 95% operation. The estimated contribution of ambient, non-Wind Farm sounds was 34 dBA. Ambient sound levels measured at MP-5 in December 2006 ranged of 30 to 53 dBA with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-6 hourly sound levels from representative Wind Farm operations ranged from 44 to 45 dBA with SW wind and near full operations, ranged from 42 to 45 with SE wind and variable operation (50 to 75% power output) and 38 to 41 dBA with NNW wind and nearby power output of 50 to 75%. The estimated contribution of ambient, non-Wind Farm sounds was 33 dBA. Sound level model estimates at this location were 43 dBA at 95% operation. Ambient sound levels measured at MP-6 in December 2006 ranged from 27 to 55 dBA, with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-6A hourly sound levels from representative Wind Farm operations ranged from 42 to 44 dBA with SW wind and near full operations and with SE wind and variable operation (50 to 75% power output), and ranged 38 to 40 dBA with NNW wind and nearby power output of 50 to 75%. The estimated contribution of ambient, non-Wind Farm sounds was 33 dBA. Sound level model estimates at this location were 42 dBA at 95% operation. Ambient sound levels at MP-6A are represented by MP-6 where hourly L_{Aeqs} measured in December 2006 ranged from 27 to 55 dBA, with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-7 hourly sound levels from representative Wind Farm operations ranged from 43 to 44 dBA with SW wind and near full operations, ranged from 42 to 43 with SE wind and variable operation (50 to 75% power output) and 39 to 40 dBA with NNW wind and nearby power output of 75 to 100%. The estimated contribution of ambient, non-Wind Farm sounds was 32 dBA. Sound level model estimates at MP-7 were 40 dBA at 95% operation. Ambient sound levels measured at MP-7 in December 2006 are represented by nearby measurements at MP-5 ranging from 30 to 53 dBA and MP-6 ranging from 27 to 55 dBA, with higher readings noted during daytime periods and when wind speeds increased.

At Position MP-8 hourly sound levels from representative Wind Farm operations ranged from 47 to 50 dBA with SW wind and near full operations, ranged from 46 to 50 with SE wind and variable operation (50 to 75% power output) and 41 to 47 dBA with NNW wind and nearby power output of 50 to 60%. The estimated contribution of ambient, non-Wind Farm sounds was 39 dBA. Sound level model estimates at this location were 47.5 dBA at 95% operation. Ambient sound levels at MP-8 are represented by measurements at nearby MP-1, where hourly L_{Aeqs} measured in December 2006 ranged from 33 to 56 dBA with higher readings noted during daytime periods and when wind speeds increased.

An overall results summary is presented in Table 7-1 which compares sound level measurements of Wind Farm operation with sound level model predictions from 2003 prior to construction and ambient monitoring results from 2006. Figure 7-14 (attached) provides a site map showing sound levels measured in May 2007 during Wind Farm operations with sound level model estimates from 2003.

7.2 Short Duration Repetitive and Tonal Sounds

As described in Section 4.0, MEDEP noise regulation requires that 5 dBA be added to short duration repetitive (SDR) and tonal sounds when they occur at a protected location. The presence of SDR and tonal sounds is determined from sound level measurements and field observations. For identification of tonal sounds, analysis of one-third octave band measurements is also required.

SDR sounds are a sequence of repetitive sounds each clearly discernible as an event that causes an increase in sound level of at least 6 dBA above the sound level observed before and after the event. SDR sounds are typically less than ten seconds in duration and occur more than once within an hour (ref. MEDEP 375.10.G.19). Measurements and field observations during Wind Farm operation indicate that sound levels from wind turbines can fluctuate over brief periods as noted by the passage of wind turbine blades. Observed measurements further indicate that these sound level fluctuations typically range from 2 to 4 dBA and thus do not result in sound level increases of 6 dBA or more. Therefore, the Wind Farm does not generate SDR sounds as set forth in Maine DEP 375.10.

Table 7-1

Hourly Sound Levels from Wind Farm Operation in Relation to Sound Model Estimates and Ambient Conditions (Sound Levels in dBA)

Monitoring Position	SW Wind Near Full	SE Wind Variable Ops.	NNW Wind Variable Ops.	Non-Wind Farm Sound Level	2006 Hourly Ambient Readings	Sound Model Estimates	Actual vs Model
MP-1	47-51	48-52 50 to 75%	42-47 50 to 60%	40	33-56	51	-8 to +1
MP-2	30	NI 50 to 75%	36 75 to 100%	30	28-60	35	-5 to +1
MP-3	30	33 50 to 75%	37 75 to 100%	31	35-51	36	-5 to +1
MP-4A	NI	NI 50 to 75%	37 75 to 100%	34	29-59[A]	37	0
MP-5	39-40	39 50 to 75%	NI 75 to 100%	34	30-53	39	0 to +1
MP-6	44-45	42-45 50 to 75%	39-42 50 to 75%	33	27-55	43	-5 to +2
MP-6A	41-44	41-44 50 to 75%	38-40 50 to 75%	33	27-55[B]	42	-4 to +2
MP-7	43-44	42-43 50 to 75%	39-40 75 to 100%	32	30-53 / 27-55[C]	40	-1 to +4
MP-8	47-50	46-50 50 to 75%	41-47 50 to 60%	39	33-56[D]	47.5	-6.5 to +2.5

[A]From ambient measurements at MP-4.
[B]From ambient measurements at MP-6.
[C]From ambient measurements at M-5 & MP-6.
[D]From ambient measurements at MP-1.
Wind Farm Sound Levels = Hourly L_{A50} – Non-Wind Farm Sound Level (per standard decibel subtraction)

A tonal sound occurs when the sound level in a one-third octave band exceeds the arithmetic average of the sound levels in the two adjacent one-third octave bands by a specified dB amount based on the octave band center frequencies (ref. MEDEP 375.10.G.24). These criteria were compared against the third-octave band sound level measurements and observations contained in Appendix V. Results indicate some potential for tonal sounds to occur in the third-octave band with a center frequency of 160 Hz particularly at position MP-7. This potential for tonality was found to be intermittent at MP-7 and was not observed to occur at all positions or all periods when the wind turbines were a primary sound source.

Measurement results at MP-7 during periods when observed tonality was most prominent, show sound levels in the 160 Hz bandwidth ranging from 6.1 to 7.8 dB above the average of the sound levels in the adjacent bandwidths (125 and 200 Hz). The 7.8 dB differential occurred over an hourly measurement on May 9, 2007 between 2 and 3 a.m. This differential ranged from 6.1 to 6.9 dB during measurements between 11 p.m. on May 11 and 3:00 a.m. on May 12. To meet the definition of a tonal sound at 160 Hz requires the tonal differential to exceed 8 dB, which did not occur during any measurement period. Although the tonal threshold was not exceeded, the measurements indicate some potential for tonal sounds to occur from operation of the Wind Farm.

Third-octave band sound levels at MP-7 were compared to frequency spectra for the 1.5sle wind turbines provided in a sound level performance specification from GE. This comparison is presented as Figure 7-13 and shows that the overall frequency spectra in the performance specification reflects the measurement results at MP-7. The tonal differential of the GE performance specification is approximately 4 dB which is consistent with the overall measurement results of the Wind Farm.

Although the measurement results and GE specification data shows that the potential to generate a tonal sound exists, the tonal differentials do not meet the MEDEP criteria for tonal sounds.

7.3 Operating Conditions and Wind Predictions

Results of the wind predictions by GHA were reviewed to determine the relationship between expected wind and operating conditions and operating conditions during the operations sound level monitoring. The predominant wind directions predicted by the GHA report were from the northwest, west, and southeast. During the three overnight test periods with significant Wind Farm operations, the wind directions ranged from southwest/west-southwest, southeast/south-southeast, and northwest/north-northwest. The wind directions during the three nighttime periods align closely with the expected predominant wind directions.

At positions MP-1 and MP-8, the predicted mean wind speed of nearby turbines (nos. 1 through 5) ranges from 6.1 to 6.9 meters/second. The actual wind speeds at the Turbine 1 hub exceeded the predicted mean of 6.1 m/s for the first two nighttime periods of significant Wind Farm operation. On the third nighttime period (5-11 to 5-12), wind speeds were above and below the predicted mean.

At positions MP-6 and MP-6A, the predicted wind of nearby wind turbines (nos. 6 through 10) ranges from 7.2 to 9.2 m/s. The actual wind speeds at the Turbine 6 hub exceeded the predicted mean of 7.2 m/s for the first two nighttime periods of significant Wind Farm operation. On the third nighttime period (5-11 to 5-12), wind speeds were generally slightly below the predicted mean.

At positions MP-2 and MP-7, the predicted wind of nearby wind turbines (nos. 10 through 14) ranges from 8.1 to 9.2 m/s. The actual wind speeds at the Turbine 12 hub exceeded the predicted mean of 8.7 m/s for the all three nighttime periods of significant Wind Farm operation.

At the other monitoring positions (MP-3, 4A, and 5), the actual wind speeds exceeded the predicted means for the first and third nighttime periods of significant Wind Farm operations. On the second nighttime period (5-11 to 5-12), wind speeds were generally slightly below the predicted mean.

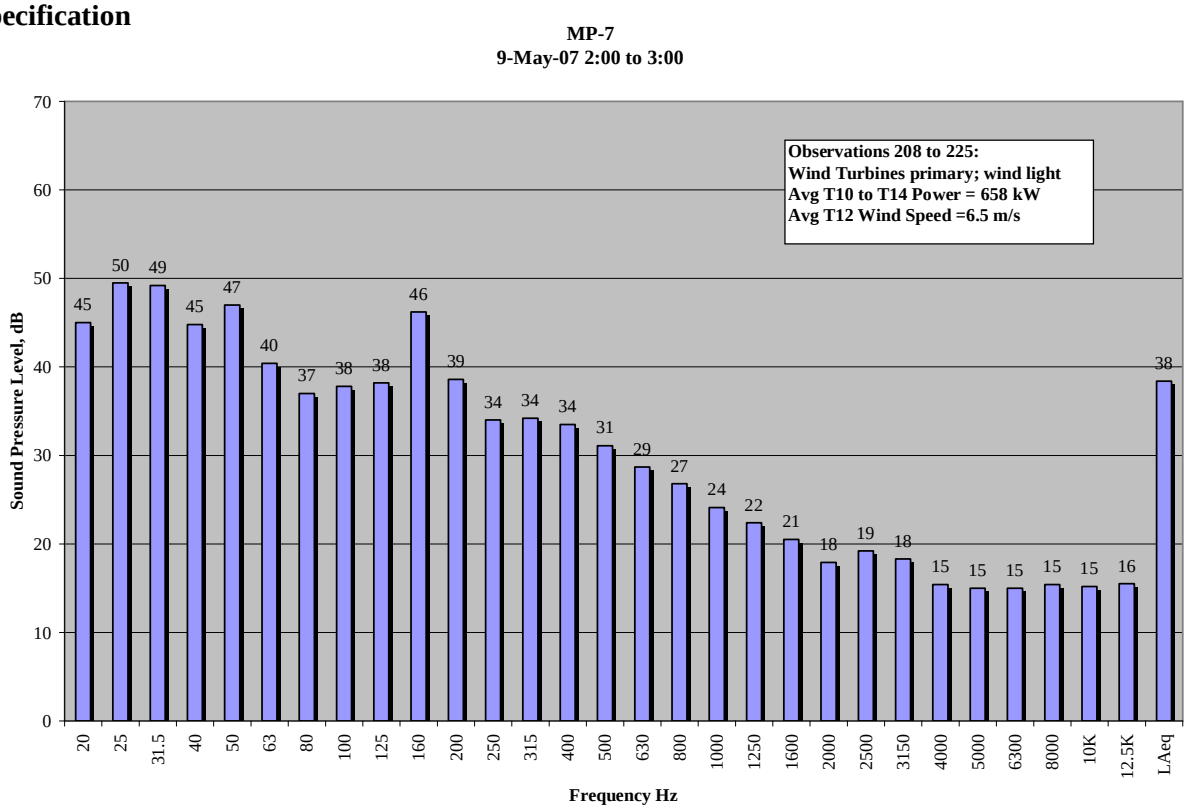
8.0 FINDINGS AND RECOMMENDATIONS

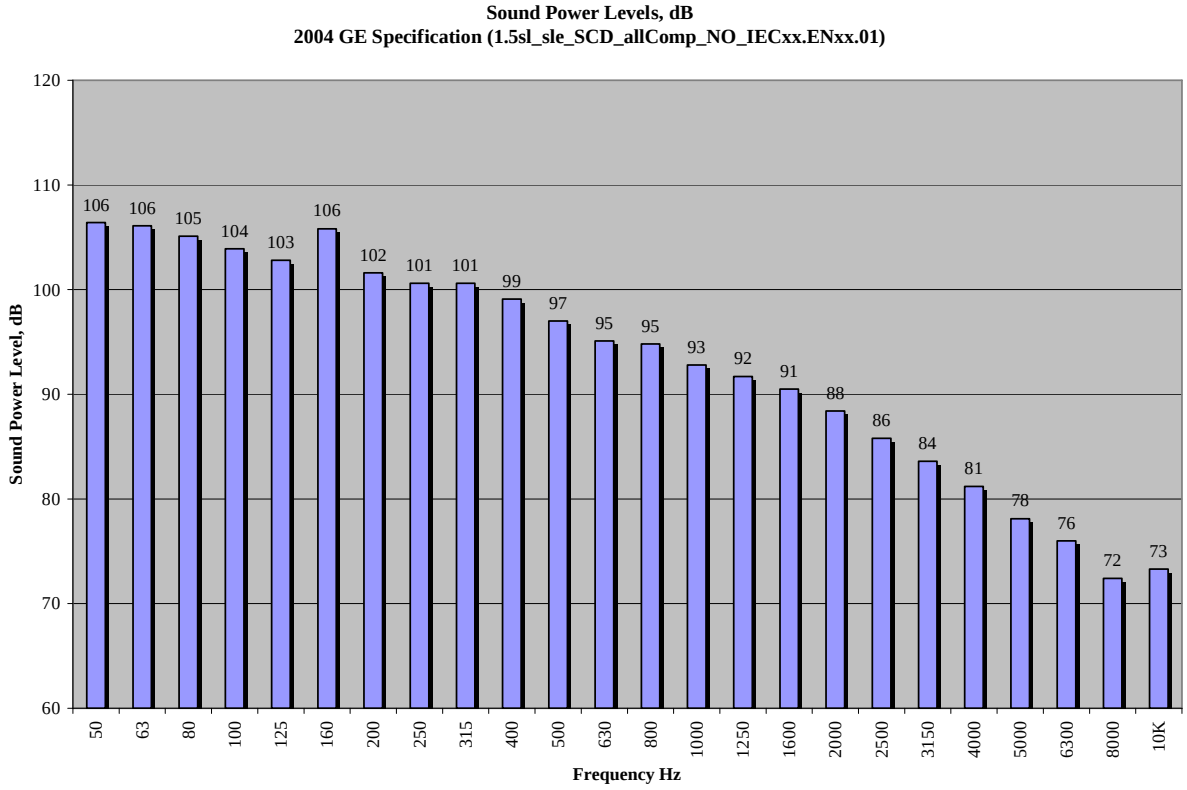
Sound level estimates for the Mars Hill Wind Farm were calculated in 2003 using a sound level prediction model developed for the project and sound performance data from the turbine manufacturer (GE). In December 2006, RSE conducted ambient sound level monitoring with construction of the Wind Farm substantially complete and the wind turbines shutdown. In May 2007, sound level monitoring was conducted during routine operation of the Wind Farm. Ambient and operation sound levels were measured under a variety of wind and weather conditions. Sound level measurements of routine Wind Farm operations were compared with ambient sound levels and sound level estimates for the Wind Farm calculated using the CADNA sound level prediction model.

Wind turbine sound levels during moderate to full operation ranged from below to slightly above (minus 8 to plus 4 dBA) the sound level model estimates (see Table 7-1). A sound level change of 3 dBA is considered to be perceptible. Sound level measurements farthest below the model estimates occurred at MP-1 and MP-8 during periods when nearby turbines were generally operating at less than 60% power. These reduced sound levels are consistent with the sound power levels provided in performance specifications by GE (see Figures 3-4 and 3-5).

Comparing operating conditions with annual predictions from the GHA wind study indicates that sound level measurements of Wind Farm operations were taken during wind conditions at or exceeding the predicted mean wind speeds and with wind from predicted predominant directions.

Figure 7-13. Comparison of Third-Octave Band Sound Level Measurements at MP-7 and GE Specification





Similar to Wind Farm sound levels, ambient sound levels vary with wind speed. At each of the monitoring positions, sound levels from Wind Farm operations were within the range of ambient sound levels. Due to their lower elevations, wind speeds at the monitoring positions are typically five to ten miles per hour less than at the turbine hubs. This difference can increase depending upon the general wind direction and amount of blockage by the terrain and vegetation. At monitoring positions where wind turbine sound could be isolated, the winds were generally light compared to wind incident at the turbine hubs. In these instances, sound levels from the Wind Farm were observed to be above sound levels from other sources.

Evaluation of measurement results for the presence of short duration repetitive sounds indicates that although sound levels from wind turbines can fluctuate over brief periods (as noted by the passage of wind turbine blades), these fluctuations do not increase sound levels by 6 dBA or more, and therefore, the wind farm does not generate short duration repetitive sounds as set forth in MEDEP 375.10.

Analysis of third-octave band sound levels for tonal sound indicates some potential for tonal sounds to occur at a center frequency of 160 Hz. This potential was found to be intermittent and was not observed to occur at all positions or all periods when the wind turbines were a primary sound source. Third-octave band sound levels were also compared to frequency spectra for the 1.5sle wind turbines provided in performance specifications from GE. Although the measurement results and GE specification data show that the potential to generate a tonal sound exists, the results did not meet the criteria for tonal sounds as set forth in MEDEP 375.10.

Based on these findings, RSE recommends that UPC Wind consider conducting additional sound level measurements of Wind Farm operations during late fall and winter periods when frog and bird activity will subside and consistently higher operating levels can likely be achieved under predominant wind directions. Additional operations testing could be done with fewer monitoring positions and use of ground level anemometers to track wind speed and direction at each position.

UPC Wind should present the measurement results to GE and work with the wind turbine manufacturer to evaluate whether potential additional sound reduction options may be available to address specific operating conditions.

9.0 REFERENCES

Code of Maine Regulations, Site Location of Development Regulations - Chapter 375.10, Control of Noise.

Acoustical Society of America, 1986, American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters (ASA 65-1986), New York, New York.

Garrad Hassan America, Assessment of the Energy Production of the Proposed Mars Hill Wind Farm, 2006.

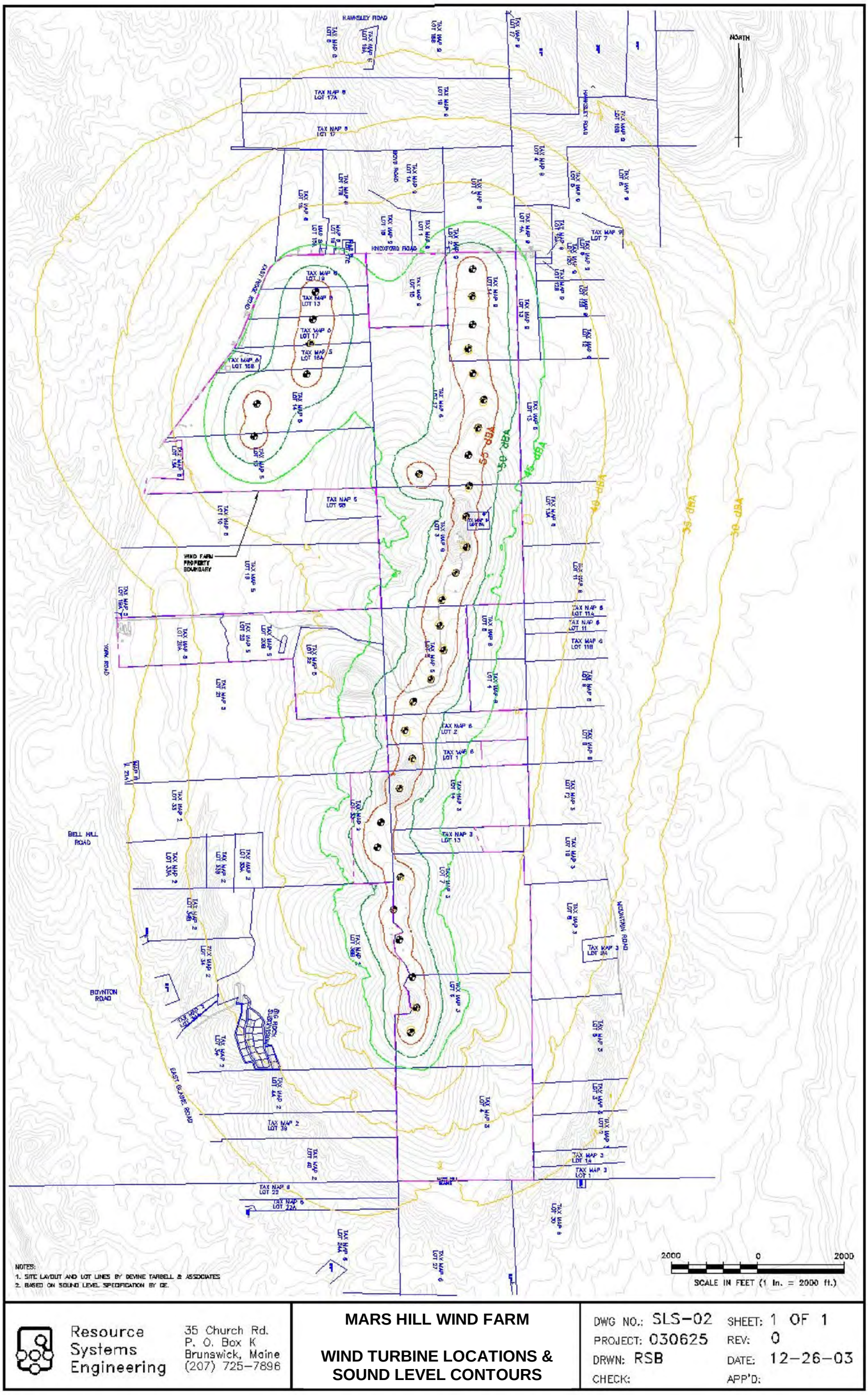
General Electric Technical Documentation Wind Turbine Generator Systems GE 1.5 sl/sle 50 & 60 Hz, 2004.

General Electric 1.5 MW Series Wind Turbine Brochure (www.gepower.com/prod_serv/products/wind_turbines/en/downloads/ge_15_brochure.pdf)

IEC International Standard 61400-11, Wind Turbine Generator Systems – Acoustic Noise Measurement Techniques, Edition 2.1, 2006.

Maine Department of Environmental Protection, Site Location of Development, Findings of Fact and Order, No. L-21635-26-A-N, June 2004.

FIGURE 3-2. Wind Turbine Locations and Sound Level Contours, December 2003.



Resource Systems Engineering 35 Church Rd. P. O. Box K Brunswick, Maine (207) 725-7896	**MARS HILL WIND FARM** **WIND TURBINE LOCATIONS & SOUND LEVEL CONTOURS**	DWG NO.: SLS-02 SHEET: 1 OF 1 PROJECT: 030625 REV: 0 DRWN: RSB DATE: 12-26-03 CHECK: APP'D:

FIGURE 5-1. VICINITY SITE PLAN & SOUND LEVEL MONITORING POSITIONS DECEMBER 2006 AND MAY 2007

0 600 1200

SCALE IN FEET

APPROXIMATE LOCATION OF RESIDENCE

APPROXIMATE LOCATION OF RESIDENCE CONSTRUCTED SINCE 2003

T3 AS-BUILT WIND TURBINE SITE

COMMUNITY SOUND LEVEL MONITORING POSITION

MP-1 MP-2 MP-3 MP-4 MP-4A MP-5 MP-6 MP-6A MP-7 MP-8

WIND FARM PROPERTY BOUNDARY

EAST RIDGE ROAD

COUNTRY CLUB ROAD

BELL HILL ROAD

BOYNTON ROAD

MOUNTAIN ROAD

BIG ROCK SUBDIVISION

SOUND LEVEL CONTOURS FROM 2003 SOUND MODEL ESTIMATES

55 dBA
50 dBA
45 dBA
40 dBA
35 dBA

FIGURE 7–14. 2003 WIND FARM MODEL ESTIMATES AND MEASURED OPERATING SOUND LEVELS FROM MAY 2007

0 600 1200
SCALE IN FEET

APPROXIMATE LOCATION OF RESIDENCE

APPROXIMATE LOCATION OF RESIDENCE CONSTRUCTED SINCE 2003

T3 AS-BUILT WIND TURBINE SITE

COMMUNITY SOUND LEVEL MONITORING POSITION

51/42–52 MODEL ESTIMATE/RANGE OF MEASURED SOUND LEVELS

N

WIND FARM PROPERTY BOUNDARY

MP–1 51/42–52

MP–2 35/30–36

MP–3 36/30–37

MP–4

MP–4A 37/37

MP–5 39/39–40

MP–6 43/39–45

MP–6A 42/38–44

MP–7 40/39–44

MP–8 47.5/41–50

EAST RIDGE ROAD

COUNTRY CLUB ROAD

BELL HILL ROAD

BOYNTON ROAD

MOUNTAIN ROAD

BIG ROCK SUBDIVISION

SOUND LEVEL CONTOURS FROM 2003 SOUND MODEL ESTIMATES

55 dBA
50 dBA
45 dBA
40 dBA
35 dBA

APPENDIX I

- Excerpts from MEDEP Site Location Order
- Full Operations Sound Level Monitoring Plan

Excerpts from Site Location Order L-21635-26-A-N/L-21635-TH-B-N

FINDINGS:

4. NOISE:

The applicant submitted a noise study completed by Resource Systems Engineering, Inc. (RSE). The report was based on noise specifications provided by the manufacturer of the wind turbines (GE).

RSE developed a sound level prediction model for the proposed wind farm using CADNA/A software to map area terrain in three dimension, locate the proposed turbines, and calculate outdoor sound propagation to the surrounding area. Sound level estimates were calculated based on all 35 possible turbine locations operating simultaneously at 95% rated power as defined by GE. The full load wind conditions existed at wind speeds at approximately 10 meters per second or 22.4 miles per hour (mph) at a height of approximately 10 meters above grade. The wind turbines begin producing electricity when the wind speeds are approximately 6.7 mph.

The predicted noise level at the edges of the property or at protected locations ranges from [4]5-55 dBA. There are 4 protected locations were the noise level would be above 45 dBA, but less than 50 dBA, which is approximately equivalent to the noise that songbirds produce. Figure 5-1 in section 5 of the application shows and aerial photo of the project area superimposed with the predicted sound level contours.

The noise model was produced with the turbines under a full load, at wind speeds of approximately 22.4 miles per hour. The Site Law Rules establish a maximum wind speed of 12 mph for purposes of measuring pre- and post-development noise levels at protected locations. Ambient noise levels increase as wind speeds increase, thus limiting the applicants' ability to accurately assess the noise impact that the turbines will make at high wind speeds due to higher ambient wind noise. Despite this more restrictive noise model parameter, the applicant has demonstrated that the project meets the current noise standards at the protected locations by predicting no more than 50 dBA will be produced at any time of the day at a wind speed of 22.4 mph.

Site Law Rules allow a variance from the noise standard provided certain criteria are met. M.R.S.A. 38 Chapter 375 (10)(F) states that "the Board recognizes that there are certain developments or activities associated with development for which noise control measures are not reasonably available. Therefore, the Board or Commissioner may grant a variance from any of the sound level limits contained in this rule upon (1) a showing by the applicant that he or she has made a comprehensive assessment of the available technologies for the development and that the sound level limits cannot practicably be met with any of these available technologies, and (2) a finding by the Board that the proposed development will not have an unreasonable impact on protected locations."

Given that ambient wind speeds at the project site exceed those typically considered under the Site Rules; that the applicant has address[ed] the noise generated by the wind turbines at 22.4 mph, close to twice the 12 mph wind speed mandated by Chapter 375, and that those noise limits are less than 50 dBA, the Department finds that the applicants' project will not have an unreasonable adverse impact on protected locations and therefore grants a variance from the noise standards for the windpower farm.

Resource
Systems
Engineering

Church Road Crossing
30 Parkers Way, P.O. Box K
Brunswick, Maine 04011-0835
Phone: (207) 725-7896
rse@gwi.net

February 15, 2007
File 030625

Mars Hill Wind Farm
Full Operations
Sound Level Monitoring

Objective – To determine by measurement, sound levels at community monitoring positions during full operation of the Mars Hill Wind Farm. Measured sound levels will be compared to sound level estimates provided to the Maine Department of Environmental Protection as part of the Site Permit application. To the extent practicable, measurements will be conducted in accordance with Maine DEP Chapter 375.10 Section H.4, Measurement of Sound from Routine Operation of Developments. Consequently, the intent is to measure wind farm sound levels at nearby protected locations during conditions when the noise from the wind farm is most noticeable. This will require ample wind speeds at higher elevations for the wind turbines to operate at or near full power, and less wind at the lower elevation, community monitoring positions.

Field observations will supplement sound level data to determine the primary contributors to the measured sound levels. These contributors may consist of noise from wind turbines and non-wind farm sources such as wind-induced sound, road traffic, aircraft traffic and natural sounds. The following describes the monitoring positions, measurement parameters, field observations, wind farm operating data, and meteorological data to be recorded during the measurement period.

Weather Conditions – Reasonable attempts will be made to measure sound levels with wind speeds in excess of 15 mph at the hub height of the wind turbines and winds less than 10 mph at community monitoring positions. There can be no significant precipitation during the monitoring period, however, an occasional snow flurry is acceptable. Due to instrument limitations, measurements cannot be conducted during periods when the ambient temperature is 10^{o}F or less. RSE will rely on forecasts and consultation from the National Weather Service office in Caribou, Maine.

Monitoring Schedule – Monitoring will be scheduled to occur the first opportunity after February 18, 2007 depending upon weather forecasts and the operating status of the wind farm.

Monitoring Positions - Based on their proximity to wind turbines and accessibility, nine monitoring positions have been pre-selected to represent protected locations in the vicinity of the wind farm. The monitoring positions are either within the boundaries of the wind farm or permission has been granted by the landowner. UPC will notify affected property owners of the scheduled date for the noise testing.

Six monitoring positions will be selected for continuous measurements based on weather forecasts and the operating status of individual wind turbines. Additional positions may be added on a rotating basis at the discretion of the field engineer. Monitoring positions will be selected on both the windward and leeward sides of Mars Hill ridge.

Measurement and Observation Periods - Measurements will be planned for a 24-hour period scheduled according to weather and operating forecasts. During this period, continuous sound level readings will be taken at six positions to record short-term and hourly statistics at each position. A field engineer and technician will measure one-third octave band sound levels and record field observations, and weather conditions at each monitoring position on a rotating basis. Monitoring positions may be

adjusted or additional monitoring positions added to the measurement rotation at the discretion of the field engineer.

Turbine Operating and Meteorological Data –UPC will record operating and meteorological data for each turbine every ten seconds and report the average readings at ten-minute intervals. Data will include power generation, wind speed, wind direction, and rotor rpm.

Sound Level Instrumentation - Instrumentation will consist of Larson-Davis Model 812 Integrating Sound Level Meters for continuous sound level measurements, and a Larson-Davis Model 824 Sound Level Meter/Real Time Analyzer and a CEL 593 Sound Level Analyzer to measure one-third octave band levels on a rotating basis. The sound level meters meet Type 1 (precision) performance requirements of American National Standard Specification for Sound Level Meters, ANSI S1.4-1983. The microphones will be fitted with standard windscreens and mounted on tripods at a height of approximately five feet above the ground. The sound level meters will be calibrated before and after the monitoring period.

Measurement Data and Reports – A field measurement report will be prepared that provides the following information for the wind farm noise measurements.

1. A project map showing property lines, protected locations, topographic features, and monitoring positions in relation to as-built configuration of the wind farm.
2. Hourly and short-term sound level readings for each monitoring position.
3. Operating data and weather conditions from representative wind turbines.
4. One-third octave band sound level readings and analysis for tonal sounds.
5. Sound level readings and observations relevant to identification of short duration repetitive sounds.
6. Data and observations concerning non-wind farm noise sources such as aircraft, road traffic, and wind noise/masking effects.
7. Comparison of measured wind farm sound levels with pre-development sound level estimates contained in the Maine DEP Site Application.
8. A list of sound level instrumentation and calibration records.

APPENDIX II
AMBIENT SOUND LEVEL MEASUREMENTS
DECEMBER 2006

Mars Hill Wind Farm

Hourly Ambient Sound Level Measurements

Position MP-1

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
12/20/06	13:00	60	44	51	48	41	33
	14:00	60	47	53	49	45	43
	15:00	60	47	56	50	45	42
	16:00	60	50	58	55	47	41
	17:00	60	45	55	50	37	32
	18:00	60	43	52	46	40	34
	19:00	60	41	50	45	39	36
	20:00	60	41	51	44	37	34
	21:00	60	36	45	38	34	32
	22:00	60	35	40	37	34	32
	23:00	60	34	43	37	33	31
12/21/06	0:00	60	35	42	36	33	29
	1:00	60	35	43	38	33	30
	2:00	60	33	40	36	32	30
	3:00	60	35	44	36	33	31
	4:00	60	33	40	35	32	30
	5:00	60	50	60	56	34	30
	6:00	60	51	58	56	44	36
	7:00	60	43	51	46	41	37
	8:00	60	45	54	48	42	38
	9:00	60	44	51	46	42	39
	10:00	60	48	56	51	45	42
	11:00	60	50	57	53	48	43
	12:00	60	55	63	57	50	44
	13:00	60	51	58	54	48	44
	14:00	60	56	64	60	52	45
	15:00	60	49	58	52	46	41
	16:00	60	51	60	55	48	42
	17:00	60	47	57	49	44	39
	18:00	60	56	66	60	51	43
	19:00	60	56	66	60	51	43
	20:00	60	51	61	55	45	39
	21:00	60	49	58	53	45	39
	22:00	60	48	57	51	44	38
	23:00	60	44	54	48	40	33
12/22/06	0:00	60	45	54	48	42	37
	1:00	60	41	48	44	39	34
	2:00	60	39	47	43	36	30
	3:00	60	35	43	38	34	30
	4:00	60	37	44	40	35	32
	5:00	60	39	49	42	37	32
	6:00	60	40	49	42	38	36
	7:00	60	42	51	46	38	35
	8:00	60	42	52	46	37	34
	9:00	60	43	52	47	38	34
	10:00	60	40	48	43	38	34
	11:00	30	39	49	42	36	31

Position MP-2

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
12/20/06	13:00	60	44	59	40	35	29
	14:00	60	44	54	46	40	36
	15:00	60	44	51	45	41	38
	16:00	60	48	59	50	43	40
	17:00	60	48	58	52	45	39
	18:00	60	52	62	56	48	42
	19:00	60	54	63	57	50	44
	20:00	60	50	59	54	47	42
	21:00	60	50	58	53	47	41
	22:00	60	45	54	48	43	38
	23:00	60	44	52	47	42	37
12/21/06	0:00	60	45	53	48	43	38
	1:00	60	42	50	45	40	35
	2:00	60	40	48	44	39	34
	3:00	60	37	45	40	35	31
	4:00	60	37	45	39	35	31
	5:00	60	36	43	39	35	32
	6:00	60	39	48	41	37	34
	7:00	60	39	47	41	37	34
	8:00	60	42	51	44	39	36
	9:00	60	42	48	44	40	38
	10:00	60	49	60	53	45	39
	11:00	60	50	61	54	44	37
	12:00	60	53	63	56	47	39
	13:00	60	52	63	56	46	38
	14:00	60	60	71	63	54	45
	15:00	60	53	63	56	48	41
	16:00	60	52	62	55	47	43
	17:00	60	51	61	55	45	37
	18:00	60	51	61	55	47	40
	19:00	60	58	70	62	52	43
	20:00	60	56	67	59	47	40
	21:00	60	52	63	56	47	39
	22:00	60	54	65	58	48	38
	23:00	60	43	54	47	37	30
12/22/06	0:00	60	47	57	50	41	33
	1:00	60	37	47	41	32	26
	2:00	60	35	47	37	29	25
	3:00	60	30	39	33	27	24
	4:00	60	28	35	31	27	24
	5:00	60	34	43	37	30	25
	6:00	60	37	48	39	33	28
	7:00	60	47	56	46	36	31
	8:00	60	42	51	45	35	30
	9:00	60	43	50	45	42	40
	10:00	60	45	55	45	42	40

Mars Hill Wind Farm

Hourly Ambient Sound Level Measurements

Position MP-3

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
12/20/06	14:00	60	38	44	39	37	35
	15:00	60	40	48	40	37	36
	16:00	60	40	46	43	39	37
	17:00	60	41	45	43	41	39
	18:00	60	43	49	46	42	39
	19:00	60	45	50	47	45	43
	20:00	60	43	48	45	42	41
	21:00	60	42	45	43	42	40
	22:00	60	39	43	41	39	37
	23:00	60	38	45	39	38	36
12/21/06	0:00	60	41	48	44	40	38
	1:00	60	43	50	45	42	40
	2:00	60	40	48	41	39	34
	3:00	60	40	50	42	36	34
	4:00	60	39	49	41	37	35
	5:00	60	37	45	38	35	34
	6:00	60	38	43	38	35	34
	7:00	60	39	46	43	36	34
	8:00	60	36	43	37	34	32
	9:00	60	35	43	38	33	30
	10:00	60	40	47	43	38	34
	11:00	60	43	50	46	42	38
	12:00	60	42	49	44	39	36
	13:00	60	44	51	47	42	38
	14:00	60	51	59	53	48	42
	15:00	60	46	53	49	44	40
	16:00	60	43	50	46	41	37
	17:00	60	45	52	47	42	39
	18:00	60	46	54	49	44	41
	19:00	60	50	58	53	48	44
	20:00	60	49	56	52	47	42
	21:00	60	46	54	49	44	40
	22:00	60	46	53	48	44	40
	23:00	60	44	52	47	42	38
12/22/06	0:00	60	47	54	50	46	42
	1:00	60	45	50	47	45	43
	2:00	60	46	53	47	45	43
	3:00	60	46	50	48	45	43
	4:00	60	44	50	46	43	41
	5:00	60	45	50	47	45	42
	6:00	60	45	48	46	44	43
	7:00	60	45	52	43	36	31
	8:00	60	39	54	38	33	30
	9:00	60	44	48	46	44	42
	10:00	60	44	49	45	43	42
	11:00	60	42	49	44	42	30

Position MP-4

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
12/20/06	14:00	60	40	49	44	38	33
	15:00	60	43	52	46	40	36
	16:00	60	42	51	45	40	36
	17:00	60	46	55	49	44	40
	18:00	60	46	54	49	43	40
	19:00	60	50	59	53	47	43
	20:00	60	43	52	46	41	39
	21:00	60	43	50	45	41	39
	22:00	60	40	46	42	39	36
	23:00	60	38	44	40	37	35
12/21/06	0:00	60	40	46	43	39	36
	1:00	60	39	44	41	38	35
	2:00	60	37	42	40	37	34
	3:00	60	37	44	39	36	33
	4:00	60	37	43	40	37	34
	5:00	60	38	42	40	37	35
	6:00	60	39	46	41	37	35
	7:00	60	40	48	42	39	36
	8:00	60	45	56	45	39	35
	9:00	60	40	51	43	36	33
	10:00	60	47	57	51	43	37
	11:00	60	50	60	54	45	39
	12:00	60	52	62	55	48	41
	13:00	60	53	62	56	49	41
	14:00	60	58	68	62	53	46
	15:00	60	54	64	58	50	43
	16:00	60	50	60	54	46	39
	17:00	60	51	61	54	46	39
	18:00	60	53	63	57	48	42
	19:00	60	59	70	63	54	46
	20:00	60	54	64	58	50	42
	21:00	60	54	65	58	49	42
	22:00	60	54	65	57	49	43
	23:00	60	47	57	50	42	35
12/22/06	0:00	60	49	59	53	45	38
	1:00	60	40	50	43	36	29
	2:00	60	36	46	39	32	27
	3:00	60	30	40	33	27	24
	4:00	60	29	36	31	27	25
	5:00	60	32	40	34	30	27
	6:00	60	35	46	37	31	28
	7:00	60	44	52	40	35	32
	8:00	60	35	44	37	33	30
	9:00	60	37	47	40	33	29
	10:00	60	42	56	40	34	30
	11:00	60	38	50	39	31	27
	12:00	60	32	43	35	29	25

Mars Hill Wind Farm

Hourly Ambient Sound Level Measurements

Position MP-5

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
12/20/06	14:05	55	36	45	35	30	27
	15:00	60	33	43	36	30	27
	16:00	60	34	44	35	31	29
	17:00	60	37	46	39	34	32
	18:00	60	36	45	35	32	30
	19:00	60	35	43	36	33	32
	20:00	60	34	41	34	32	30
	21:00	60	33	42	34	31	30
	22:00	60	30	34	31	30	28
	23:00	60	35	45	35	31	30
12/21/06	0:00	60	34	41	35	32	30
	1:00	60	34	39	35	33	32
	2:00	60	33	37	34	33	31
	3:00	60	32	40	33	31	30
	4:00	60	32	40	34	31	30
	5:00	60	30	33	31	30	28
	6:00	60	34	42	33	30	29
	7:00	60	34	41	33	29	28
	8:00	60	34	46	32	30	28
	9:00	60	36	47	37	29	27
	10:00	60	47	58	44	35	31
	11:00	60	43	50	42	36	33
	12:00	60	47	59	47	38	33
	13:00	60	48	59	50	42	37
	14:00	60	50	63	51	42	39
	15:00	60	53	64	51	43	38
	16:00	60	36	44	38	35	33
	17:00	60	37	46	40	35	33
	18:00	60	41	50	42	38	35
	19:00	60	43	52	46	40	37
	20:00	60	42	52	44	38	35
	21:00	60	41	48	43	39	35
	22:00	60	37	44	39	36	33
	23:00	60	40	53	40	31	29
12/22/06	0:00	60	38	48	39	34	30
	1:00	60	34	42	33	30	28
	2:00	60	32	43	32	29	27
	3:00	60	31	39	33	30	28
	4:00	60	36	47	39	30	27
	5:00	60	35	45	38	31	27
	6:00	60	38	48	41	33	30
	7:00	60	40	52	38	31	28
	8:00	60	37	48	38	31	28
	9:00	60	36	45	39	32	28
	10:00	60	36	44	38	31	26
	11:00	60	33	43	34	27	23

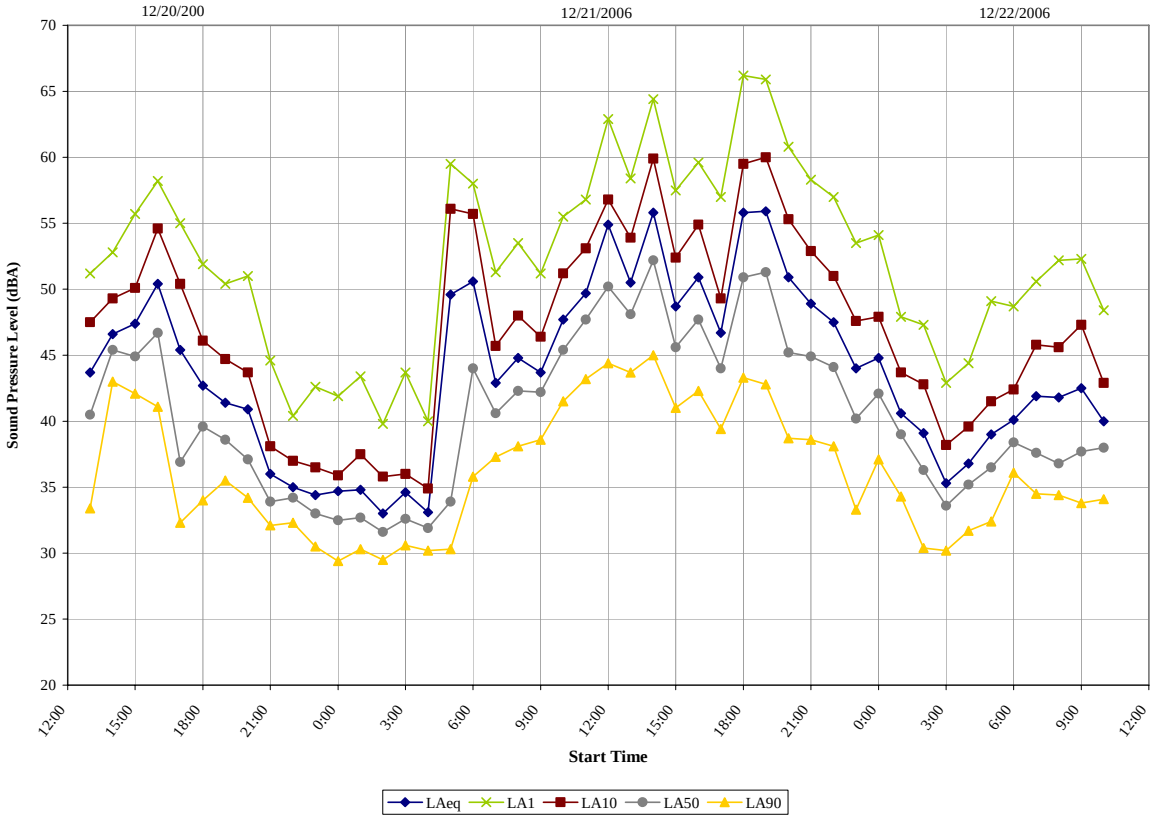
Position MP-6

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
12/20/06	16:00	59	36	43	38	34	30
	17:00	60	35	44	39	33	29
	18:00	60	32	37	34	31	30
	19:00	60	32	37	34	31	30
	20:00	60	33	40	36	32	30
	21:00	60	33	42	34	30	29
	22:00	60	30	35	31	29	28
	23:00	60	31	38	33	30	28
12/21/06	0:00	60	30	41	29	27	26
	1:00	60	28	32	30	28	27
	2:00	60	27	30	28	27	26
	3:00	60	30	40	29	28	26
	4:00	60	28	31	29	28	26
	5:00	60	27	31	29	27	25
	6:00	60	34	42	36	31	28
	7:00	60	34	43	36	31	29
	8:00	60	33	40	35	32	30
	9:00	60	35	42	37	31	28
	10:00	60	41	50	44	38	34
	11:00	60	45	54	48	41	37
	12:00	60	48	58	51	44	38
	13:00	60	48	58	51	44	40
	14:00	60	55	65	58	50	42
	15:00	60	50	61	53	45	40
	16:00	60	52	62	54	47	42
	17:00	60	49	59	52	44	39
	18:00	60	54	64	58	50	42
	19:00	60	55	66	58	51	44
	20:00	60	52	63	56	48	42
	21:00	60	53	63	56	49	43
	22:00	60	51	61	54	48	43
	23:00	60	45	55	48	42	36
12/22/06	0:00	60	48	57	51	45	39
	1:00	60	43	52	46	40	36
	2:00	60	42	50	45	39	34
	3:00	60	43	52	46	40	36
	4:00	60	37	45	40	35	31
	5:00	60	41	49	43	38	34
	6:00	60	44	52	47	43	39
	7:00	60	43	52	46	41	37
	8:00	60	41	48	44	40	37
	9:00	60	42	49	45	40	36
	10:00	60	41	50	44	38	34
	11:00	60	35	44	38	33	28

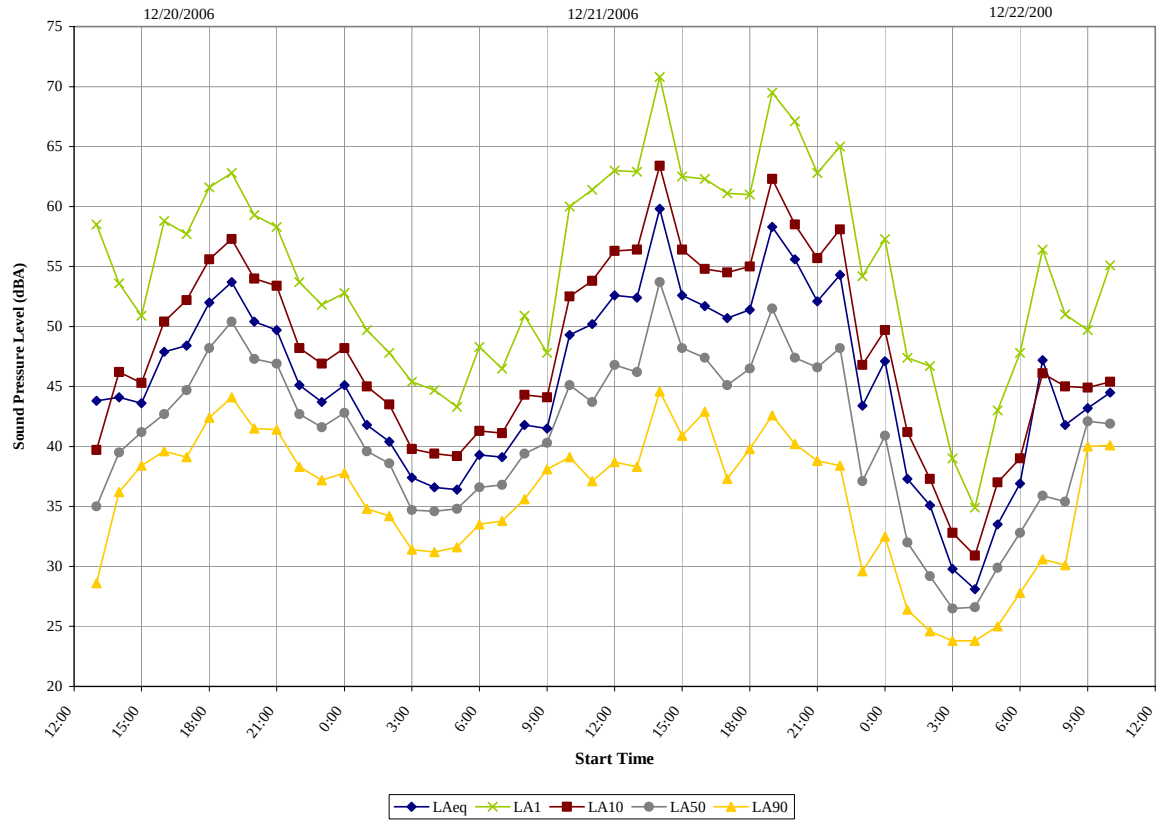
Mars Hill Wind Farm

Hourly Ambient Sound Level Measurements

Hourly Ambient Sound Levels at MP-1



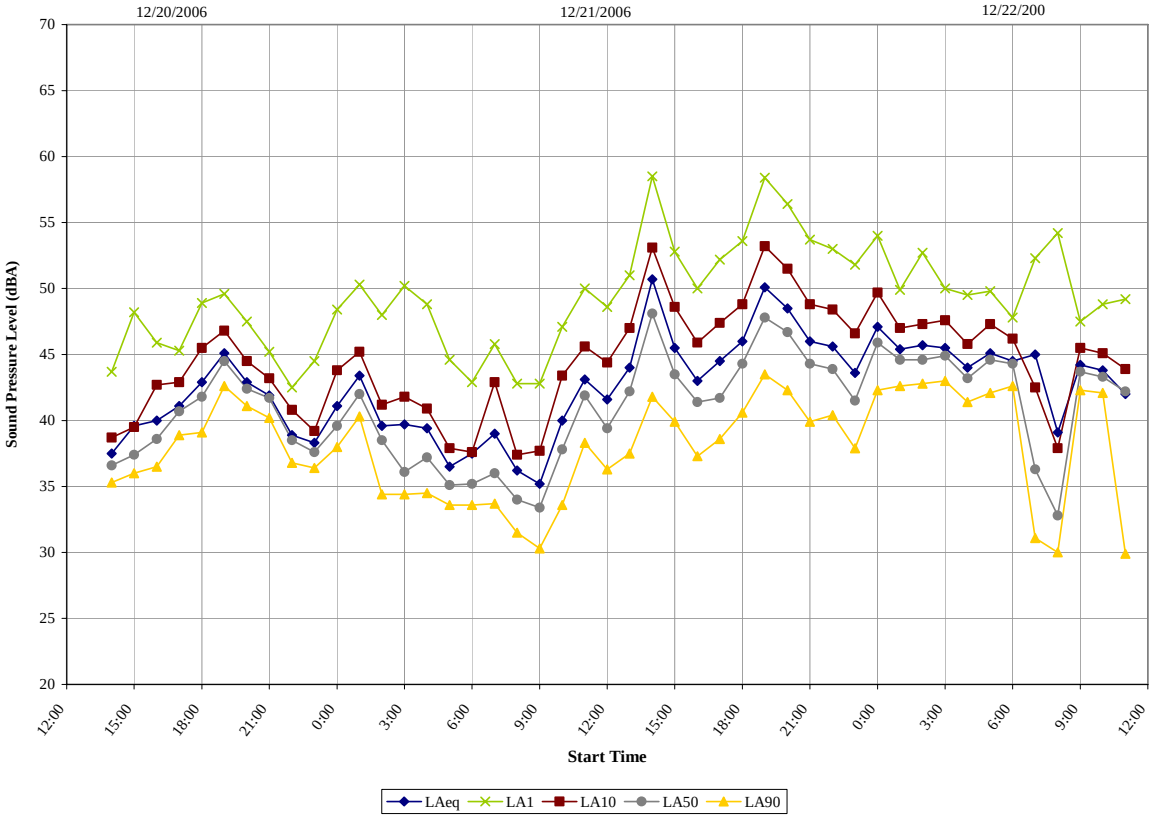
Hourly Ambient Sound Levels at MP-2



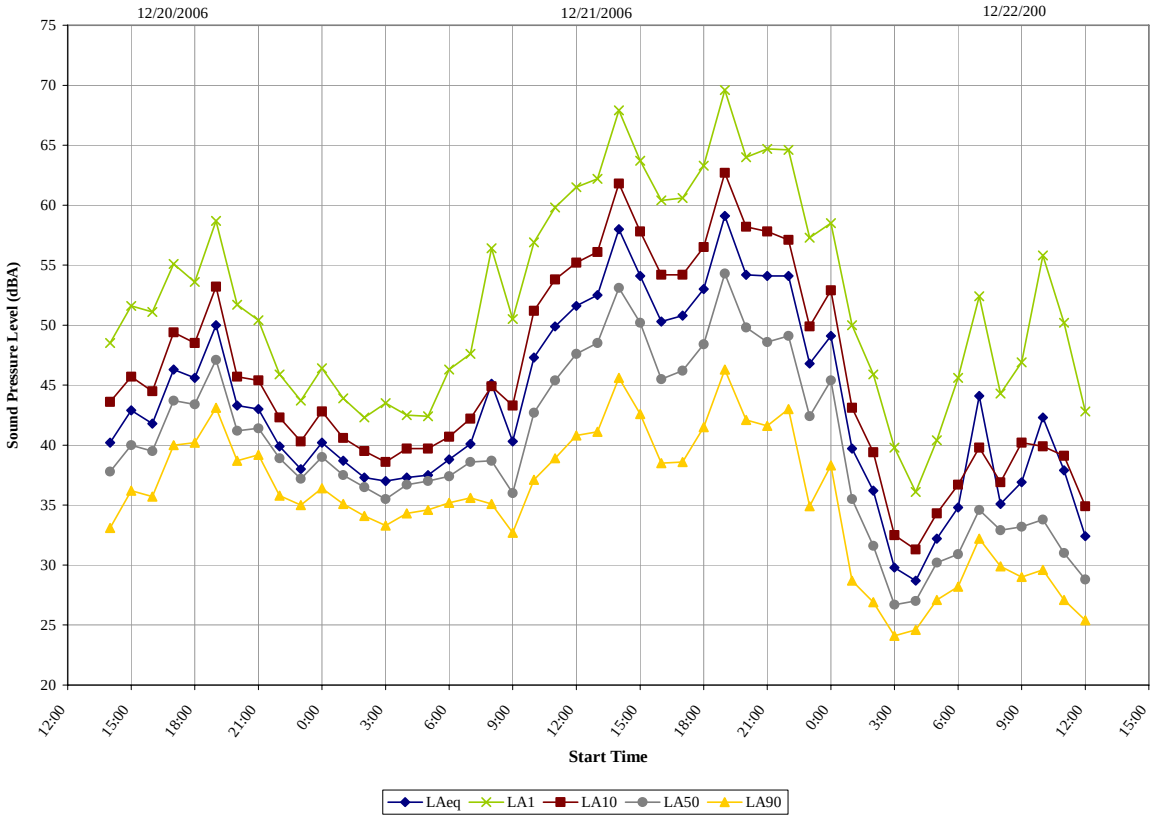
Mars Hill Wind Farm

Hourly Ambient Sound Level Measurements

Hourly Ambient Sound Levels at MP-3



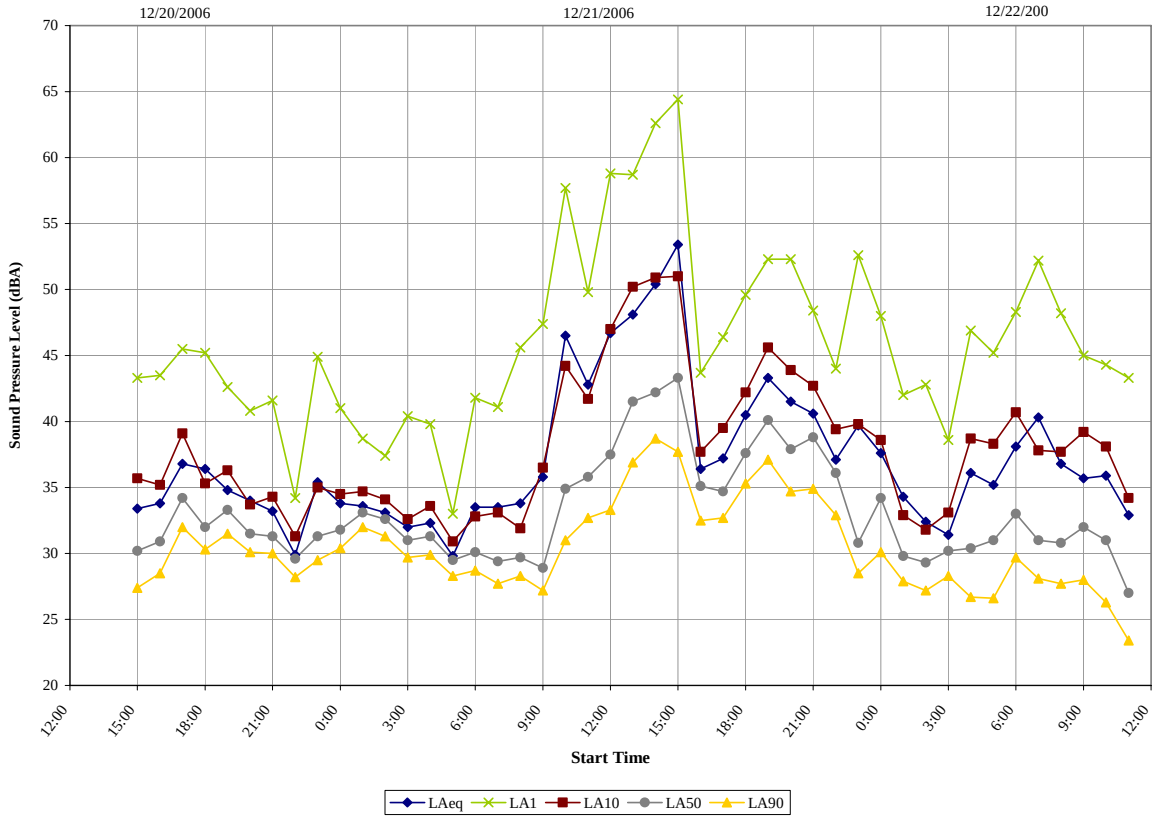
Hourly Ambient Sound Levels at MP-4



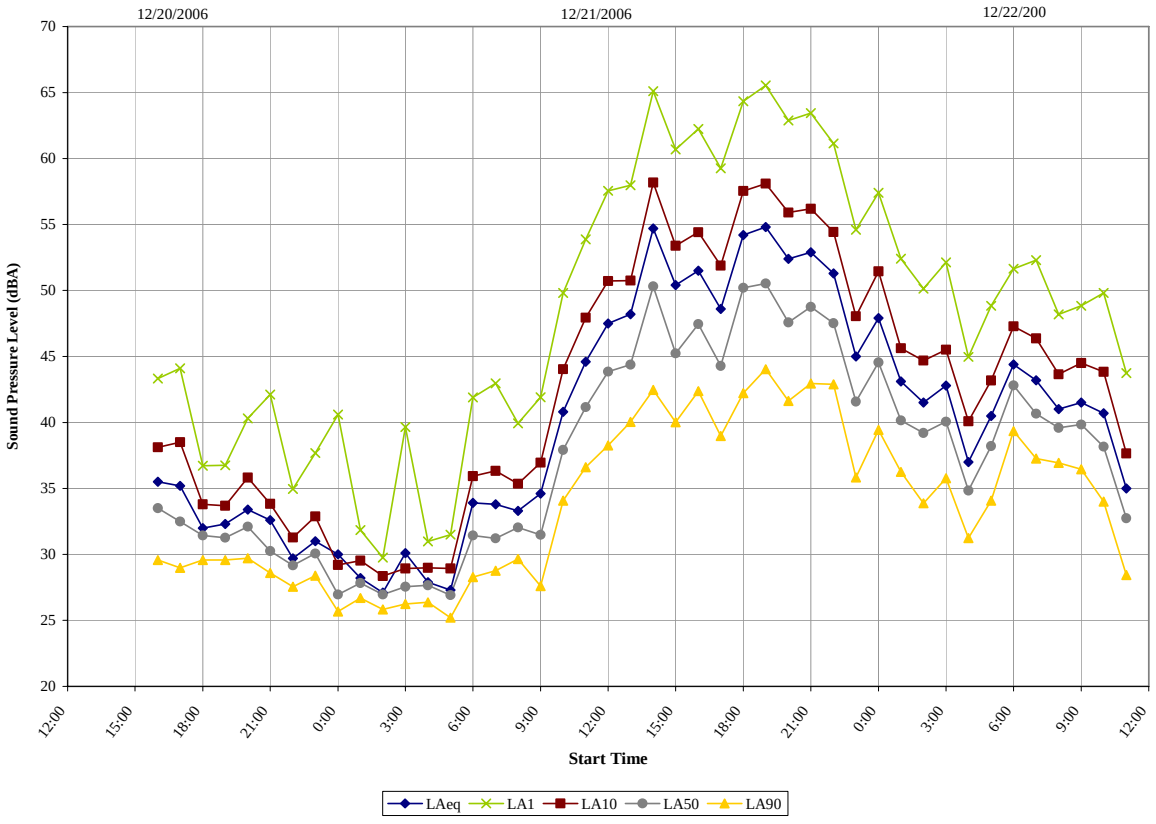
Mars Hill Wind Farm

Hourly Ambient Sound Level Measurements

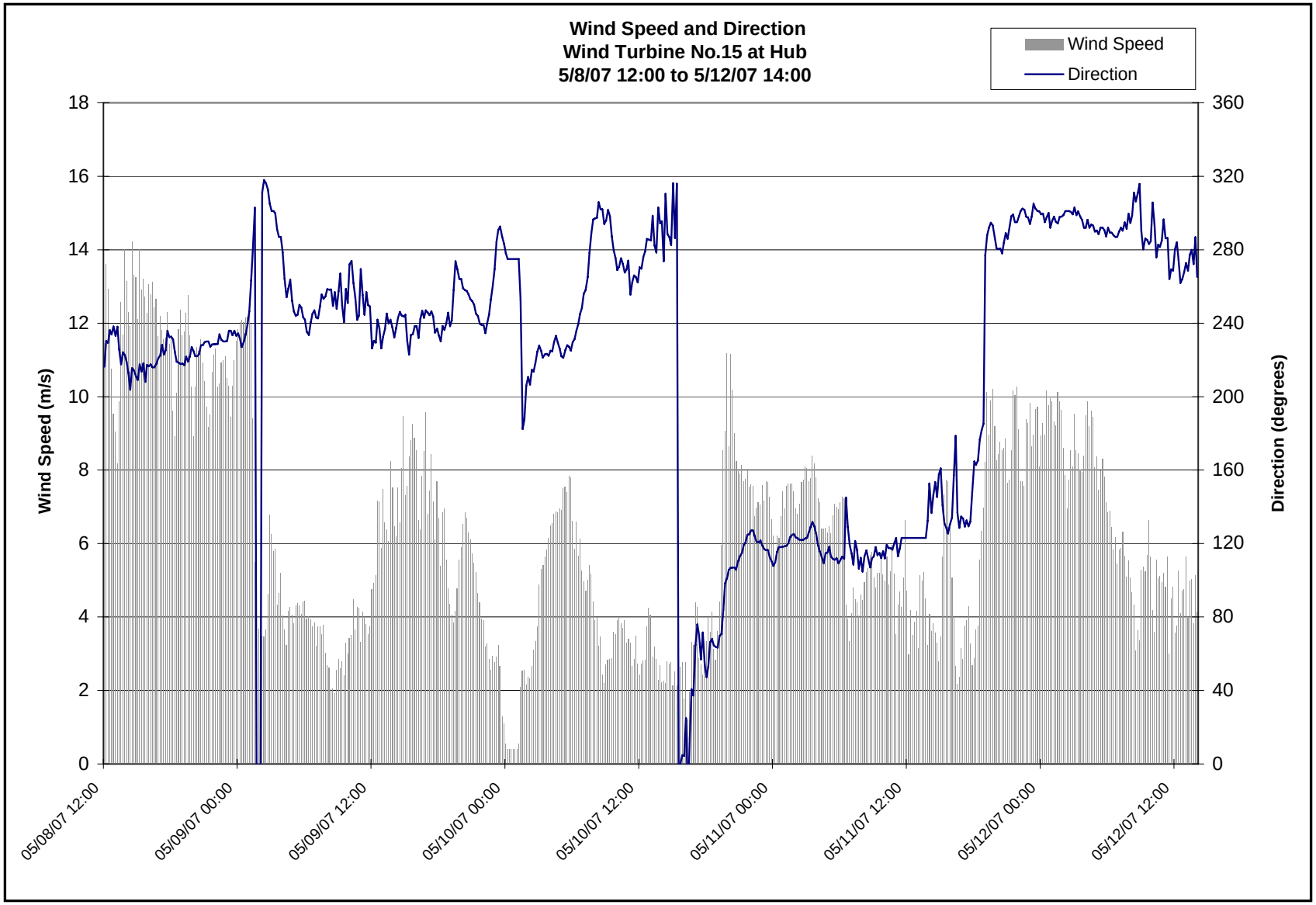
Hourly Ambient Sound Levels at MP-5

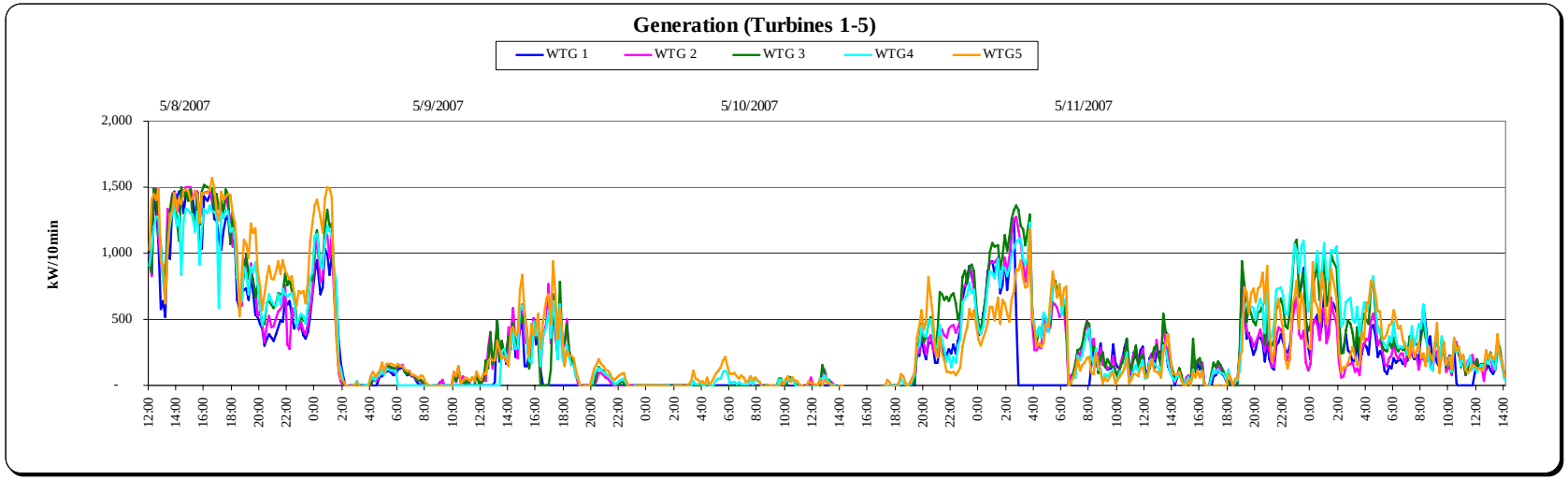


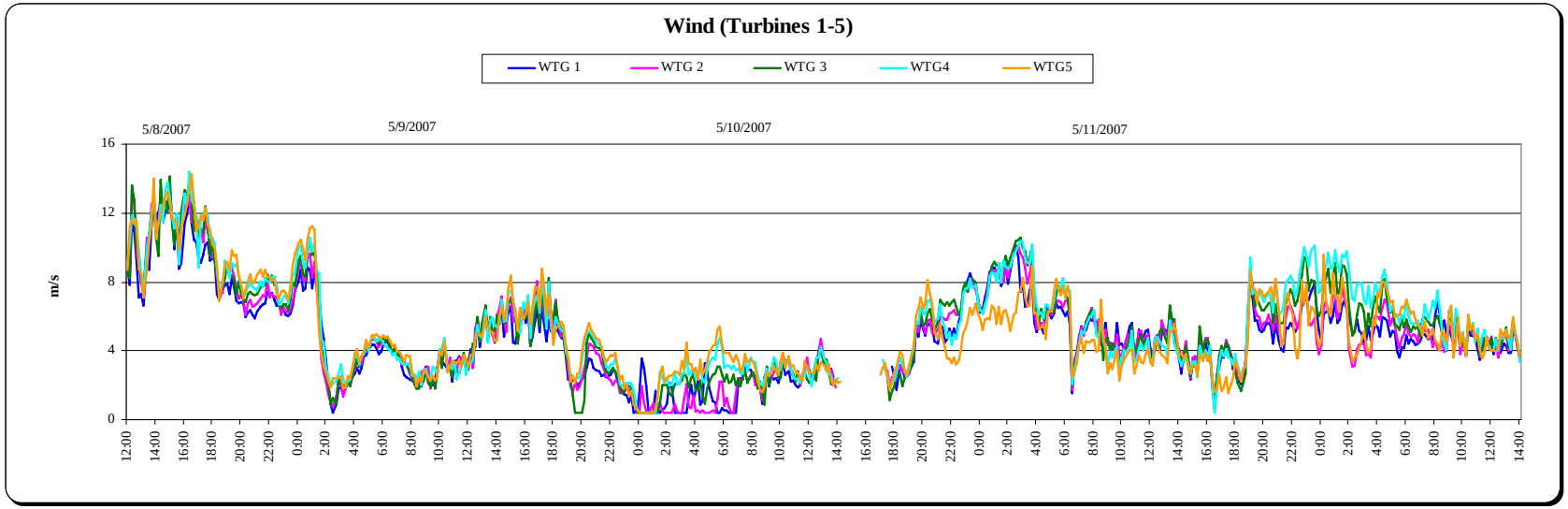
Hourly Ambient Sound Levels at MP-6

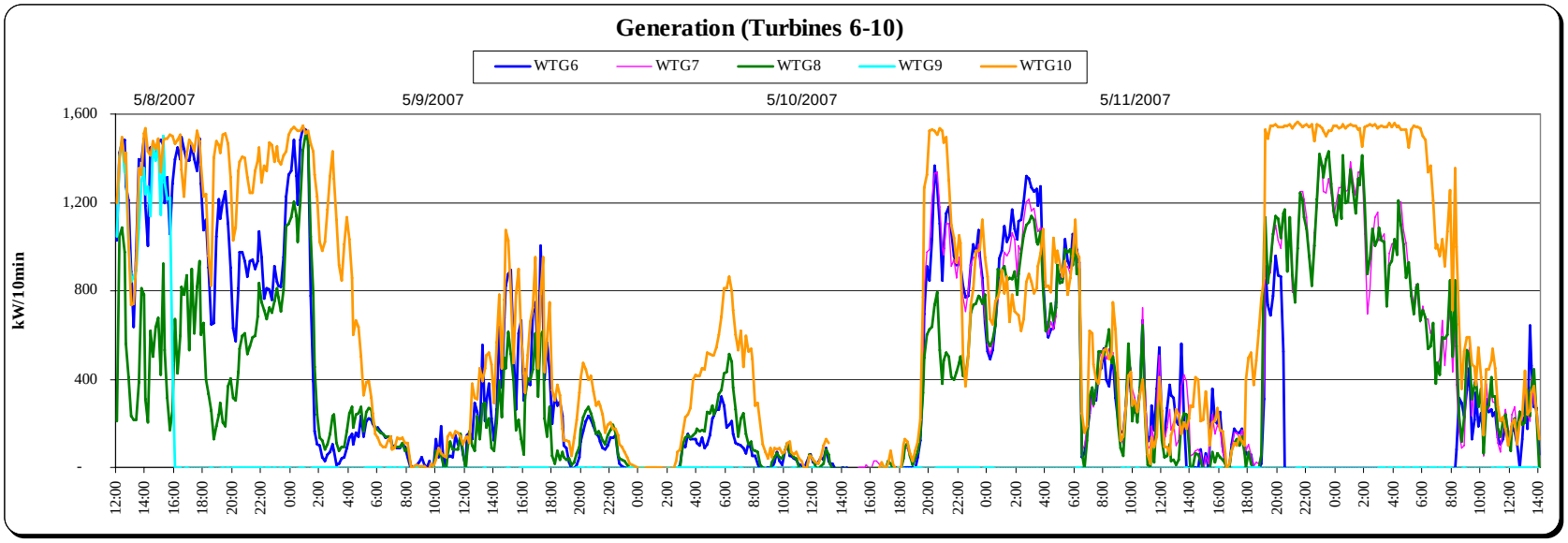


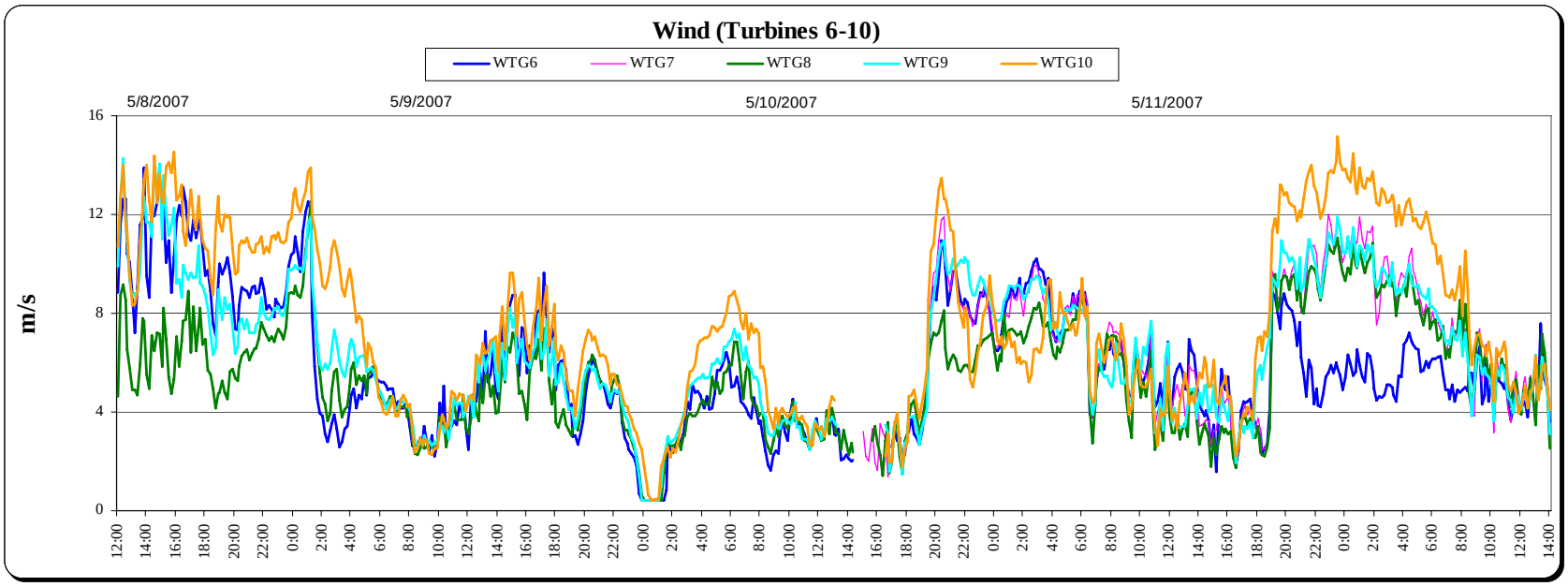
APPENDIX III
WIND TURBINE POWER PRODUCTION AND WIND SPEEDS - MAY 8-12, 2007
(compiled by UPC Operations)

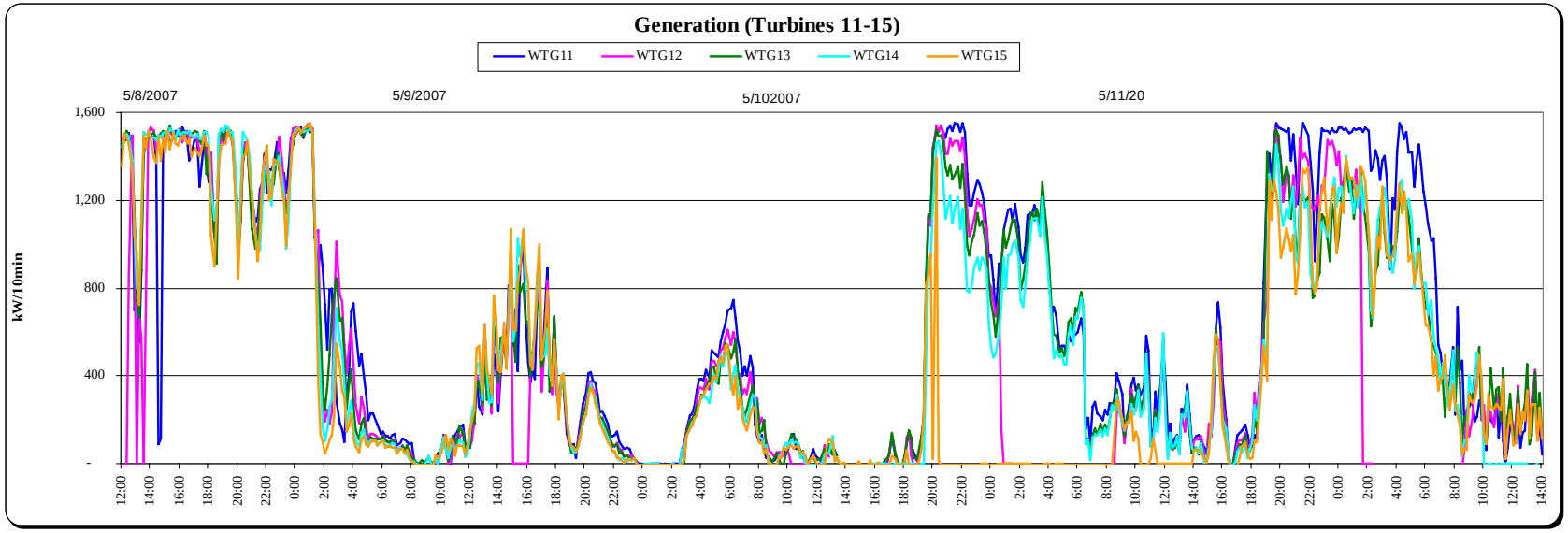

Wind Speed and Direction
Wind Turbine No.15 at Hub
5/8/07 12:00 to 5/12/07 14:00
Wind Speed
Direction
Wind Speed (m/s)
Direction (degrees)
0
2
4
6
8
10
12
14
16
18
0
40
80
120
160
200
240
280
320
360
05/08/07 12:00
05/09/07 00:00
05/09/07 12:00
05/10/07 00:00
05/10/07 12:00
05/11/07 00:00
05/11/07 12:00
05/12/07 00:00
05/12/07 12:00

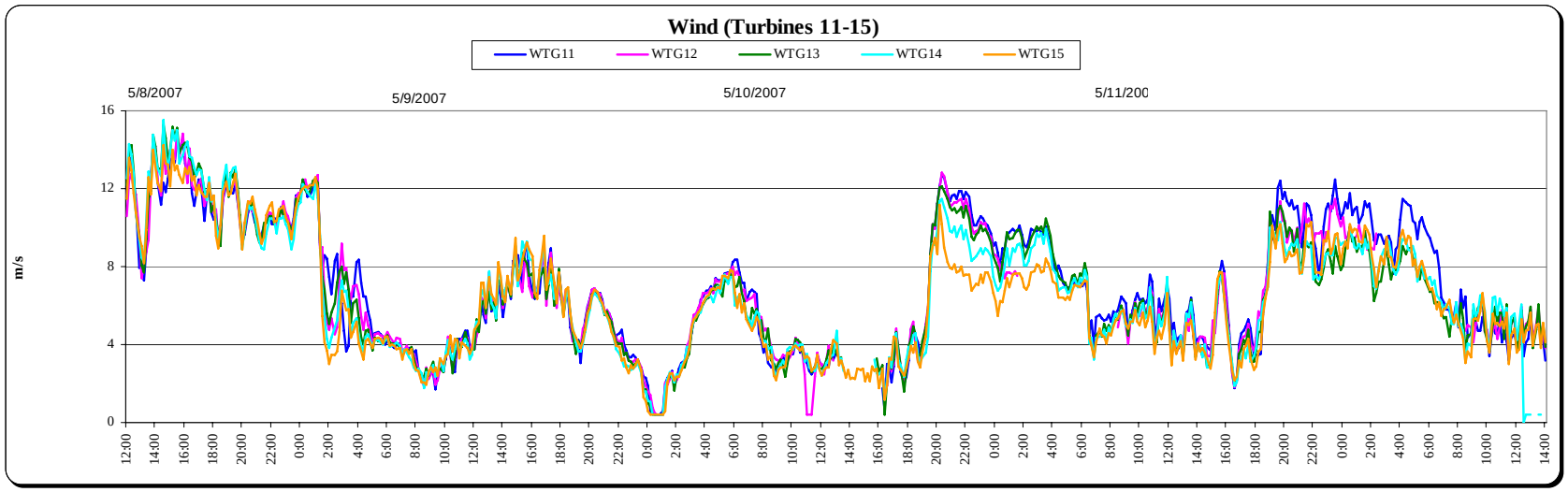

Generation (Turbines 1-5)
WTG 1
WTG 2
WTG 3
WTG4
WTG5
5/8/2007
5/9/2007
5/10/2007
5/11/2007
kW/10min
2,000
1,500
1,000
500
-

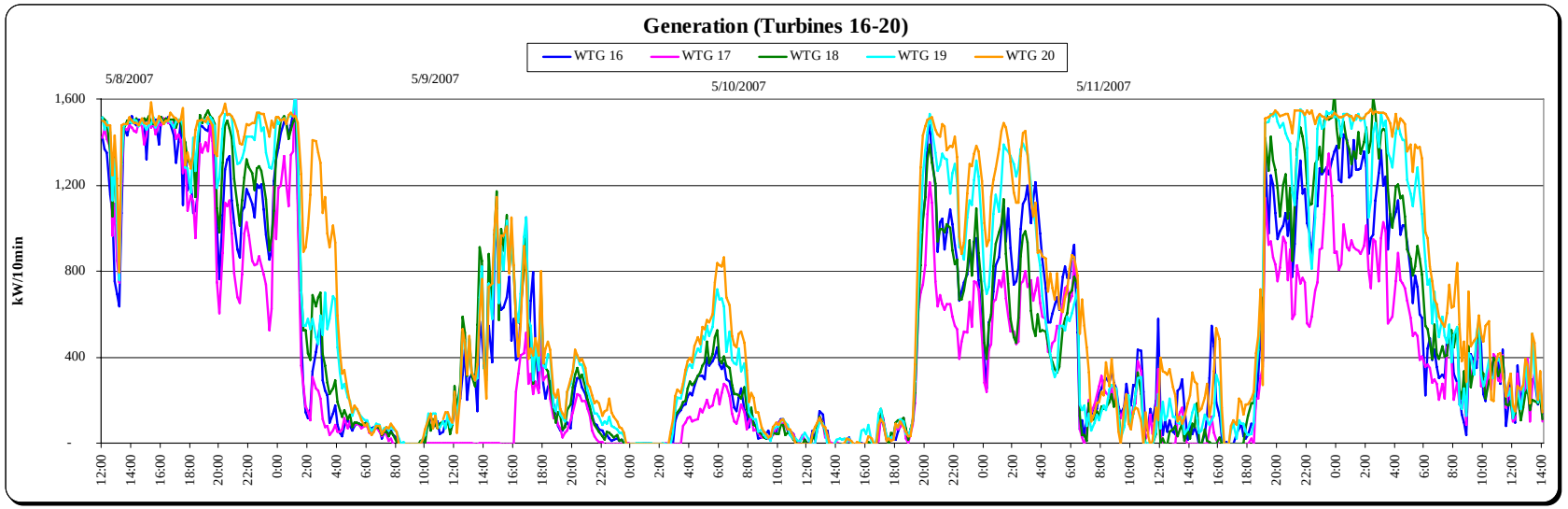

Wind (Turbines 1-5)
WTG 1
WTG 2
WTG 3
WTG4
WTG5
5/8/2007
5/9/2007
5/10/2007
5/11/2007
m/s
16
12
8
4
0

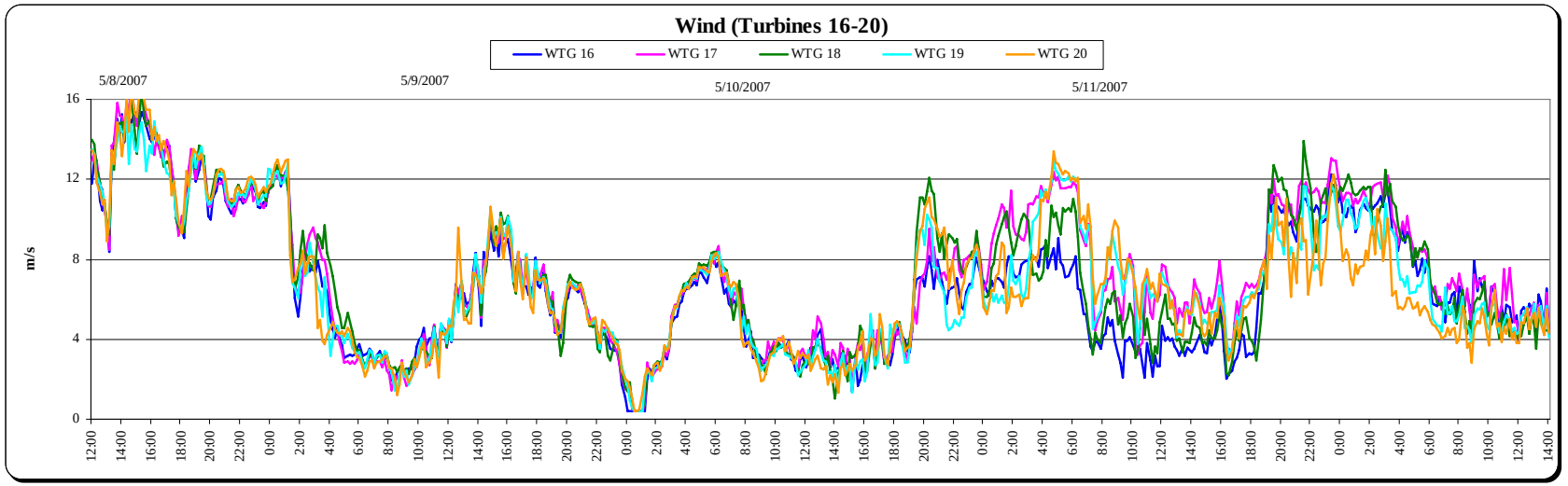

Generation (Turbines 6-10)
WTG6
WTG7
WTG8
WTG9
WTG10
5/8/2007
5/9/2007
5/10/2007
5/11/2007
kW/10min
1,600
1,200
800
400
-

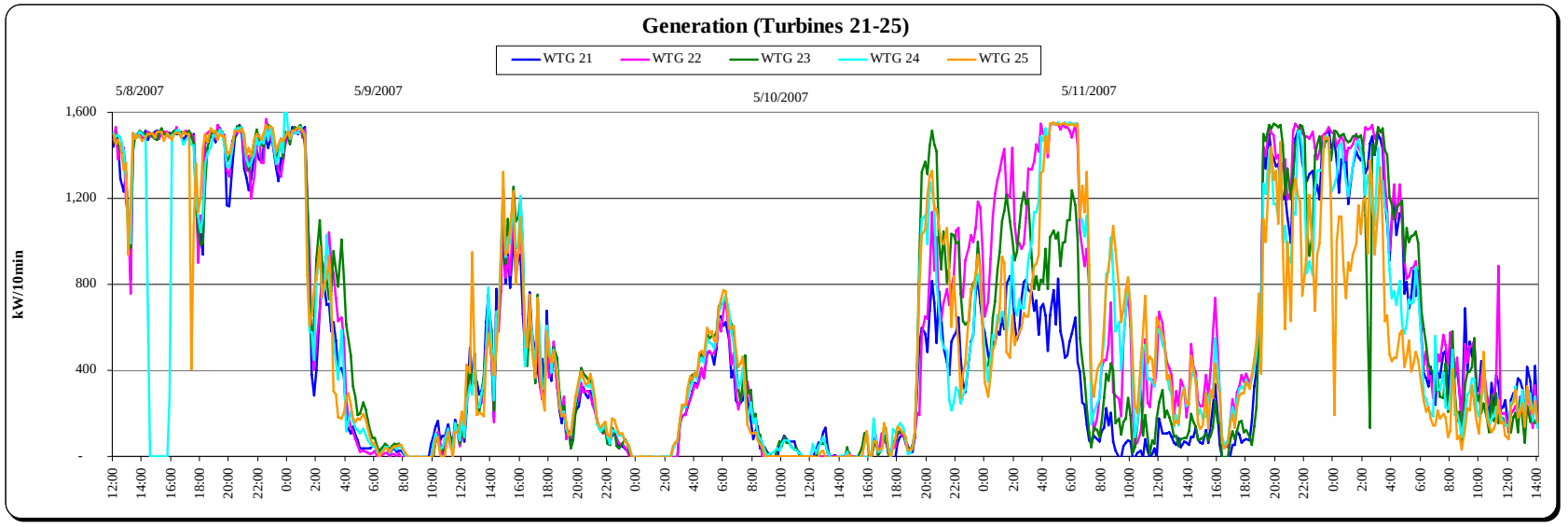

Wind (Turbines 6-10)
WTG6
WTG7
WTG8
WTG9
WTG10
5/8/2007
5/9/2007
5/10/2007
5/11/2007
m/s
16
12
8
4
0

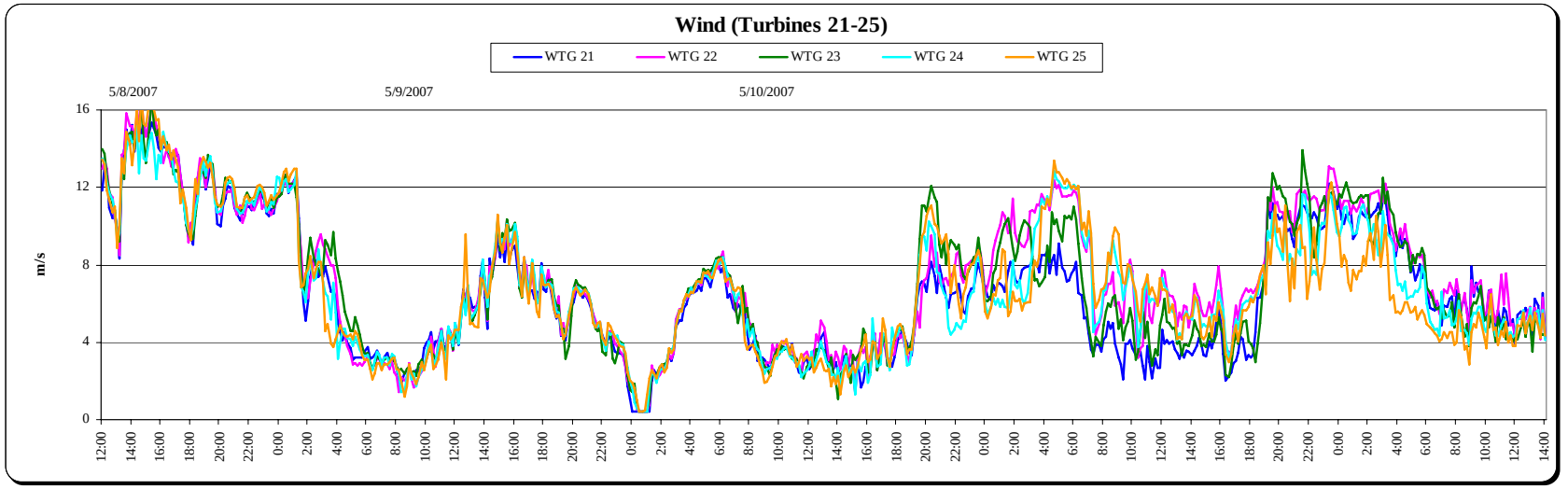

Generation (Turbines 11-15)
WTG11
WTG12
WTG13
WTG14
WTG15
5/8/2007
5/9/2007
5/102007
5/11/20
kW/10min
1,600
1,200
800
400
-

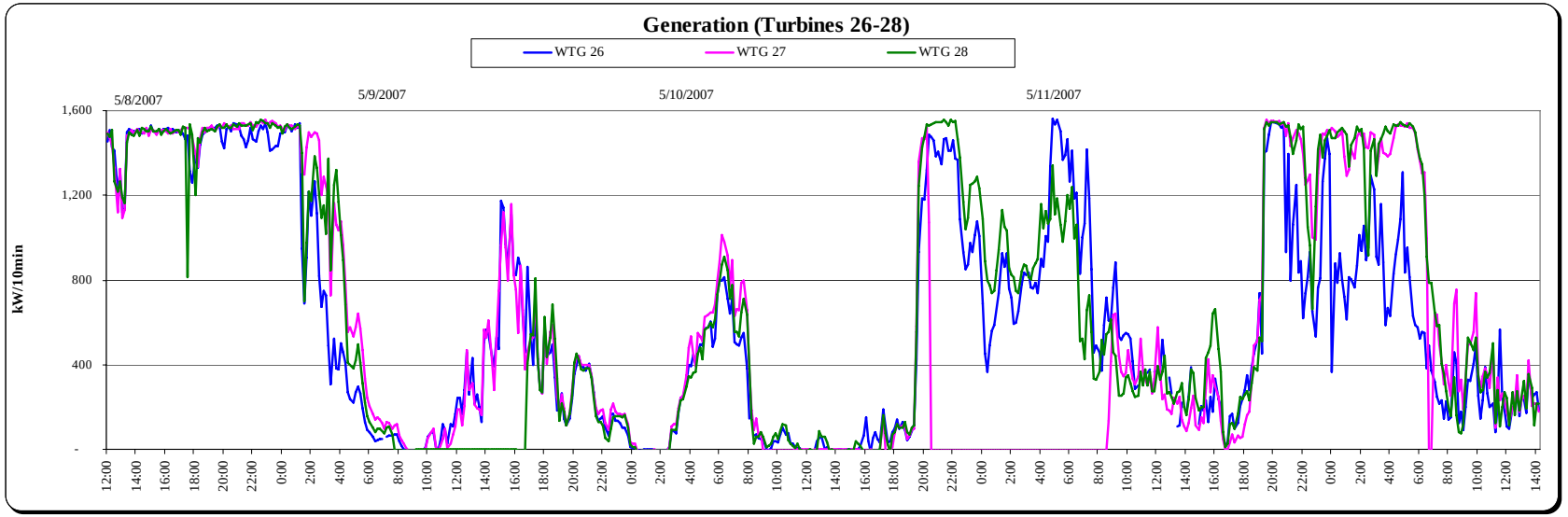

Wind (Turbines 11-15)
WTG11
WTG12
WTG13
WTG14
WTG15
5/8/2007
5/9/2007
5/10/2007
5/11/200
m/s
16
12
8
4
0

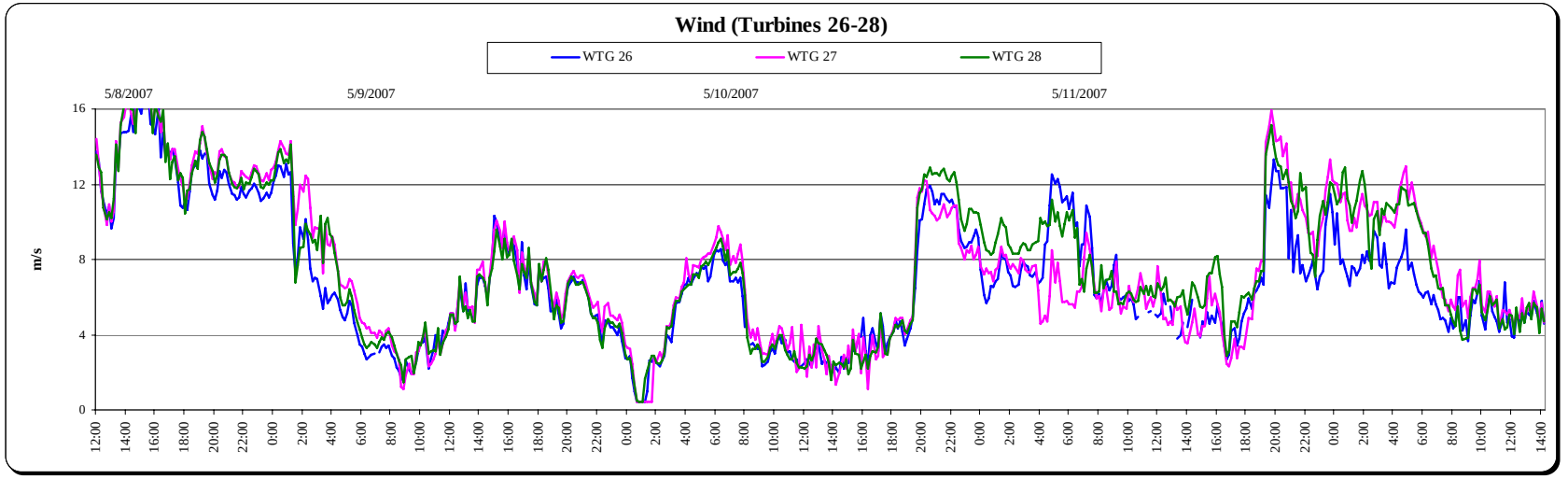

Generation (Turbines 16-20)
WTG 16
WTG 17
WTG 18
WTG 19
WTG 20
5/8/2007
5/9/2007
5/10/2007
5/11/2007
kW/10min
1,600
1,200
800
400
-


Wind (Turbines 16-20)
WTG 16
WTG 17
WTG 18
WTG 19
WTG 20
5/8/2007
5/9/2007
5/10/2007
5/11/2007
m/s
16
12
8
4
0


Generation (Turbines 21-25)
WTG 21
WTG 22
WTG 23
WTG 24
WTG 25
5/8/2007
5/9/2007
5/10/2007
5/11/2007
kW/10min
1,600
1,200
800
400
-


Wind (Turbines 21-25)
WTG 21
WTG 22
WTG 23
WTG 24
WTG 25
5/8/2007
5/9/2007
5/10/2007
m/s
16
12
8
4
0


Generation (Turbines 26-28)
WTG 26
WTG 27
WTG 28
5/8/2007
5/9/2007
5/10/2007
5/11/2007
kW/10min
1,600
1,200
800
400
-
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00

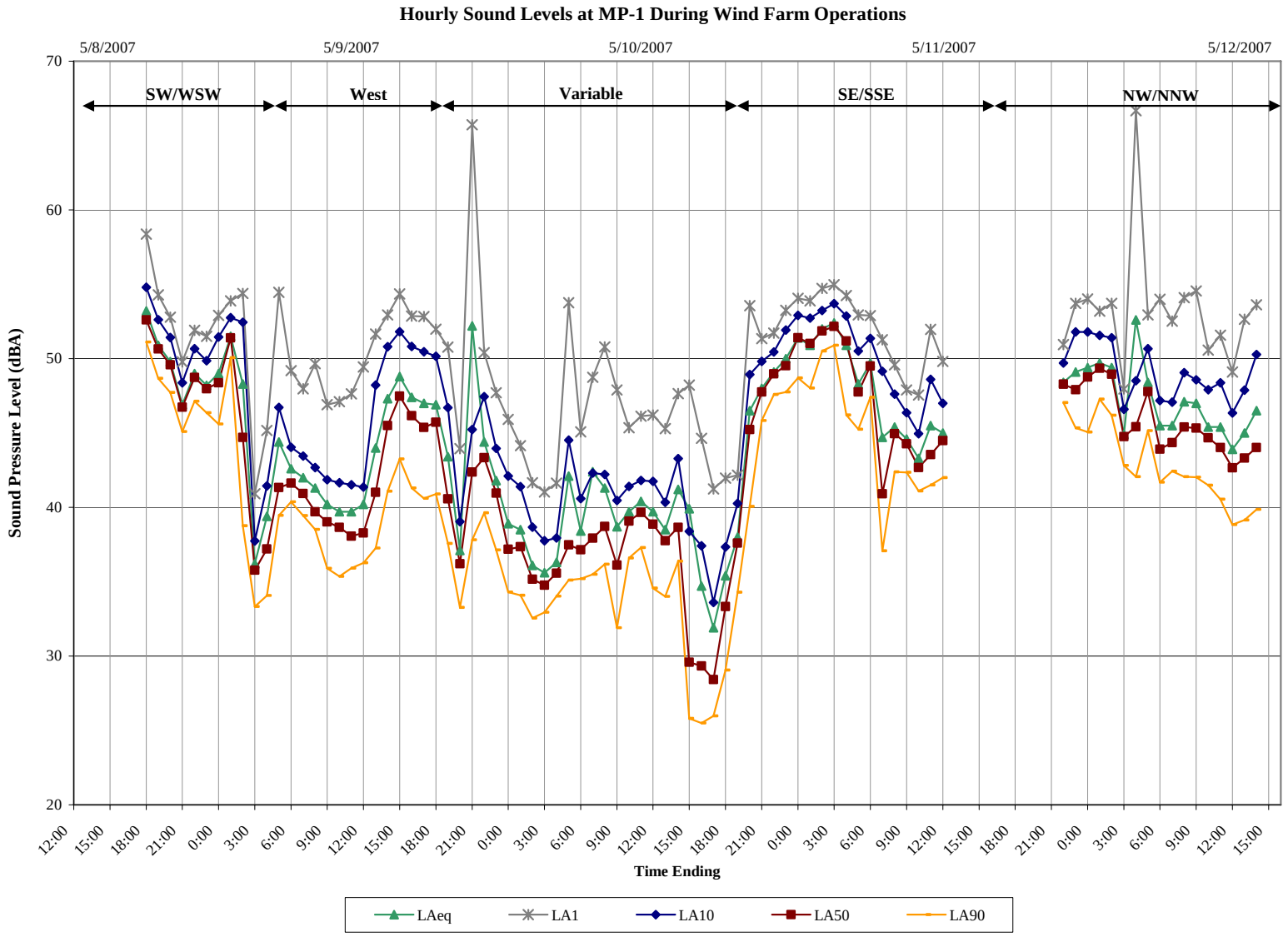

Wind (Turbines 26-28)
WTG 26
WTG 27
WTG 28
5/8/2007
5/9/2007
5/10/2007
5/11/2007
m/s
16
12
8
4
0
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00

APPENDIX IV
SOUND LEVEL MEASUREMENTS OF WIND FARM OPERATION – MAY 2007

Mars Hill Wind Farm
Hourly Sound Level Measurements During Routine Operation
Position MP-1

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	17:00	60	53	58	55	53	51
	18:00	60	51	54	53	51	49
	19:00	60	50	53	51	50	48
	20:00	60	47	50	48	47	45
	21:00	60	49	52	51	49	47
	22:00	60	48	52	50	48	46
	23:00	60	49	53	51	48	46
5/9/07	0:00	60	52	54	53	51	50
	1:00	60	48	54	52	45	39
	2:00	60	36	41	38	36	33
	3:00	60	39	45	41	37	34
	4:00	60	44	54	47	41	39
	5:00	60	43	49	44	42	40
	6:00	60	42	48	43	41	39
	7:00	60	41	50	43	40	39
	8:00	60	40	47	42	39	36
	9:00	60	40	47	42	39	35
	10:00	60	40	48	42	38	36
	11:00	60	40	49	41	38	36
	12:00	60	44	52	48	41	37
	13:00	60	47	53	51	46	41
	14:00	60	49	54	52	47	43
	15:00	60	47	53	51	46	41
	16:00	60	47	53	50	45	41
	17:00	60	47	52	50	46	41
	18:00	60	43	51	47	41	38
	19:00	60	37	44	39	36	33
	20:00	60	52	66	45	42	38
	21:00	60	44	50	47	43	40
	22:00	60	42	48	44	41	37
	23:00	60	39	46	42	37	34
5/10/07	0:00	60	39	44	41	37	34
	1:00	60	36	42	39	35	33
	2:00	60	36	41	38	35	33
	3:00	60	36	42	38	36	34
	4:00	60	42	54	45	37	35
	5:00	60	38	45	41	37	35
	6:00	60	42	49	42	38	35
	7:00	60	41	51	42	39	36
	8:00	60	39	48	40	36	32
	9:00	60	40	45	41	39	37
	10:00	60	40	46	42	40	37
	11:00	60	40	46	42	39	35

Date	Start Time	Duration (min)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	12:00	60	39	45	40	38	34
	13:00	10	41	48	43	39	36
	14:04	56	40	48	38	30	26
	15:00	60	35	45	37	29	26
	16:00	60	32	41	34	28	26
	17:00	60	35	42	37	33	29
	18:00	60	38	42	40	38	34
	19:00	60	47	54	49	45	40
	20:00	60	48	51	50	48	46
	21:00	60	49	52	50	49	48
	22:00	60	50	53	52	50	48
	23:00	60	51	54	53	51	49
5/11/07	0:00	60	51	54	53	51	48
	1:00	60	52	55	53	52	51
	2:00	60	52	55	54	52	51
	3:00	60	51	54	53	51	46
	4:00	60	48	53	51	48	45
	5:00	60	50	53	51	50	47
	6:00	60	45	51	49	41	37
	7:00	60	45	50	48	45	42
	8:00	60	45	48	46	44	42
	9:00	60	43	48	45	43	41
	10:00	60	46	52	49	44	41
	11:00	60	45	50	47	44	42
	12:00	3	47	55	44	41	39
	measurements paused due to rain						
	21:27	33	48	51	50	48	47
	22:00	60	49	54	52	48	45
	23:00	60	49	54	52	49	45
5/12/07	0:00	60	50	53	52	49	47
	1:00	60	49	54	51	49	46
	2:00	60	45	48	47	45	43
	3:00	60	53	67	49	45	42
	4:00	60	48	53	51	48	45
	5:00	60	46	54	47	44	42
	6:00	60	46	53	47	44	42
	7:00	60	47	54	49	45	42
	8:00	60	47	55	49	45	42
	9:00	60	45	51	48	45	41
	10:00	60	45	52	48	44	41
	11:00	60	44	49	46	43	39
	12:00	60	45	53	48	43	39
	13:00	60	47	54	50	44	40


Hourly Sound Levels at MP-1 During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

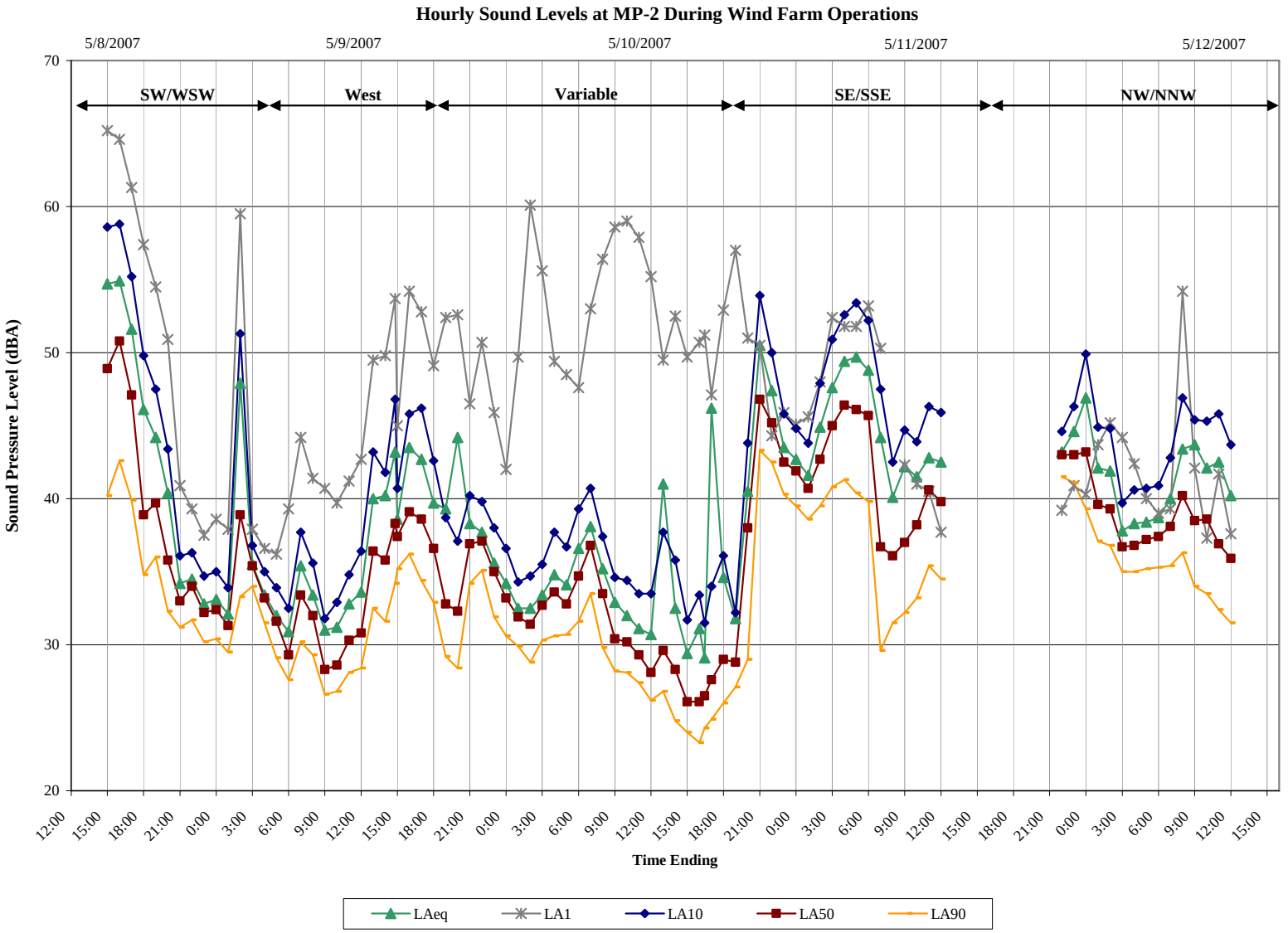
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-2

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	14:00	60	55	65	59	49	40
	15:00	60	55	65	59	51	43
	16:00	60	52	61	55	47	40
	17:00	60	46	57	50	39	35
	18:00	60	44	55	48	40	36
	19:00	60	40	51	43	36	32
	20:00	60	34	41	36	33	31
	21:00	60	35	39	36	34	32
	22:00	60	33	38	35	32	30
	23:00	60	33	39	35	32	30
5/9/07	0:00	60	32	38	34	31	30
	1:00	60	48	60	51	39	33
	2:00	60	36	38	37	35	34
	3:00	60	33	37	35	33	32
	4:00	60	32	36	34	32	29
	5:00	60	31	39	33	29	28
	6:00	60	35	44	38	33	30
	7:00	60	33	41	36	32	29
	8:00	60	31	41	32	28	27
	9:00	60	31	40	33	29	27
	10:00	60	33	41	35	30	28
	11:00	60	34	43	36	31	28
	12:00	60	40	50	43	36	33
	13:00	60	40	50	42	36	32
	14:00	32	43	54	47	38	34
	14:48	11	39	45	41	37	35
	15:00	60	44	54	46	39	36
	16:00	60	43	53	46	39	34
	17:00	60	40	49	43	37	33
	18:00	60	39	52	39	33	29
	19:00	60	44	53	37	32	28
	20:00	60	38	47	40	37	34
	21:00	60	38	42	40	37	35
	22:00	60	36	41	38	35	32
	23:00	60	34	41	37	33	31
5/10/07	0:00	60	33	38	34	32	30
	1:00	60	33	40	35	31	29
	2:00	60	33	39	36	33	30
	3:00	60	35	41	38	34	31
	4:00	60	34	40	37	33	31
	5:00	60	37	44	39	35	32
	6:00	60	38	45	41	37	34
	7:00	60	35	44	37	34	30
	8:00	60	33	42	35	30	28

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	9:00	60	32	40	34	30	28
	10:00	60	31	39	34	29	27
	11:00	60	31	39	34	28	26
	12:00	60	41	54	38	30	27
	13:00	60	33	42	36	28	25
	14:00	60	29	37	32	26	24
	15:00	60	31	42	33	26	23
	16:00	21	29	38	32	27	24
	16:25	34	46	51	34	28	25
	17:00	60	35	46	36	29	26
	18:00	60	32	42	32	29	27
	19:00	60	41	50	44	38	29
	20:00	60	51	60	54	47	43
	21:00	60	47	56	50	45	43
	22:00	60	44	49	46	43	40
	23:00	60	43	49	45	42	40
	0:00	60	42	48	44	41	39
	1:00	60	45	53	48	43	40
	2:00	60	48	56	51	45	41
	3:00	60	49	59	53	46	41
5/11/07	4:00	60	50	59	53	46	40
	5:00	60	49	58	52	46	40
	6:00	60	44	55	48	37	30
	7:00	60	40	50	43	36	32
	8:00	60	42	53	45	37	32
	9:00	60	42	50	44	38	33
	10:00	60	43	51	46	41	35
	11:00	50	43	51	46	40	35
	measurements paused due to rain						
	21:17	43	43	47	45	43	42
	22:00	60	45	53	46	43	41
	23:00	60	47	57	50	43	39
	0:00	60	42	51	45	40	37
	1:00	60	42	51	45	39	37
	2:00	60	38	44	40	37	35
	3:00	60	38	46	41	37	35
5/12/07	4:00	60	38	45	41	37	35
	5:00	60	39	46	41	37	35
	6:00	60	40	48	43	38	35
	7:00	60	43	52	47	40	36
	8:00	60	44	52	45	39	34
	9:00	60	42	52	45	39	34
	10:00	60	43	53	46	37	32


Hourly Sound Levels at MP-2 During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

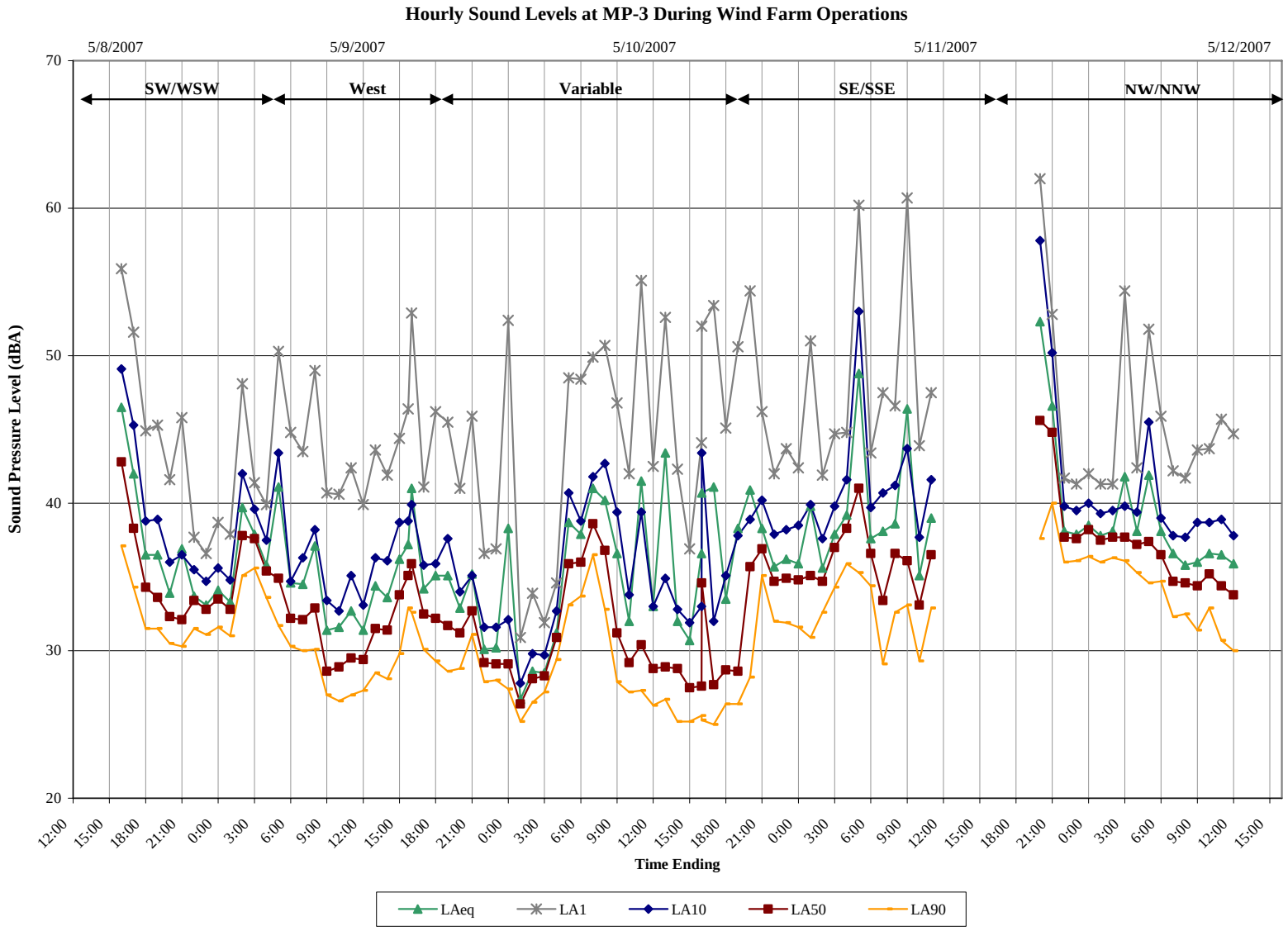
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-3

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	15:00	60	47	56	49	43	37
	16:00	60	42	52	45	38	34
	17:00	60	37	45	39	34	32
	18:00	60	37	45	39	34	32
	19:00	60	34	42	36	32	31
	20:00	60	37	46	37	32	30
	21:00	60	34	38	36	33	32
	22:00	60	33	37	35	33	31
	23:00	60	34	39	36	34	32
5/9/07	0:00	60	33	38	35	33	31
	1:00	60	40	48	42	38	35
	2:00	60	38	41	40	38	36
	3:00	60	36	40	38	35	34
	4:00	60	41	50	43	35	32
	5:00	60	35	45	35	32	30
	6:00	60	35	44	36	32	30
	7:00	60	37	49	38	33	30
	8:00	60	31	41	33	29	27
	9:00	60	32	41	33	29	27
	10:00	60	33	42	35	30	27
	11:00	60	31	40	33	29	27
	12:00	60	34	44	36	32	29
	13:00	60	34	42	36	31	28
	14:00	60	36	44	39	34	30
	15:00	30	37	46	39	35	33
	15:43	16	41	53	40	36	33
	16:00	60	34	41	36	33	30
	17:00	60	35	46	36	32	29
	18:00	60	35	46	38	32	29
	19:00	60	33	41	34	31	29
	20:00	60	35	46	35	33	31
	21:00	60	30	37	32	29	28
	22:00	60	30	37	32	29	28
	23:00	60	38	52	32	29	27
5/10/07	0:00	60	27	31	28	26	25
	1:00	60	29	34	30	28	27
	2:00	60	29	32	30	28	27
	3:00	60	31	35	33	31	29
	4:00	60	39	49	41	36	33
	5:00	60	38	48	39	36	34
	6:00	60	41	50	42	39	37
	7:00	60	40	51	43	37	33
	8:00	60	37	47	39	31	28
	9:00	60	32	42	34	29	27
	10:00	60	42	55	39	30	27

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	11:00	60	33	43	33	29	26
	12:00	60	43	53	35	29	27
	13:00	60	32	42	33	29	25
	14:00	60	31	37	32	28	25
	15:00	56	37	44	33	28	26
	15:59	0	41	52	43	35	25
	16:00	60	41	53	32	28	25
	17:00	60	34	45	35	29	26
	18:00	60	38	51	38	29	26
	19:00	60	41	54	39	36	28
	20:00	60	38	46	40	37	35
	21:00	60	36	42	38	35	32
	22:00	60	36	44	38	35	32
	23:00	60	36	42	39	35	32
5/11/07	0:00	60	40	51	40	35	31
	1:00	60	36	42	38	35	33
	2:00	60	38	45	40	37	34
	3:00	60	39	45	42	38	36
	4:00	60	49	60	53	41	35
	5:00	60	38	43	40	37	34
	6:00	60	38	48	41	33	29
	7:00	60	39	47	41	37	33
	8:00	60	46	61	44	36	33
	9:00	60	35	44	38	33	29
	10:00	60	39	48	42	37	33
	11:00	39	38	47	37	33	30
	measurements paused due to rain						
	19:09	51	52	62	58	46	38
	21:00	60	38	42	40	38	36
	22:00	60	38	41	40	38	36
5/12/07	23:00	60	39	42	40	38	36
	0:00	60	38	41	39	38	36
	1:00	60	38	41	40	38	36
	2:00	60	42	54	40	38	36
	3:00	60	38	42	39	37	35
	4:00	60	42	52	46	37	35
	5:00	60	38	46	39	37	35
	6:00	60	37	42	38	35	32
	7:00	60	36	42	38	35	33
	8:00	60	36	44	39	34	31
	9:00	60	37	44	39	35	33
	10:00	60	37	46	39	34	31
	11:00	60	36	45	38	34	30


Hourly Sound Levels at MP-3 During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

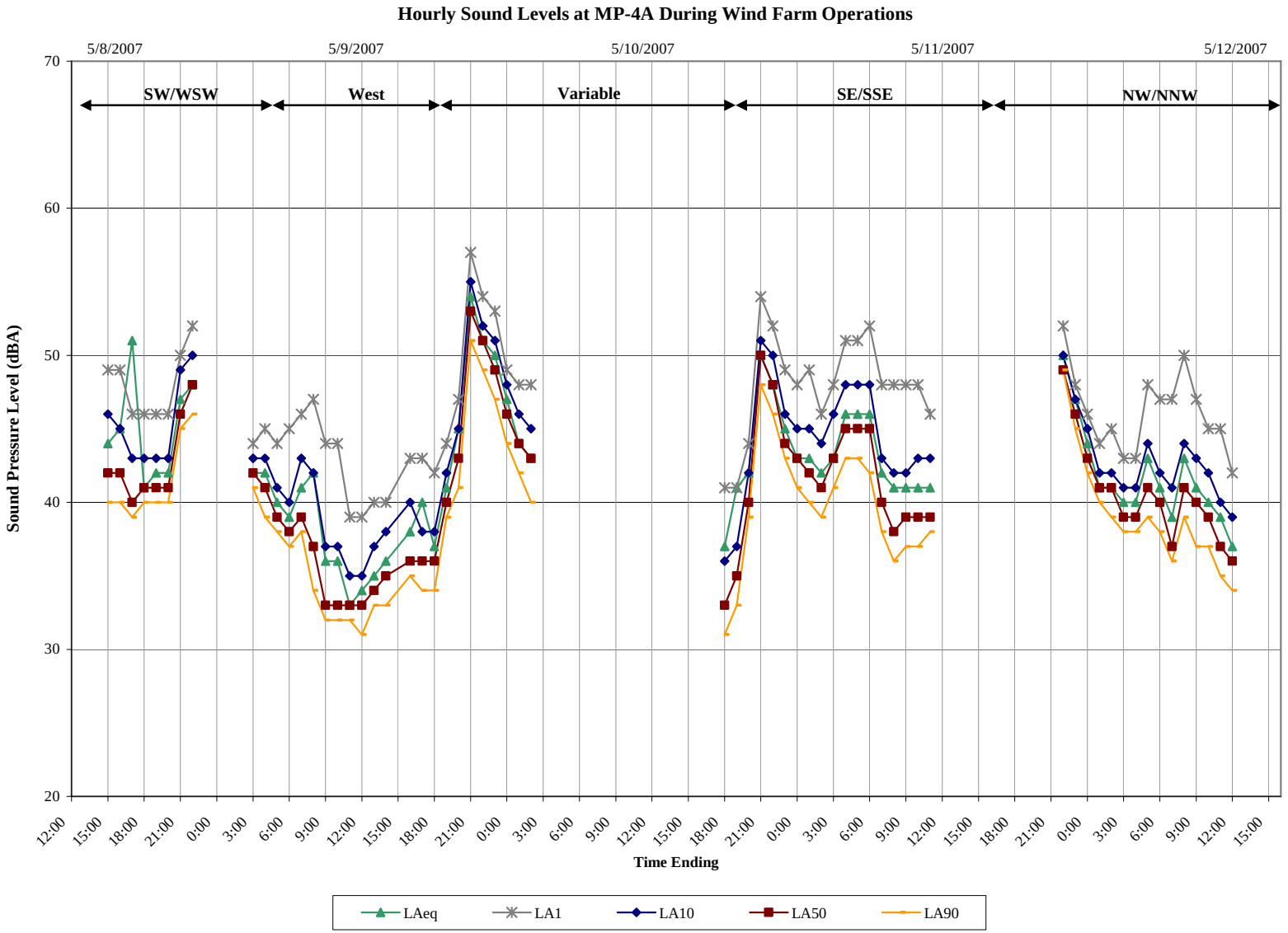
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-4A

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	14:00	60	44	49	46	42	40
	15:00	60	45	49	45	42	40
	16:00	60	51	46	43	40	39
	17:00	60	41	46	43	41	40
	18:00	60	42	46	43	41	40
	19:00	60	42	46	43	41	40
	20:00	60	47	50	49	46	45
	21:00	60	48	52	50	48	46
5/9/07	2:00	60	42	44	43	42	41
	3:00	60	42	45	43	41	39
	4:00	60	40	44	41	39	38
	5:00	60	39	45	40	38	37
	6:00	60	41	46	43	39	38
	7:00	60	42	47	42	37	34
	8:00	60	36	44	37	33	32
	9:00	60	36	44	37	33	32
	10:00	60	33	39	35	33	32
	11:00	60	34	39	35	33	31
	12:00	60	35	40	37	34	33
	13:00	60	36	40	38	35	33
	14:00	60	38	43	40	36	35
	16:00	60	40	43	38	36	34
	17:00	60	37	42	38	36	34
	18:00	60	41	44	42	40	39
	19:00	60	45	47	45	43	41
	20:00	60	54	57	55	53	51
	21:00	60	51	54	52	51	49
	22:00	60	50	53	51	49	47
	23:00	60	47	49	48	46	44
5/10/07	0:00	60	44	48	46	44	42
	1:00	60	43	48	45	43	40
	17:00	60	37	41	36	33	31
	18:00	60	41	41	37	35	33
	19:00	60	42	44	42	40	39

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	20:00	60	50	54	51	50	48
	21:00	60	48	52	50	48	46
	22:00	60	45	49	46	44	43
	23:00	60	43	48	45	43	41
5/11/07	0:00	60	43	49	45	42	40
	1:00	60	42	46	44	41	39
	2:00	60	43	48	46	43	41
	3:00	60	46	51	48	45	43
	4:00	60	46	51	48	45	43
	5:00	60	46	52	48	45	42
	6:00	60	42	48	43	40	38
	7:00	60	41	48	42	38	36
	8:00	60	41	48	42	39	37
	9:00	60	41	48	43	39	37
	10:00	60	41	46	43	39	38
	measurements paused due to rain						
	21:00	60	50	52	50	49	49
	22:00	60	47	48	47	46	45
5/12/07	23:00	60	44	46	45	43	42
	0:00	60	41	44	42	41	40
	1:00	60	41	45	42	41	39
	2:00	60	40	43	41	39	38
	3:00	60	40	43	41	39	38
	4:00	60	43	48	44	41	39
	5:00	60	41	47	42	40	38
	6:00	60	39	47	41	37	36
	7:00	60	43	50	44	41	39
	8:00	60	41	47	43	40	37
	9:00	60	40	45	42	39	37
	10:00	60	39	45	40	37	35
	11:00	60	37	42	39	36	34


Hourly Sound Levels at MP-4A During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

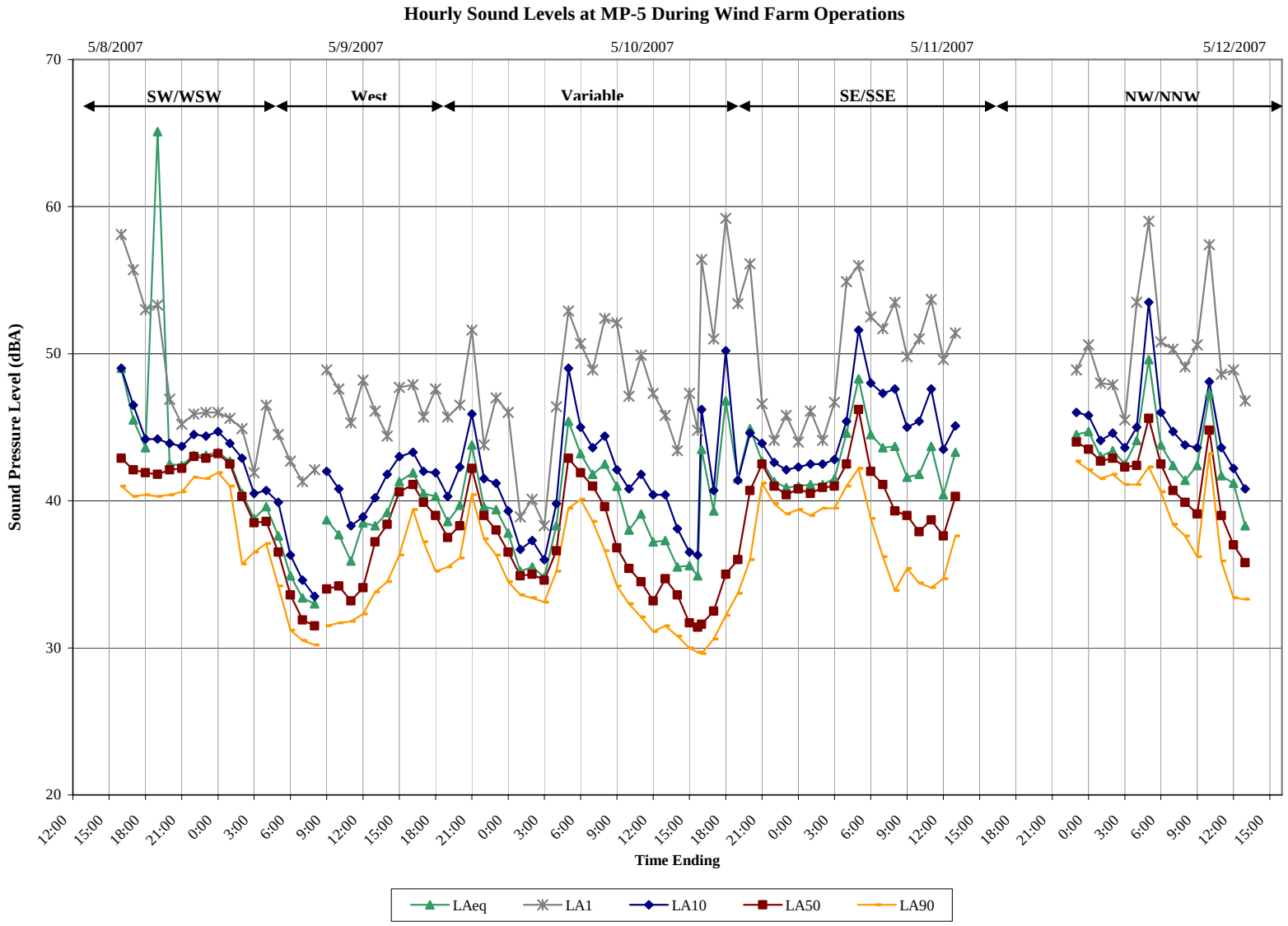
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-5

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	15:00	60	49	58	49	43	41
	16:00	60	46	56	47	42	40
	17:00	60	44	53	44	42	40
	18:00	60	65	53	44	42	40
	19:00	60	43	47	44	42	40
	20:00	60	42	45	44	42	41
	21:00	60	43	46	45	43	42
	22:00	60	43	46	44	43	42
	23:00	60	43	46	45	43	42
5/9/07	0:00	60	43	46	44	43	41
	1:00	60	41	45	43	40	36
	2:00	60	39	42	41	39	37
	3:00	60	40	47	41	39	37
	4:00	60	38	45	40	37	34
	5:00	60	35	43	36	34	31
	6:00	60	33	41	35	32	31
	7:00	60	33	42	34	32	30
	8:15	45	39	49	42	34	32
	9:00	60	38	48	41	34	32
	10:00	60	36	45	38	33	32
	11:00	60	39	48	39	34	32
	12:00	60	38	46	40	37	34
	13:00	60	39	44	42	38	35
	14:00	60	41	48	43	41	36
	15:00	59	42	48	43	41	39
	16:08	52	41	46	42	40	37
	17:00	60	40	48	42	39	35
	18:00	60	39	46	40	38	36
	19:00	60	40	47	42	38	36
	20:00	60	44	52	46	42	40
	21:00	60	40	44	42	39	37
	22:00	60	39	47	41	38	36
	23:00	60	38	46	39	37	35
	0:00	60	35	39	37	35	34
5/10/07	1:00	60	36	40	37	35	33
	2:00	60	35	38	36	35	33
	3:00	60	38	46	40	37	35
	4:00	60	45	53	49	43	40
	5:00	60	43	51	45	42	40
	6:00	60	42	49	44	41	39
	7:00	60	43	52	44	40	37
	8:00	60	41	52	42	37	34
	9:00	60	38	47	41	35	33
	10:00	60	39	50	42	35	32

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	11:00	60	37	47	40	33	31
	12:00	60	37	46	40	35	32
	13:00	60	36	43	38	34	31
	14:00	60	36	47	37	32	30
	15:00	36	35	45	36	31	30
	15:40	19	44	56	46	32	30
	16:00	60	39	51	41	33	31
	17:00	60	47	59	50	35	32
	18:00	60	42	53	41	36	34
	19:00	60	45	56	45	41	36
	20:00	60	43	47	44	43	41
	21:00	60	41	44	43	41	40
	22:00	60	41	46	42	40	39
	23:00	60	41	44	42	41	39
	0:00	60	41	46	43	41	39
	1:00	60	41	44	43	41	40
	2:00	60	42	47	43	41	40
	3:00	60	45	55	45	43	41
	4:00	60	48	56	52	46	42
5/11/07	5:00	60	45	53	48	42	39
	6:00	60	44	52	47	41	36
	7:00	60	44	54	48	39	34
	8:00	60	42	50	45	39	35
	9:00	60	42	51	45	38	34
	10:00	60	44	54	48	39	34
	11:00	60	40	50	44	38	35
	12:00	58	43	51	45	40	38
	measurements paused due to rain						42
	23:00	60	45	51	46	44	42
	0:00	60	43	48	44	43	42
	1:00	60	43	48	45	43	41
	2:00	60	43	46	44	42	41
	3:00	60	44	54	45	42	42
	4:00	60	50	59	54	46	41
5/12/07	5:00	60	44	51	46	43	38
	6:00	60	42	50	45	41	38
	7:00	60	41	49	44	40	36
	8:00	60	42	51	44	39	43
	9:00	60	47	57	48	45	36
	10:00	60	42	49	44	39	33
	11:00	60	41	49	42	37	33
	12:00	57	38	47	41	36	36
	12:58	1	39	48	41	38	


Hourly Sound Levels at MP-5 During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

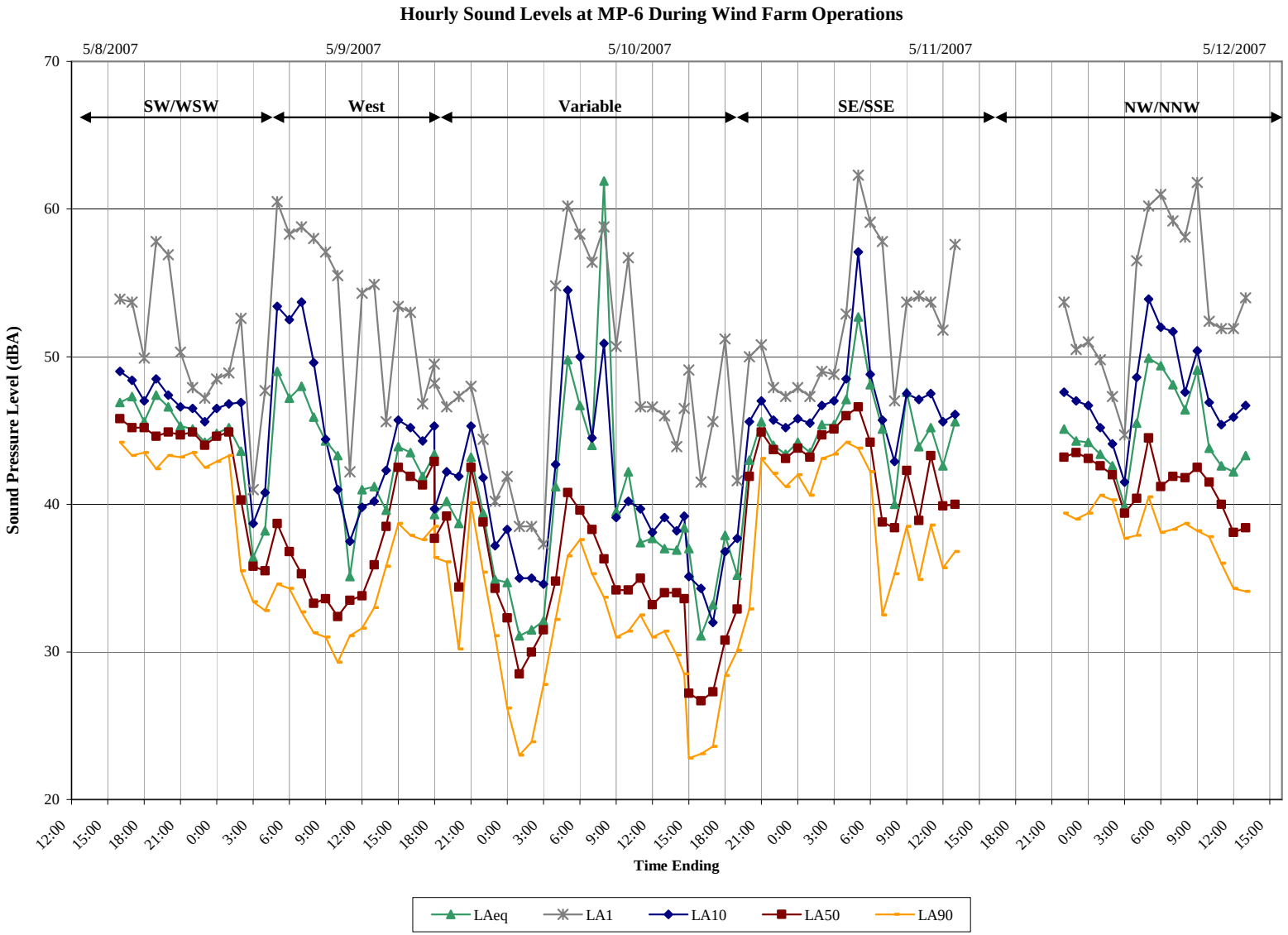
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-6

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	16:00	60	47	54	48	45	43
	17:00	60	46	50	47	45	44
	18:00	60	47	58	49	45	42
	19:00	60	47	57	47	45	43
	20:00	60	45	50	47	45	43
	21:00	60	45	48	47	45	44
	22:00	60	44	47	46	44	43
	23:00	60	45	49	47	45	43
5/9/07	0:00	60	45	49	47	45	43
	1:00	60	44	53	47	40	36
	2:00	60	36	41	39	36	33
	3:00	60	38	48	41	36	33
	4:00	60	49	61	53	39	35
	5:00	60	47	58	53	37	34
	6:00	60	48	59	54	35	33
	7:00	60	46	58	50	33	31
	8:00	60	44	57	44	34	31
	10:00	60	35	42	38	34	31
	11:00	60	41	54	40	34	32
	12:00	60	41	55	40	36	33
	13:00	60	40	46	42	39	36
	14:00	60	44	53	46	43	39
	15:00	60	44	53	45	42	38
	16:00	60	42	47	44	41	38
	17:00	47	43	50	45	43	39
	17:58	1	39	48	40	38	36
	18:00	60	40	47	42	39	36
	19:00	60	39	47	42	34	30
	20:00	60	43	48	45	43	40
	21:00	60	39	44	42	39	35
	22:00	60	35	40	37	34	31
	23:00	60	35	42	38	32	26
5/10/07	0:00	60	31	39	35	29	23
	1:00	60	32	39	35	30	24
	2:00	60	32	37	35	32	28
	3:00	60	41	55	43	35	32
	4:00	60	50	60	55	41	37
	5:00	60	47	58	50	40	38
	6:00	60	44	56	45	38	35
	7:00	60	62	59	51	36	34
	8:00	60	40	51	39	34	31
	9:00	60	42	57	40	34	31
	10:00	60	37	47	40	35	33

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	11:00	60	38	47	38	33	31
	12:00	60	37	46	39	34	31
	13:00	60	37	44	38	34	30
	14:00	24	38	47	39	34	29
	14:37	22	37	49	35	27	23
	15:00	60	31	42	34	27	23
	16:00	60	33	46	32	27	24
	17:00	60	38	51	37	31	28
	18:00	60	35	42	38	33	30
	19:00	60	43	50	46	42	33
	20:00	60	46	51	47	45	43
	21:00	60	44	48	46	44	42
	22:00	60	43	47	45	43	41
	23:00	60	44	48	46	44	42
5/11/07	0:00	60	44	47	46	43	41
	1:00	60	45	49	47	45	43
	2:00	60	45	49	47	45	43
	3:00	60	47	53	49	46	44
	4:00	60	53	62	57	47	44
	5:00	60	48	59	49	44	42
	6:00	60	45	58	46	39	33
	7:00	60	40	47	43	38	35
	8:00	60	48	54	48	42	39
	9:00	60	44	54	47	39	35
	10:00	60	45	54	48	43	39
	11:00	60	43	52	46	40	36
	12:00	33	46	58	46	40	37
	measurements paused due to rain						
	21:44	16	45	54	48	43	39
	23:00	60	44	51	47	43	39
5/12/07	0:00	60	43	50	45	43	41
	1:00	60	43	47	44	42	40
	2:00	60	40	45	42	39	38
	3:00	60	46	57	49	40	38
	4:00	60	50	60	54	45	41
	5:00	60	49	61	52	41	38
	6:00	60	48	59	52	42	38
	7:00	60	46	58	48	42	39
	8:00	60	49	62	50	43	38
	9:00	60	44	52	47	42	38
	10:00	60	43	52	45	40	36
	11:00	60	42	52	46	38	34
	12:00	60	43	54	47	38	34


Hourly Sound Levels at MP-6 During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

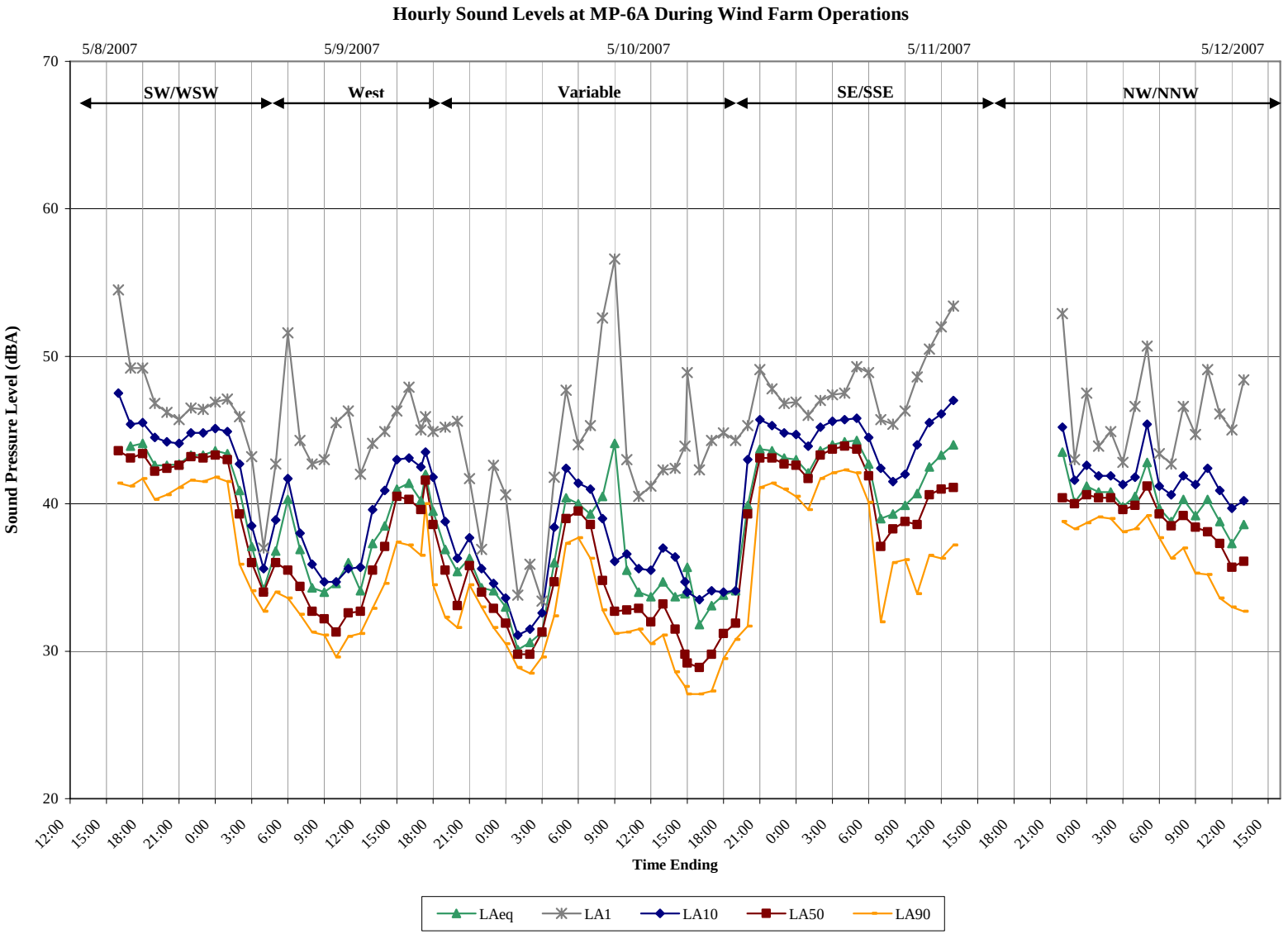
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-6A

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	16:00	60	44	49	45	43	41
	17:00	60	44	49	46	43	42
	18:00	60	43	47	45	42	40
	19:00	60	43	46	44	42	41
	20:00	60	43	46	44	43	41
	21:00	60	43	47	45	43	42
	22:00	60	43	46	45	43	42
	23:00	60	44	47	45	43	42
5/9/07	0:00	60	43	47	45	43	42
	1:00	60	41	46	43	39	36
	2:00	60	37	43	39	36	34
	3:00	60	34	37	36	34	33
	4:00	60	37	43	39	36	34
	5:00	60	40	52	42	36	34
	6:00	60	37	44	38	34	33
	7:00	60	34	43	36	33	31
	8:00	60	34	43	35	32	31
	10:00	60	36	46	36	33	31
	11:00	60	34	42	36	33	31
	12:00	60	37	44	40	36	33
	13:00	60	39	45	41	37	35
	14:00	60	41	46	43	41	37
	15:00	60	41	48	43	40	37
	16:00	60	40	45	43	40	37
	17:00	13	42	46	44	42	40
	17:22	38	40	45	42	39	35
	18:00	60	37	45	39	36	32
	19:00	60	35	46	36	33	32
	20:00	60	36	42	38	36	35
	21:00	60	34	37	36	34	33
	22:00	60	34	43	35	33	32
	23:00	60	33	41	34	32	31
5/10/07	0:00	60	30	34	31	30	29
	1:00	60	31	36	32	30	29
	2:00	60	31	33	33	31	30
	3:00	60	36	42	38	35	32
	4:00	60	40	48	42	39	37
	5:00	60	40	44	41	40	38
	6:00	60	39	45	41	39	36
	7:00	60	41	53	39	35	33
	8:00	60	44	57	36	33	31
	9:00	60	36	43	37	33	31
	10:00	60	34	41	36	33	32
	11:00	60	34	41	36	32	31

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA)				
			L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	12:00	60	35	42	37	33	31
	13:00	60	34	42	36	32	29
	14:00	43	34	44	35	30	28
	14:48	11	36	49	34	29	27
	15:00	60	32	42	34	29	27
	16:00	60	33	44	34	30	27
	17:00	60	34	45	34	31	30
	18:00	60	34	44	34	32	31
	19:00	60	40	45	43	39	32
	20:00	60	44	49	46	43	41
	21:00	60	44	48	45	43	41
	22:00	60	43	47	45	43	41
	23:00	60	43	47	45	43	41
5/11/07	0:00	60	42	46	44	42	40
	1:00	60	44	47	45	43	42
	2:00	60	44	47	46	44	42
	3:00	60	44	48	46	44	42
	4:00	60	44	49	46	44	42
	5:00	60	43	49	45	42	40
	6:00	60	39	46	42	37	32
	7:00	60	39	45	42	38	36
	8:00	60	40	46	42	39	36
	9:00	60	41	49	44	39	34
	10:00	60	43	51	46	41	37
	11:00	60	43	52	46	41	36
	12:00	43	44	53	47	41	37
	measurements paused due to rain						
	21:49	10	44	53	45	40	39
	22:00	60	40	43	42	40	38
	23:00	60	41	48	43	41	39
5/12/07	0:00	60	41	44	42	40	39
	1:00	60	41	45	42	40	39
	2:00	60	40	43	41	40	38
	3:00	60	41	47	42	40	38
	4:00	60	43	51	45	41	39
	5:00	60	40	43	41	39	38
	6:00	60	39	43	41	39	36
	7:00	60	40	47	42	39	37
	8:00	60	39	45	41	38	35
	9:00	60	40	49	42	38	35
	10:00	60	39	46	41	37	34
	11:00	60	37	45	40	36	33
	12:00	60	39	48	40	36	33


Hourly Sound Levels at MP-6A During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

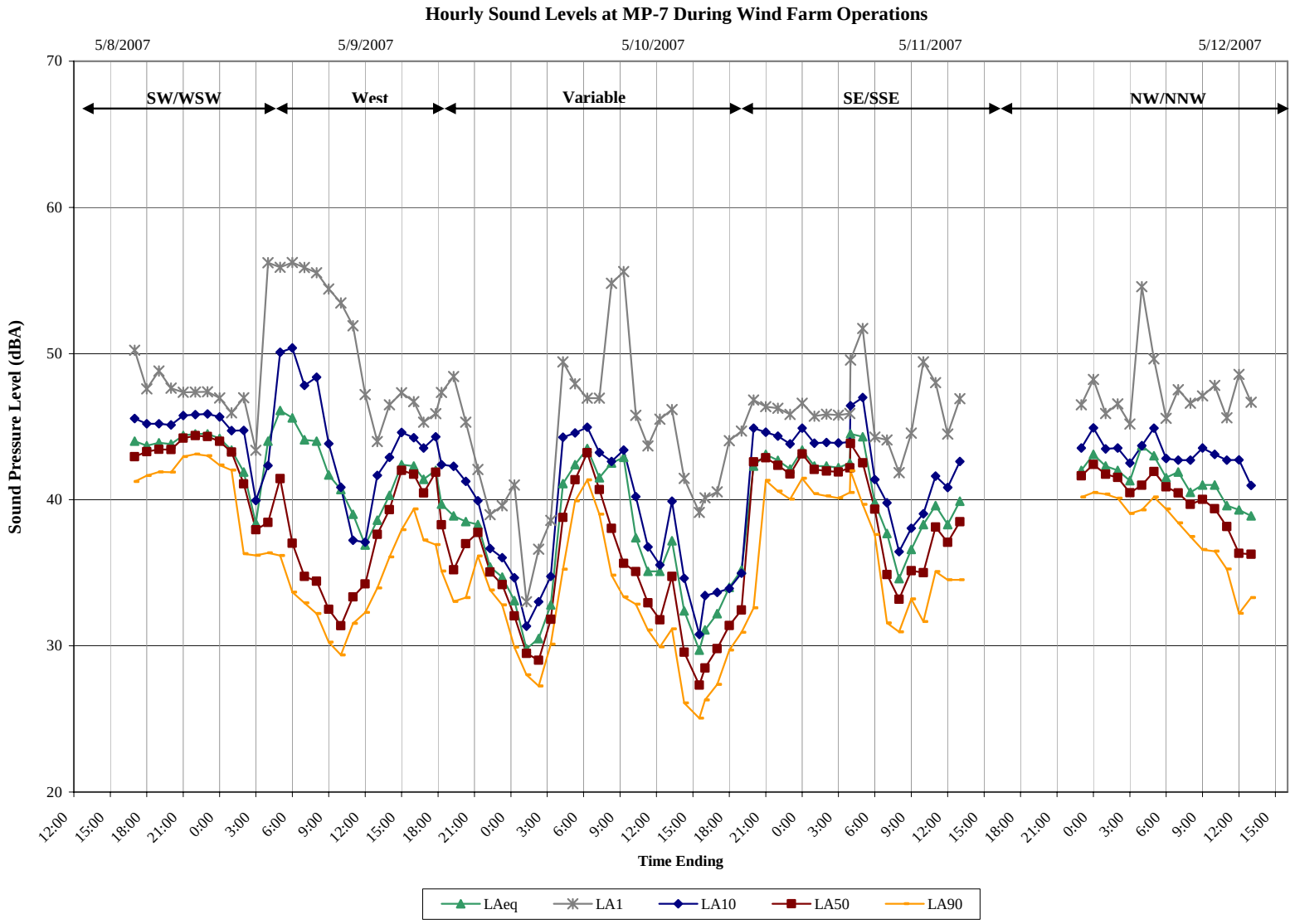
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-7

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	16:00	60	44	50	46	43	41
	17:00	60	44	48	45	43	42
	18:00	60	44	49	45	43	42
	19:00	60	44	48	45	43	42
	20:00	60	44	47	46	44	43
	21:00	60	45	47	46	44	43
	22:00	60	45	47	46	44	43
	23:00	60	44	47	46	44	42
5/9/07	0:00	60	43	46	45	43	42
	1:00	60	42	47	45	41	36
	2:00	60	38	43	40	38	36
	3:00	60	44	56	42	38	36
	4:00	60	46	56	50	41	36
	5:00	60	46	56	50	37	34
	6:00	60	44	56	48	35	33
	7:00	60	44	56	48	34	32
	8:00	60	42	54	44	33	30
	9:00	60	41	53	41	31	29
	10:00	60	39	52	37	33	32
	11:00	60	37	47	37	34	32
	12:00	60	39	44	42	38	34
	13:00	60	40	46	43	39	36
	14:00	60	42	47	45	42	38
	15:00	60	42	47	44	42	39
	16:00	25	41	45	44	40	37
	16:49	60	42	46	44	42	37
	17:49	21	40	47	42	38	35
	18:17	60	39	48	42	35	33
	19:17	60	39	45	41	37	33
	20:17	60	38	42	40	38	36
	21:17	60	35	39	37	35	34
	22:17	60	35	40	36	34	33
5/10/07	23:17	60	33	41	35	32	30
	0:17	60	30	33	31	29	28
	1:17	60	31	37	33	29	27
	2:17	60	33	39	35	32	30
	3:17	60	41	49	44	39	35
	4:17	60	42	48	45	41	40
	5:17	60	44	47	45	43	41
	6:17	60	42	47	43	41	39
	7:17	60	43	55	43	38	35
	8:17	60	43	56	43	36	33
	9:17	60	37	46	40	35	33
	10:17	60	35	44	37	33	31

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	11:17	60	35	46	36	32	30
	12:17	60	37	46	40	35	31
	13:17	60	32	41	35	30	26
	14:17	36	30	39	31	27	25
	15:32	28	31	40	33	28	26
	16:00	60	32	41	34	30	27
	17:00	60	34	44	34	31	30
	18:00	60	35	45	35	32	31
	19:00	60	42	47	45	43	33
	20:00	60	43	46	45	43	41
	21:00	60	43	46	44	42	41
	22:00	60	42	46	44	42	40
	23:00	60	43	47	45	43	41
5/11/07	0:00	60	42	46	44	42	40
	1:00	60	42	46	44	42	40
	2:00	60	42	46	44	42	40
	3:00	54	43	46	44	42	40
	3:56	4	45	50	46	44	42
	4:00	60	44	52	47	43	40
	5:00	60	40	44	41	39	38
	6:00	60	38	44	40	35	32
	7:00	60	35	42	36	33	31
	8:00	60	37	45	38	35	33
	9:00	60	38	49	39	35	32
	10:00	60	40	48	42	38	35
	11:00	60	38	44	41	37	35
	12:00	49	40	47	43	38	35
	measurements paused due to rain						
	22:02	57	42	46	44	42	40
	23:00	60	43	48	45	42	40
5/12/07	0:00	60	42	46	43	42	40
	1:00	60	42	47	44	42	40
	2:00	60	41	45	43	40	39
	3:00	60	44	55	44	41	39
	4:00	60	43	50	45	42	40
	5:00	60	42	46	43	41	39
	6:00	60	42	48	43	40	38
	7:00	60	41	47	43	40	37
	8:00	60	41	47	44	40	37
	9:00	60	41	48	43	39	36
	10:00	60	40	46	43	38	35
	11:00	60	39	49	43	36	32
	12:00	60	39	47	41	36	33


Hourly Sound Levels at MP-7 During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

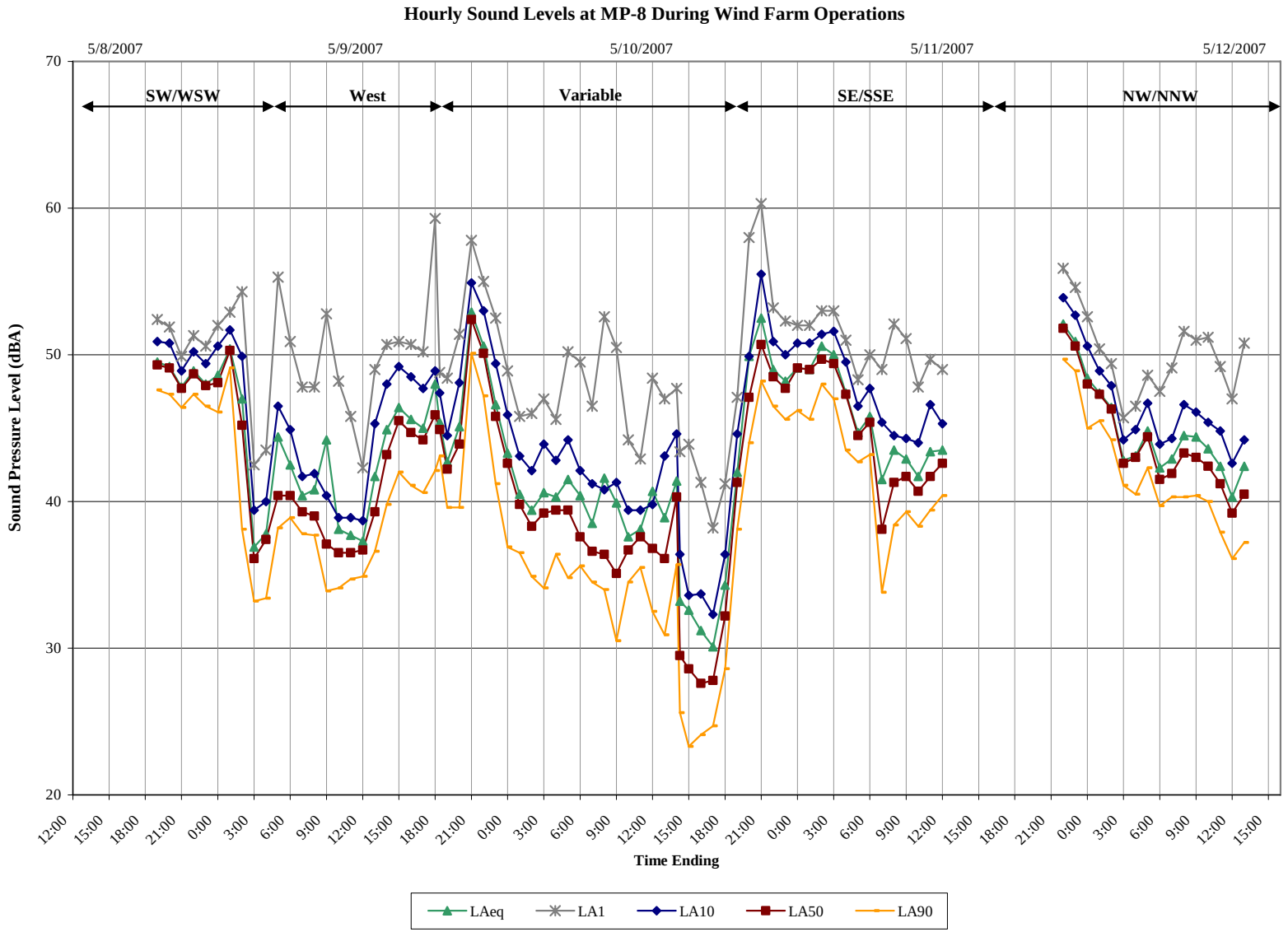
Mars Hill Wind Farm

Hourly Sound Level Measurements During Routine Operation

Position MP-8

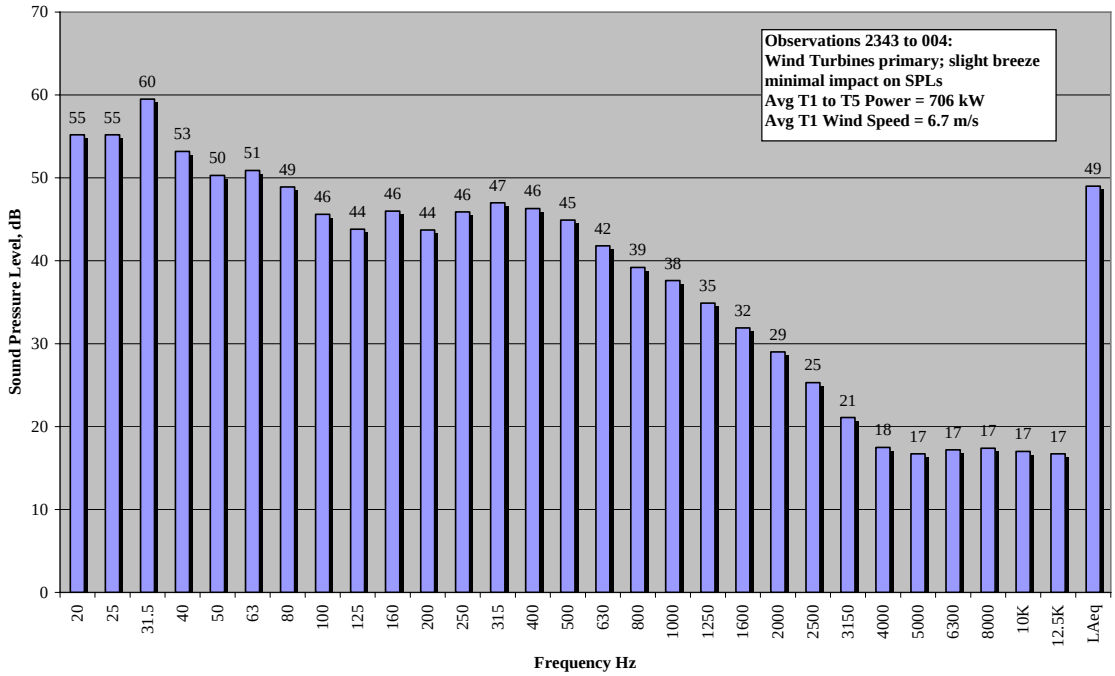
Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/8/07	18:00	60	50	52	51	49	48
	19:00	60	49	52	51	49	47
	20:00	60	48	50	49	48	46
	21:00	60	49	51	50	49	47
	22:00	60	48	51	49	48	47
	23:00	60	49	52	51	48	46
5/9/07	0:00	60	50	53	52	50	49
	1:00	60	47	54	50	45	38
	2:00	60	37	43	39	36	33
	3:00	60	38	44	40	37	33
	4:00	60	44	55	47	40	38
	5:00	60	43	51	45	40	39
	6:00	60	40	48	42	39	38
	7:00	60	41	48	42	39	38
	8:00	60	44	53	40	37	34
	9:00	60	38	48	39	37	34
	10:00	60	38	46	39	37	35
	12:00	60	42	49	45	39	37
	13:00	60	45	51	48	43	40
	14:00	60	46	51	49	46	42
	15:00	60	46	51	49	45	41
	16:00	60	45	50	48	44	41
	17:00	60	48	59	49	46	42
	18:00	12	45	49	47	45	43
	18:22	37	43	48	45	42	40
	19:00	60	45	51	48	44	40
	20:00	60	53	58	55	52	50
	21:00	60	51	55	53	50	47
	22:00	60	47	53	49	46	41
	23:00	60	43	49	46	43	37
5/10/07	0:00	60	41	46	43	40	37
	1:00	60	39	46	42	38	35
	2:00	60	41	47	44	39	34
	3:00	60	40	46	43	39	36
	4:00	60	42	50	44	39	35
	5:00	60	40	50	42	38	36
	6:00	60	39	47	41	37	35
	7:00	60	42	53	41	36	34
	8:00	60	40	51	41	35	31
	9:00	60	38	44	39	37	35
	10:00	60	38	43	39	38	36
	11:00	60	41	48	40	37	33
	12:00	60	39	47	43	36	31

Date	Start Time	Duration (min.)	Measured Sound Levels (dBA) L_{Aeq}	L_{A1}	L_{A10}	L_{A50}	L_{A90}
5/10/07	13:00	60	41	48	45	40	36
	14:00	9	33	43	36	30	26
	14:15	44	33	44	34	29	23
	15:00	60	31	41	34	28	24
	16:00	60	30	38	32	28	25
	17:00	60	34	41	36	32	29
	18:00	60	42	47	45	41	38
	19:00	60	50	58	50	47	44
	20:00	60	53	60	56	51	48
	21:00	60	49	53	51	49	47
	22:00	60	48	52	50	48	46
	23:00	60	49	52	51	49	46
5/11/07	0:00	60	49	52	51	49	46
	1:00	60	51	53	51	50	48
	2:00	60	50	53	52	49	47
	3:00	60	47	51	50	47	44
	4:00	60	45	48	47	45	43
	5:00	60	46	50	48	45	43
	6:00	60	42	49	45	38	34
	7:00	60	44	52	45	41	38
	8:00	60	43	51	44	42	39
	9:00	60	42	48	44	41	38
	10:00	60	43	50	47	42	39
	11:00	60	44	49	45	43	40
	12:00	11	41	47	42	40	38
	measurements paused due to rain						
	21:34	26	52	56	54	52	50
	22:00	60	51	55	53	51	49
	23:00	60	48	53	51	48	45
5/12/07	0:00	60	47	50	49	47	46
	1:00	60	46	49	48	46	44
	2:00	60	43	46	44	43	41
	3:00	60	43	47	45	43	41
	4:00	60	45	49	47	44	42
	5:00	60	42	48	44	42	40
	6:00	60	43	49	44	42	40
	7:00	60	45	52	47	43	40
	8:00	60	44	51	46	43	40
	9:00	60	44	51	45	42	40
	10:00	60	42	49	45	41	38
	11:00	60	40	47	43	39	36
	12:00	60	42	51	44	41	37

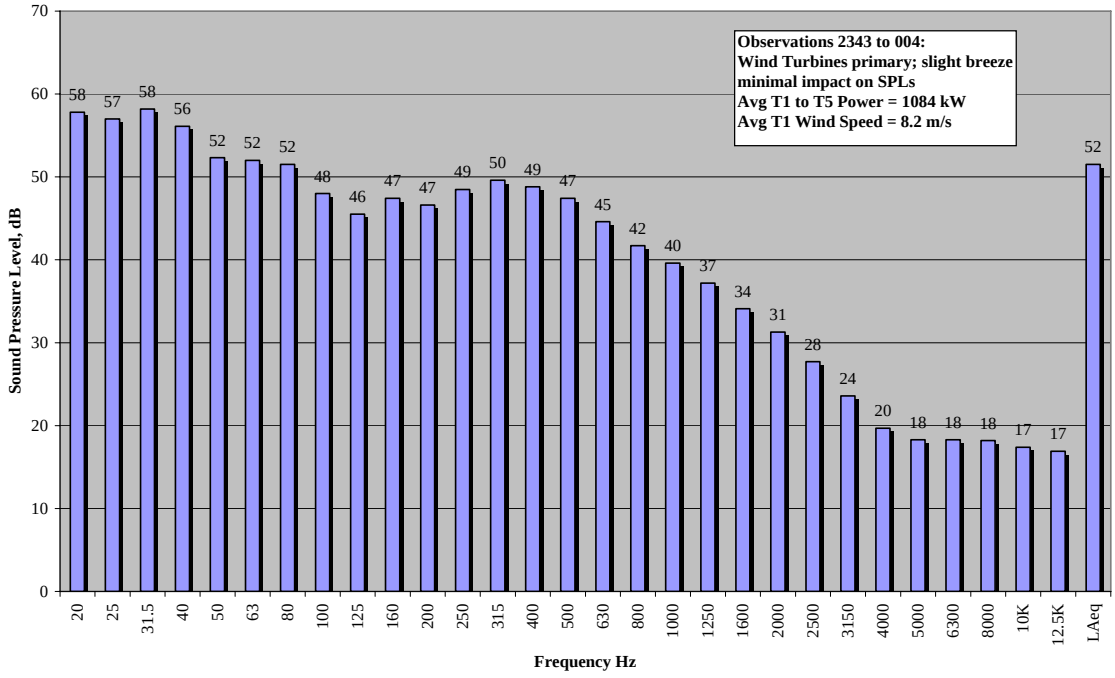

Hourly Sound Levels at MP-8 During Wind Farm Operations
5/8/2007
5/9/2007
5/10/2007
5/11/2007
5/12/2007
SW/WSW
West
Variable
SE/SSE
NW/NNW
Sound Pressure Level (dBA)
70
60
50
40
30
20
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
18:00
21:00
0:00
3:00
6:00
9:00
12:00
15:00
Time Ending
LAeq
LA1
LA10
LA50
LA90

APPENDIX V
ONE-THIRD OCTAVE BAND SOUND LEVEL MEASUREMENTS – MAY 2007

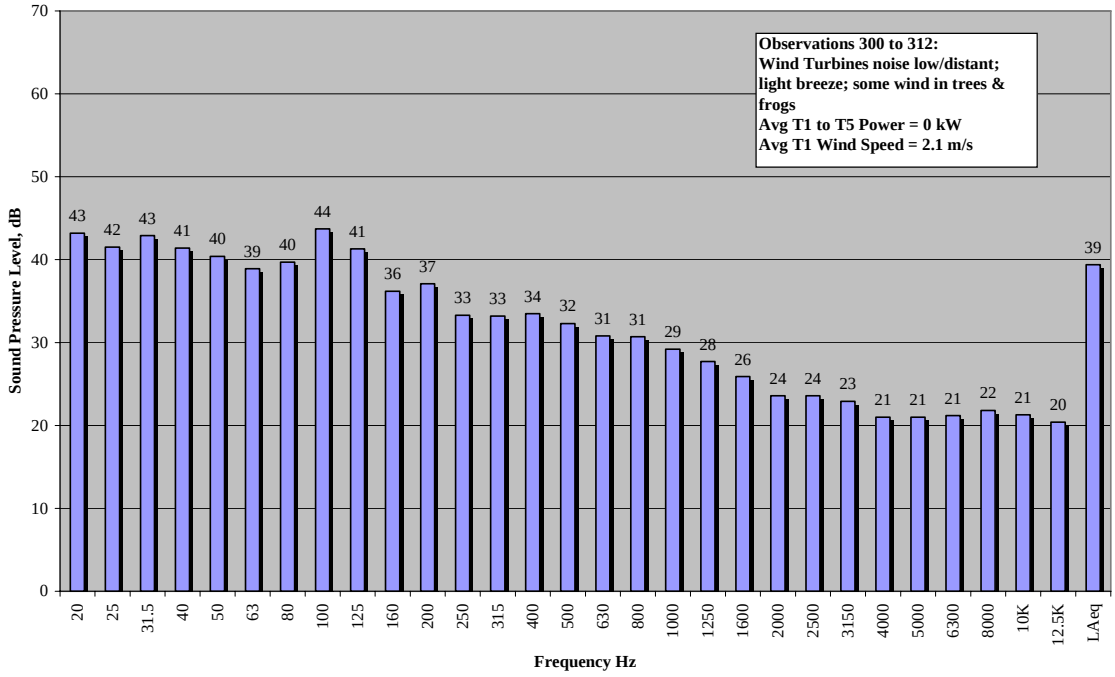
MP-1
8-May-07 23:00 to 9-May-07 0:00



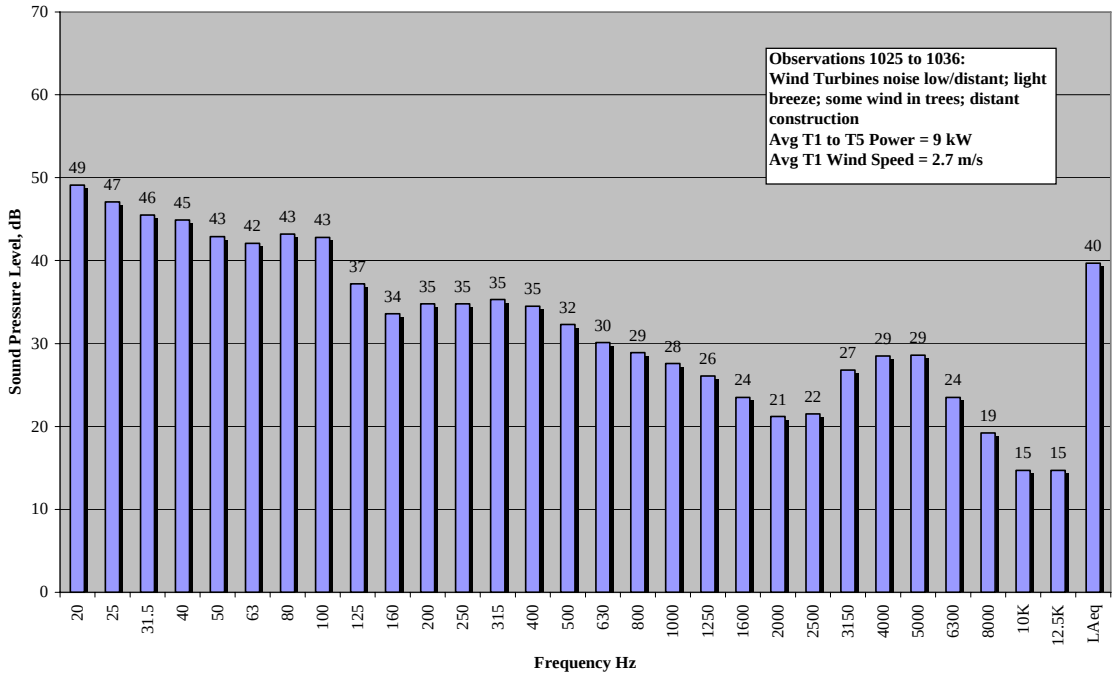
MP-1
9-May-07 0:00 to 1:00



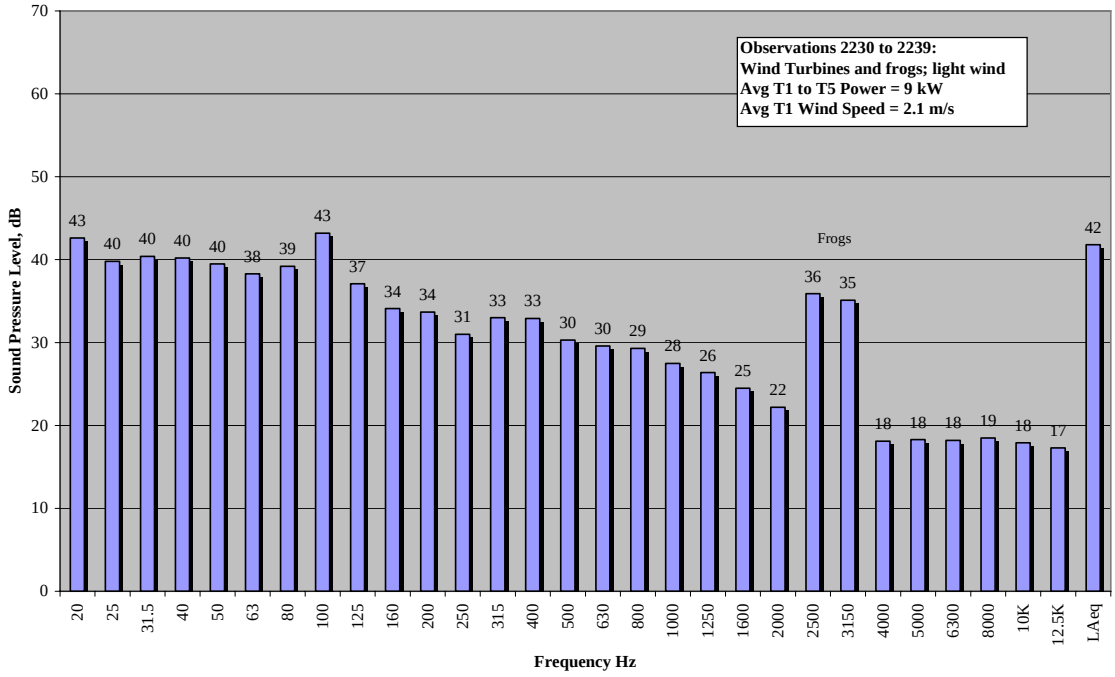
MP-1
9-May-07 3:00 to 4:00



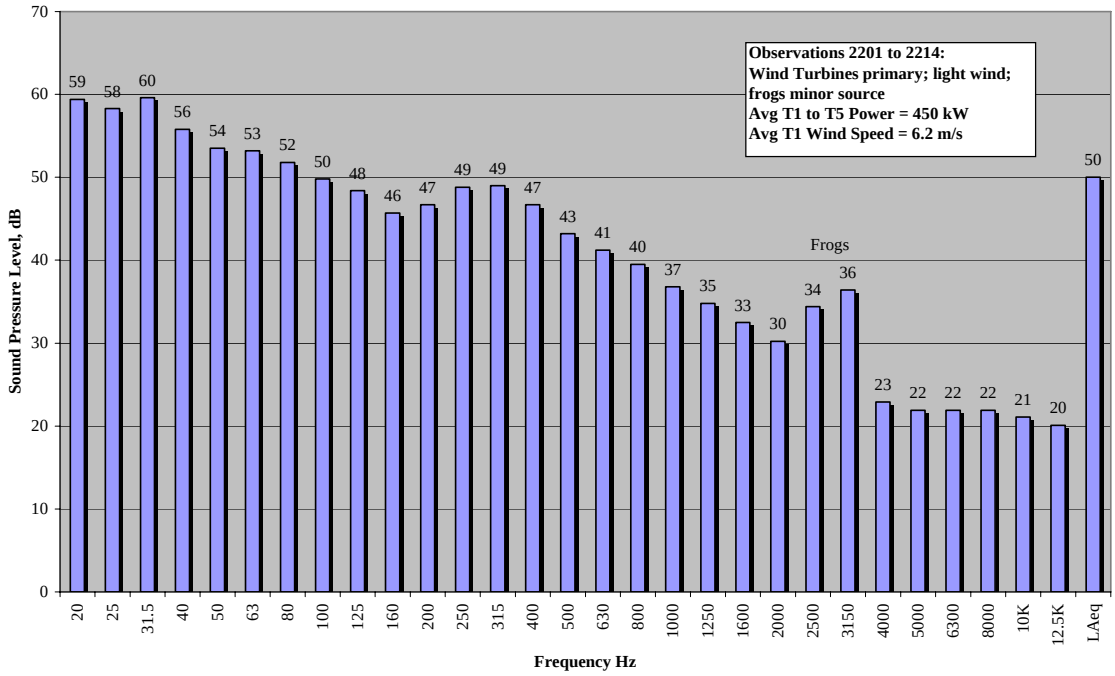
MP-1
9-May-07 10:00 to 11:00



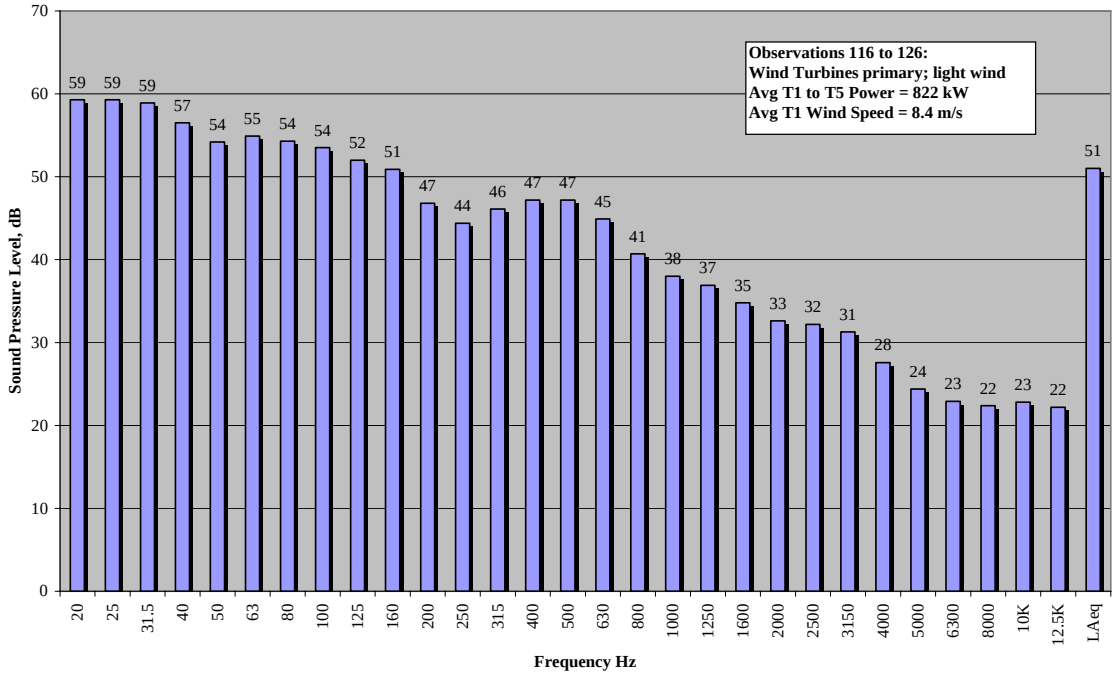
MP-1
9-May-07 22:00 to 23:00



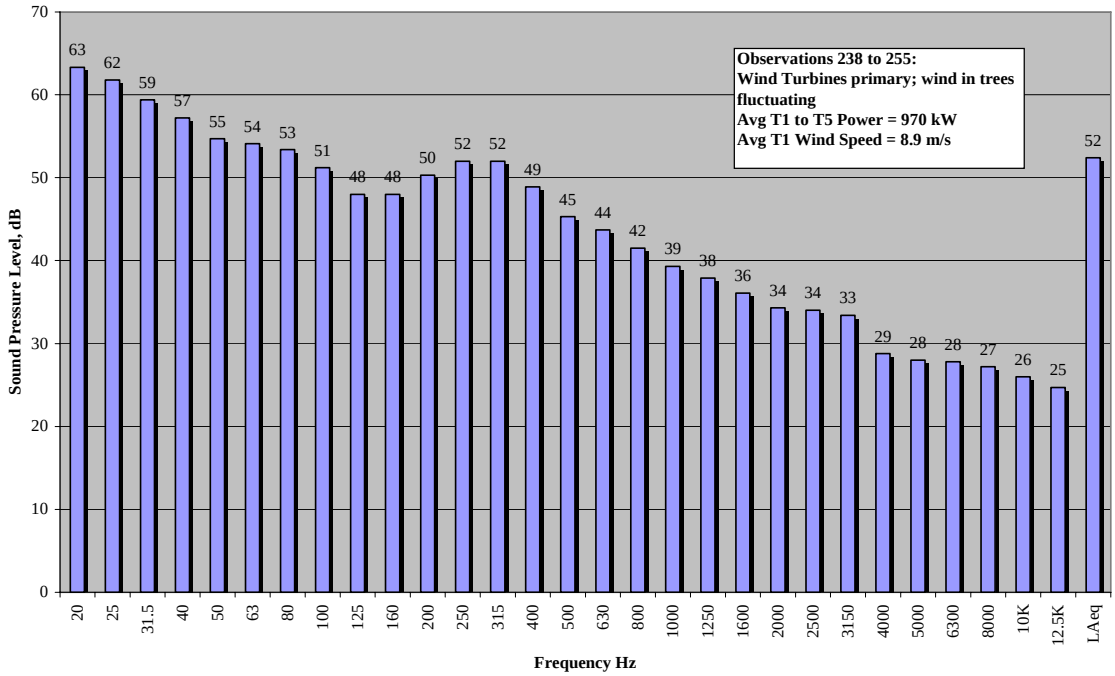
MP-1
10-May-07 22:00 to 23:00



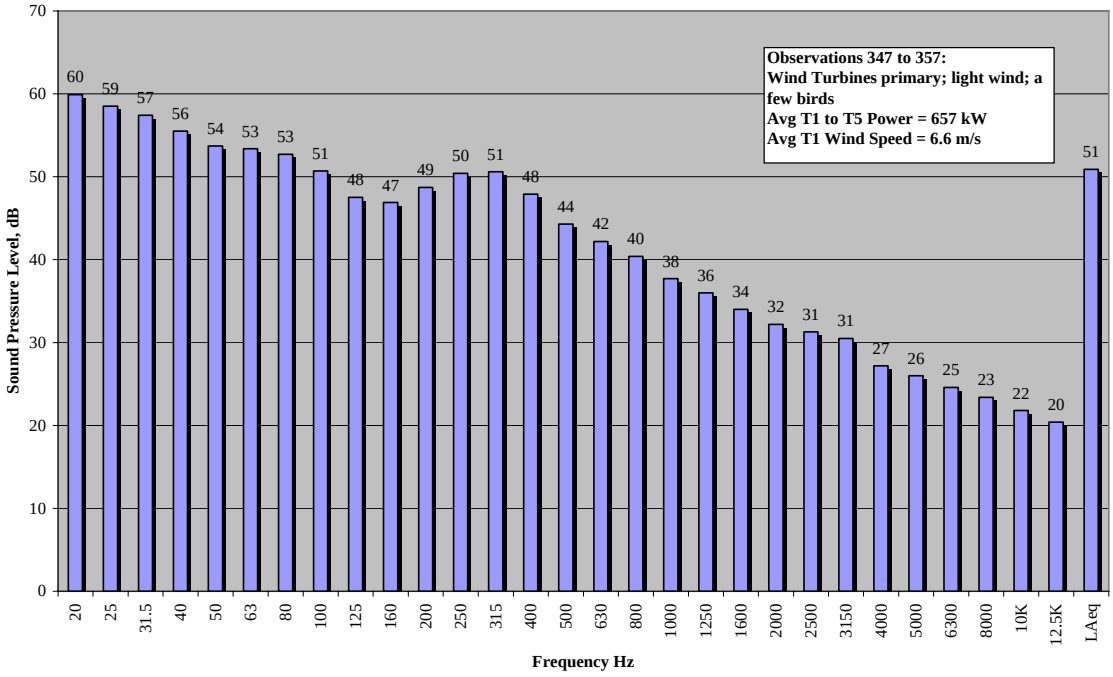
MP-1
11-May-07 1:16 to 1:26



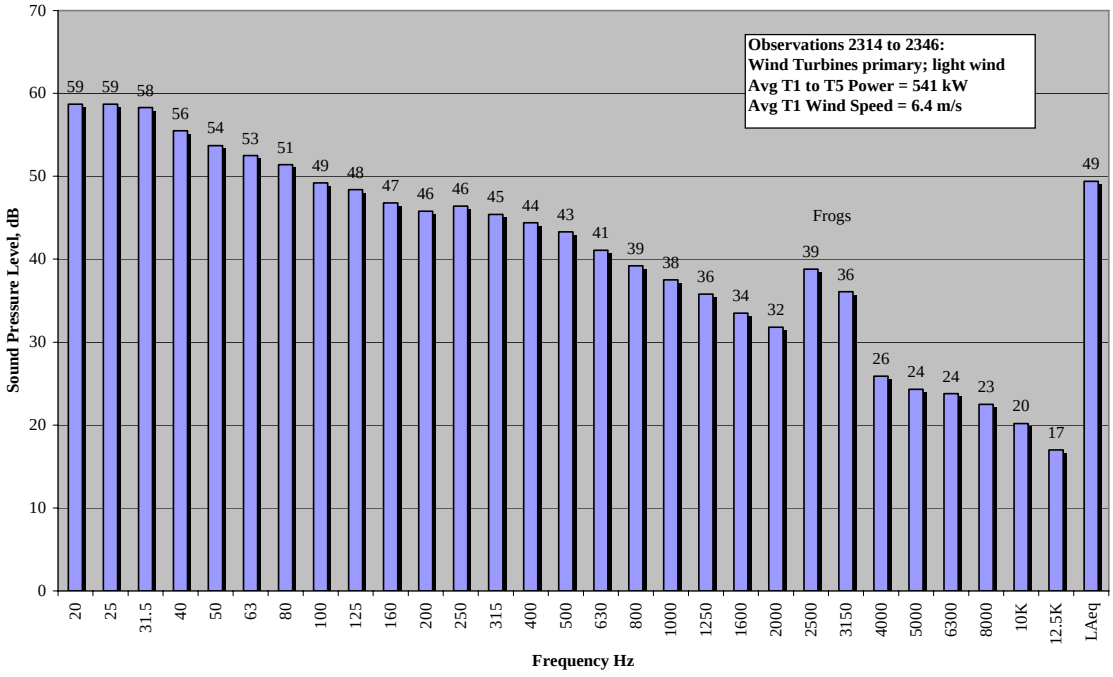
MP-1
11-May-07 2:00 to 3:00



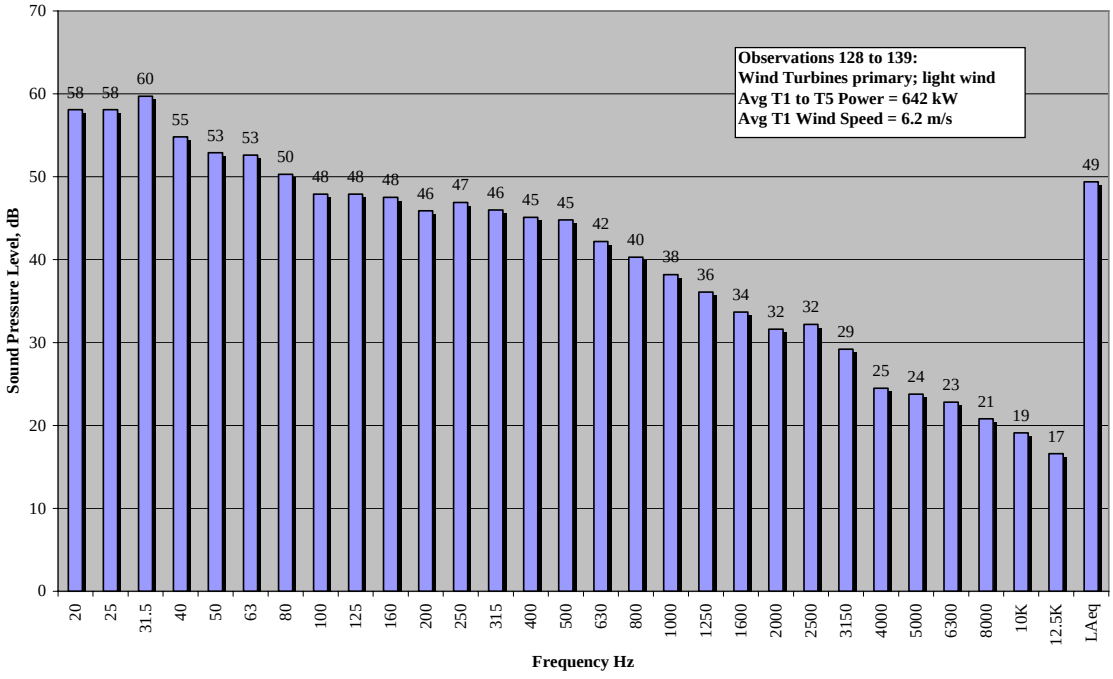
MP-1
11-May-07 3:00 to 4:00



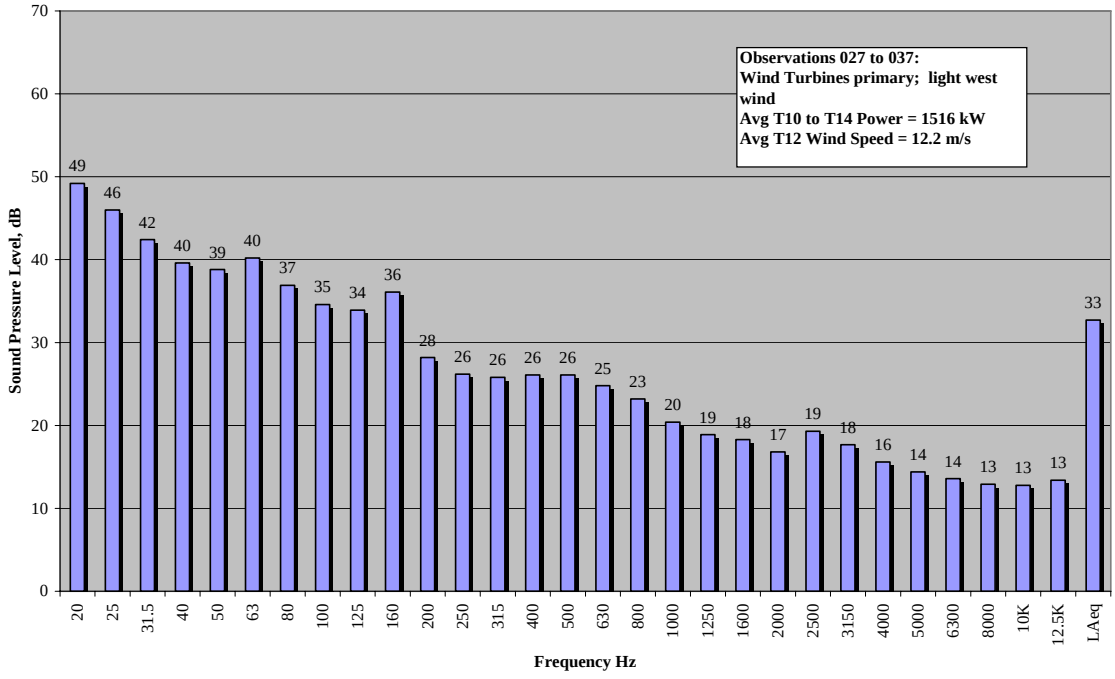
MP-1
11-May-07 23:00 to 0:00



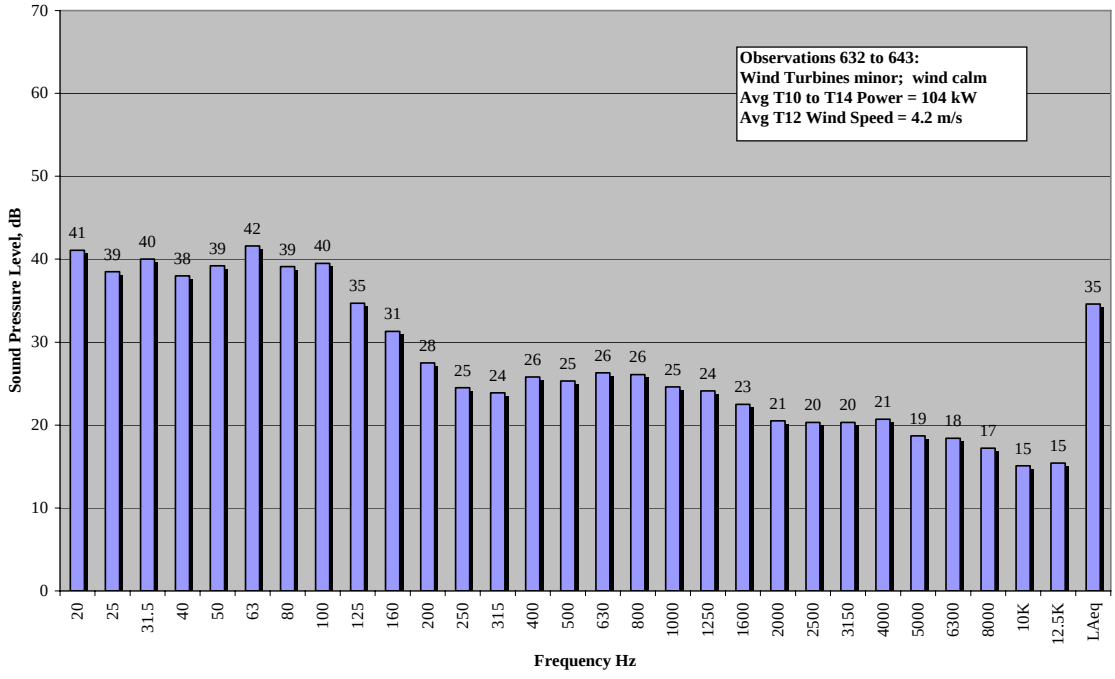
MP-1
12-May-07 1:00 to 2:00



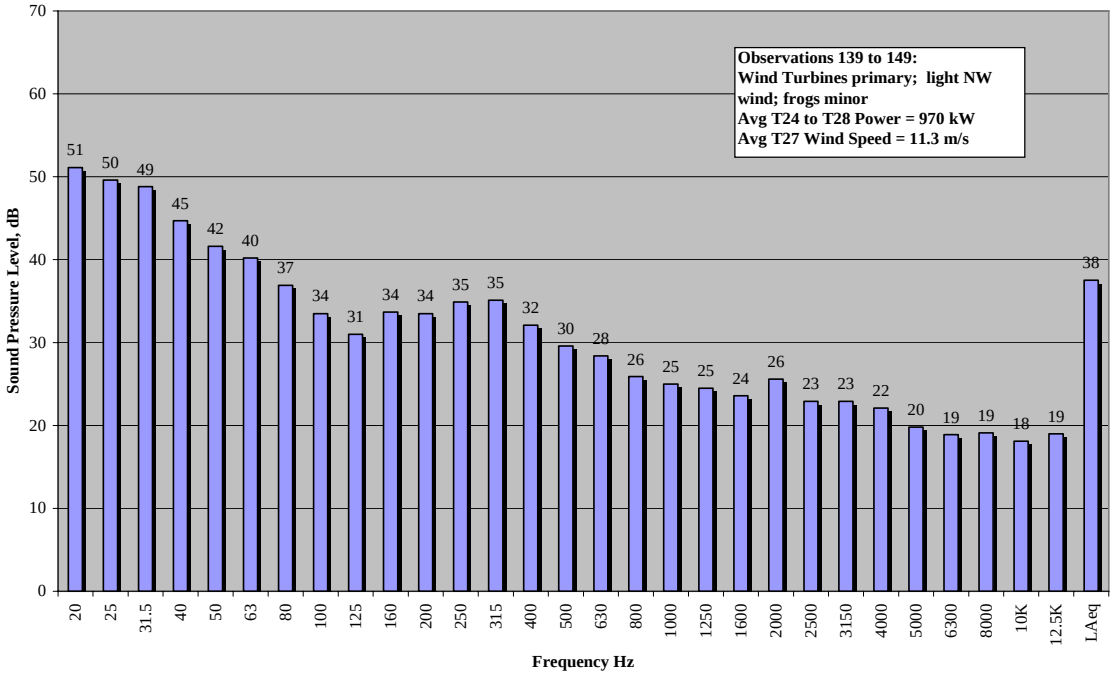
MP-2
9-May-07 0:27 to 0:37



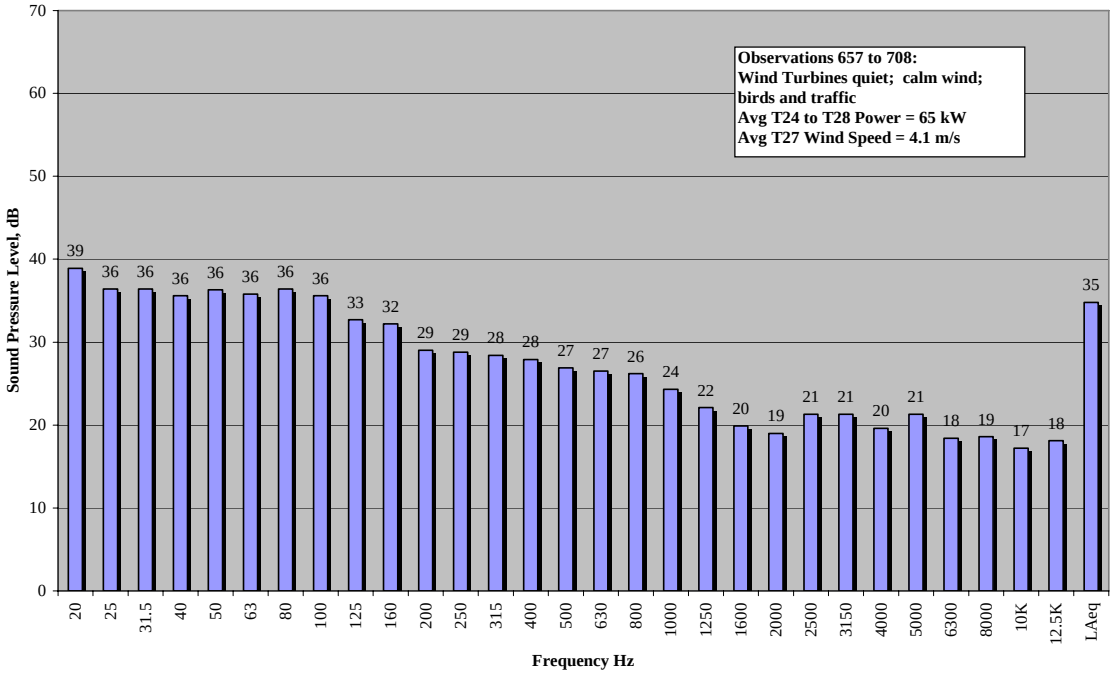
MP-2
9-May-07 6:32 to 6:43



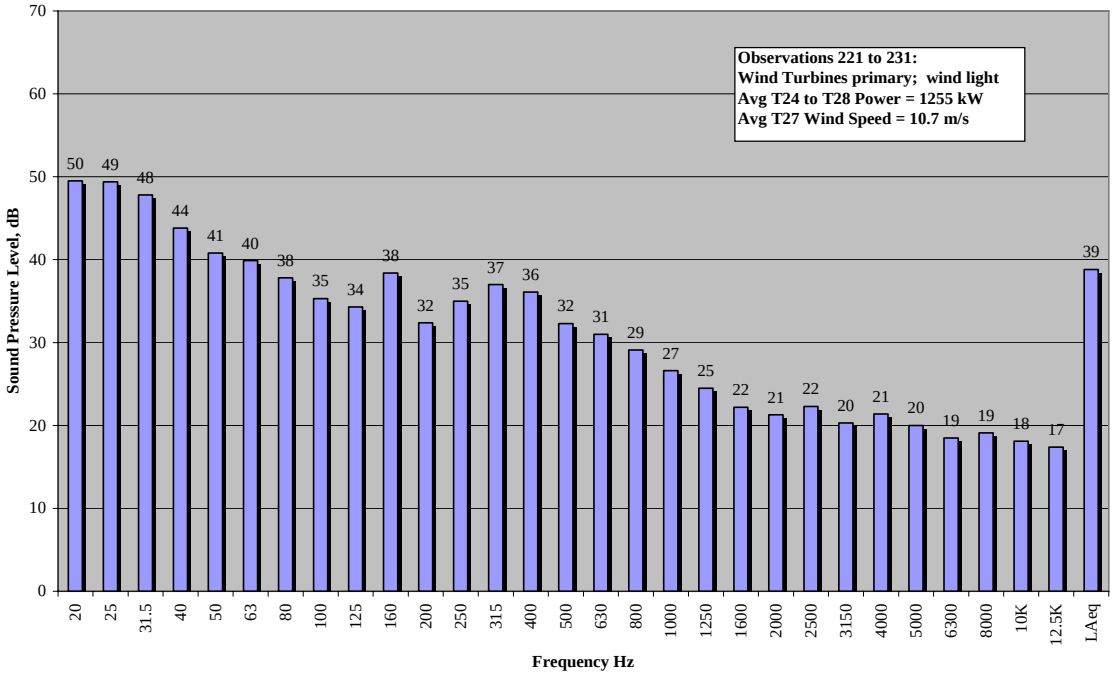
MP-3
9-May-07 1:39 to 1:49



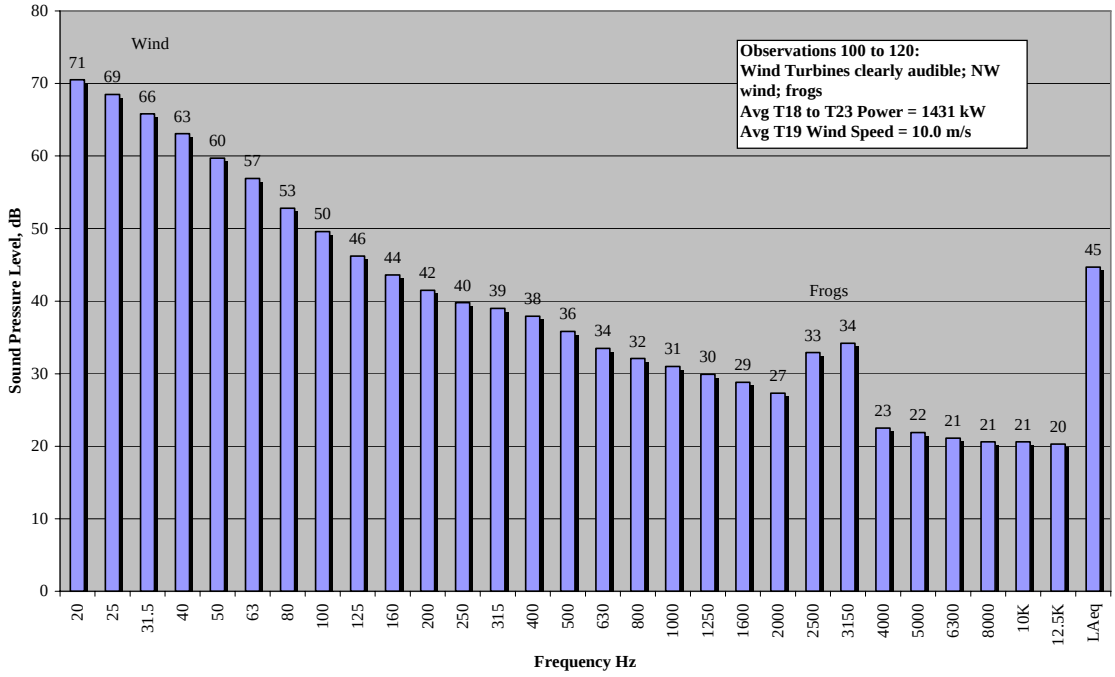
MP-3
9-May-07 6:57 to 7:08



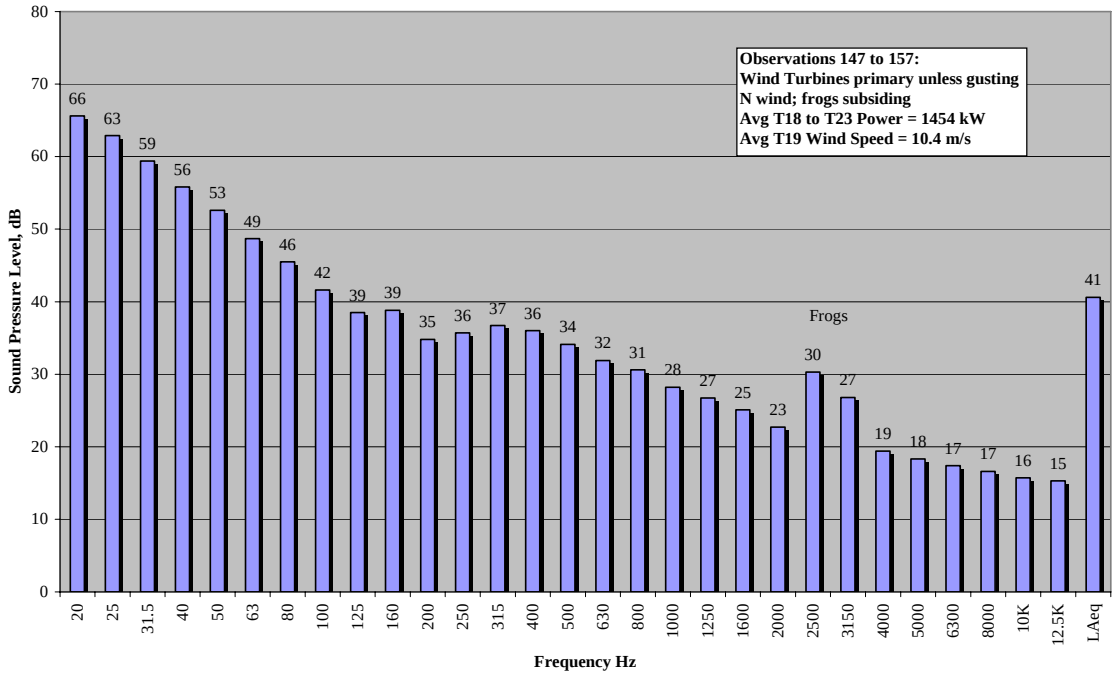
MP-3
12-May-07 2:21 to 2:31



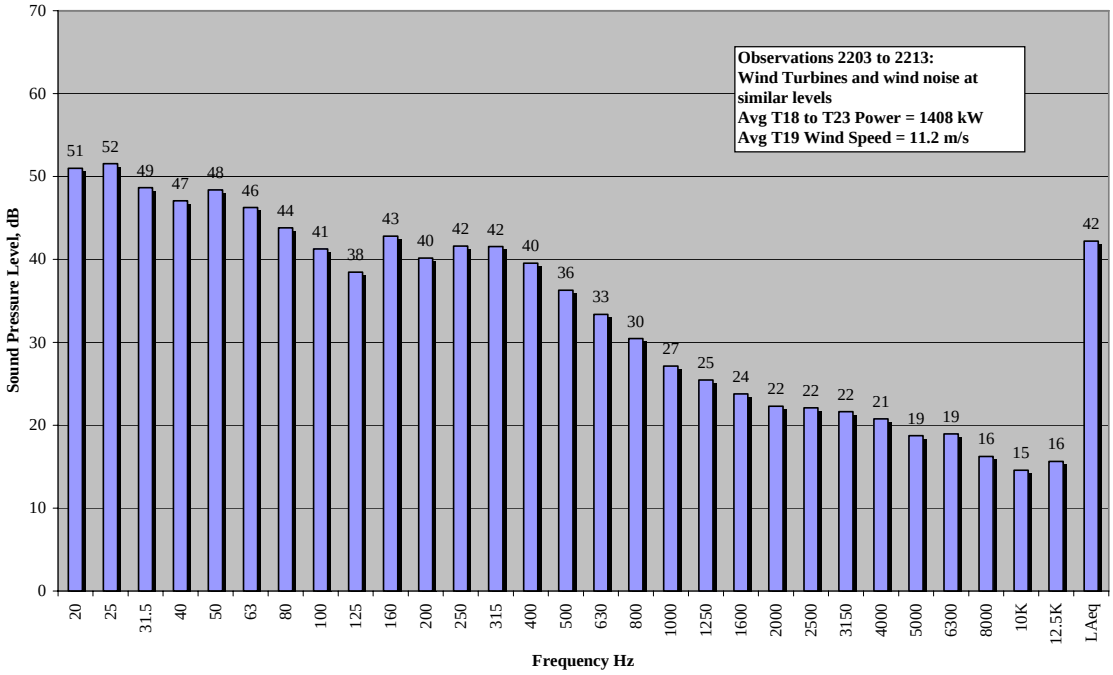
MP-4A
9-May-07 1:00 to 1:20



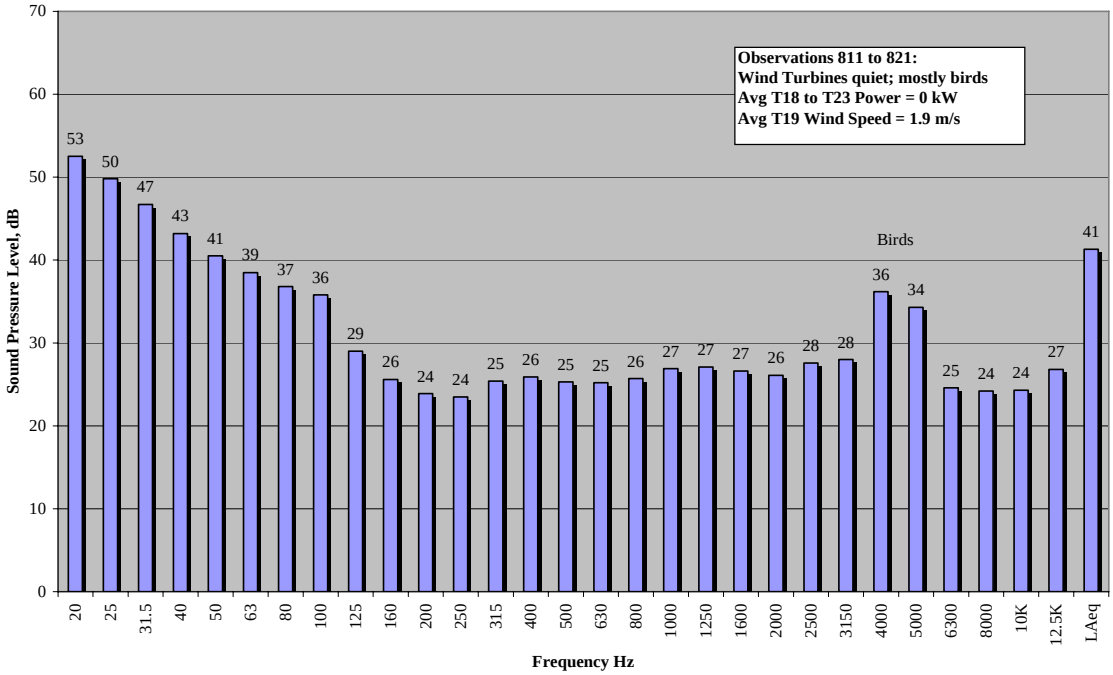
MP-4A
12-May-07 1:47 to 1:57



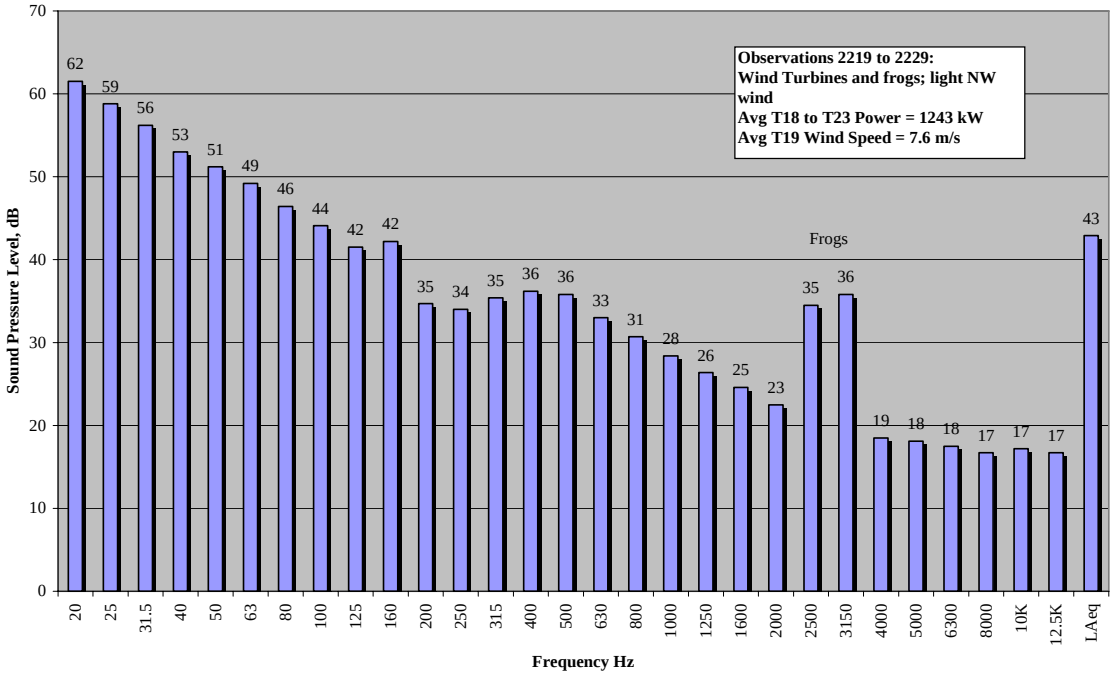
MP-5
8-May-07 22:03 to 22:13



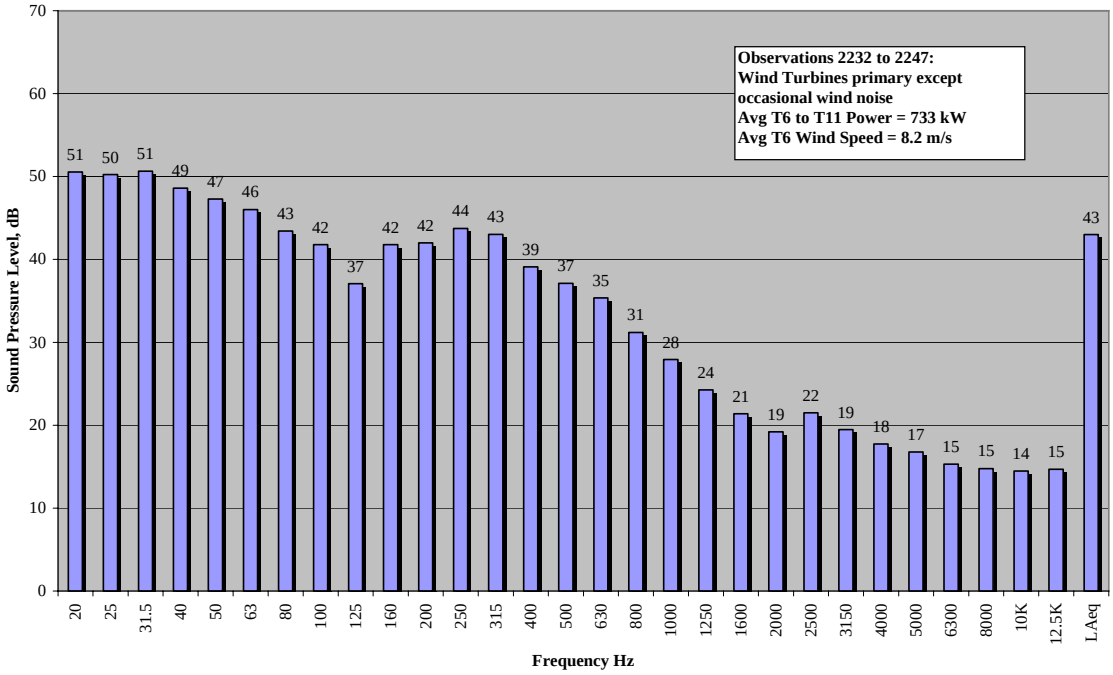
MP-5
9-May-07 8:11 to 8:21



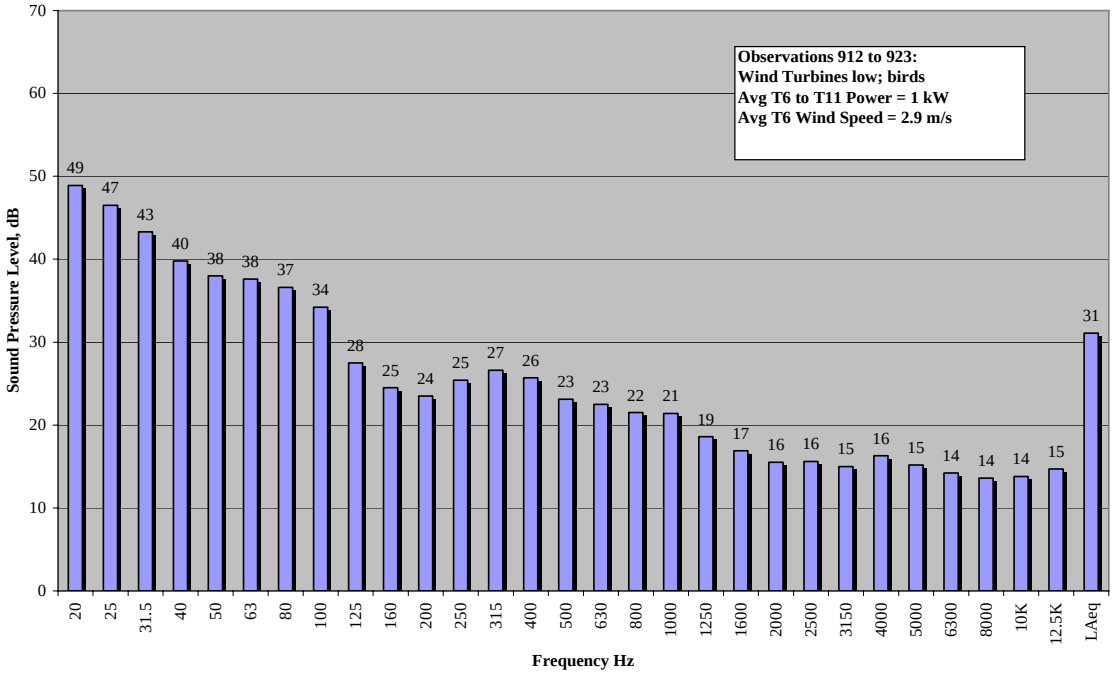
MP-5
11-May-07 22:19 to 22:29



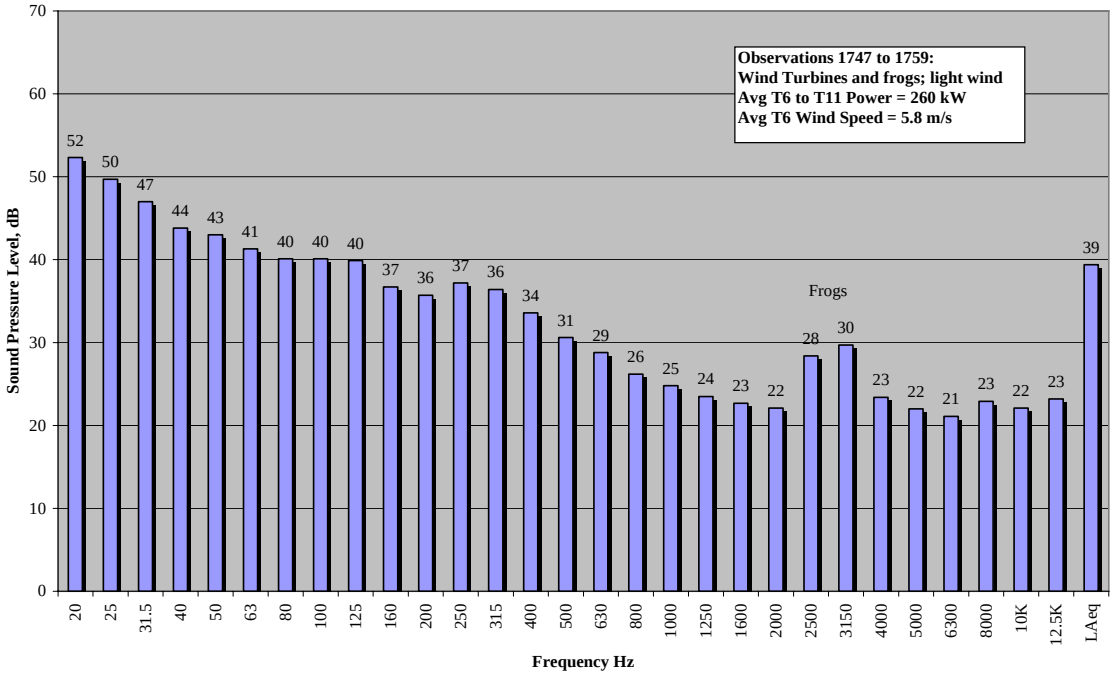
MP-6
8-May-07 22:32 to 22:47



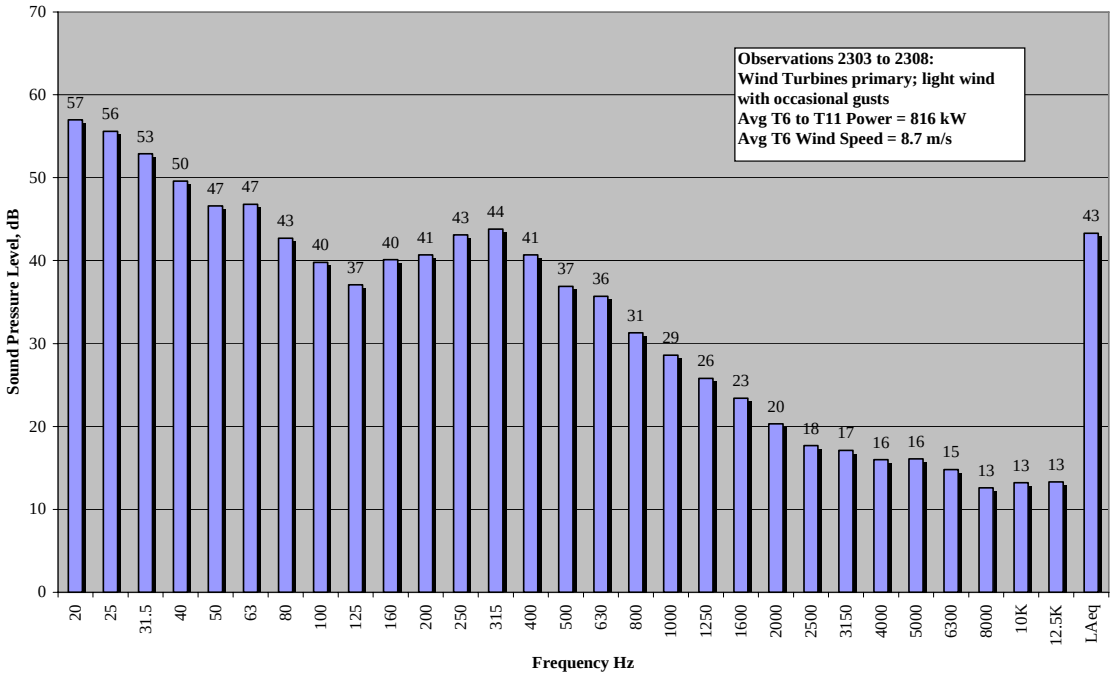
MP-6
9-May-07 9:12 to 9:23



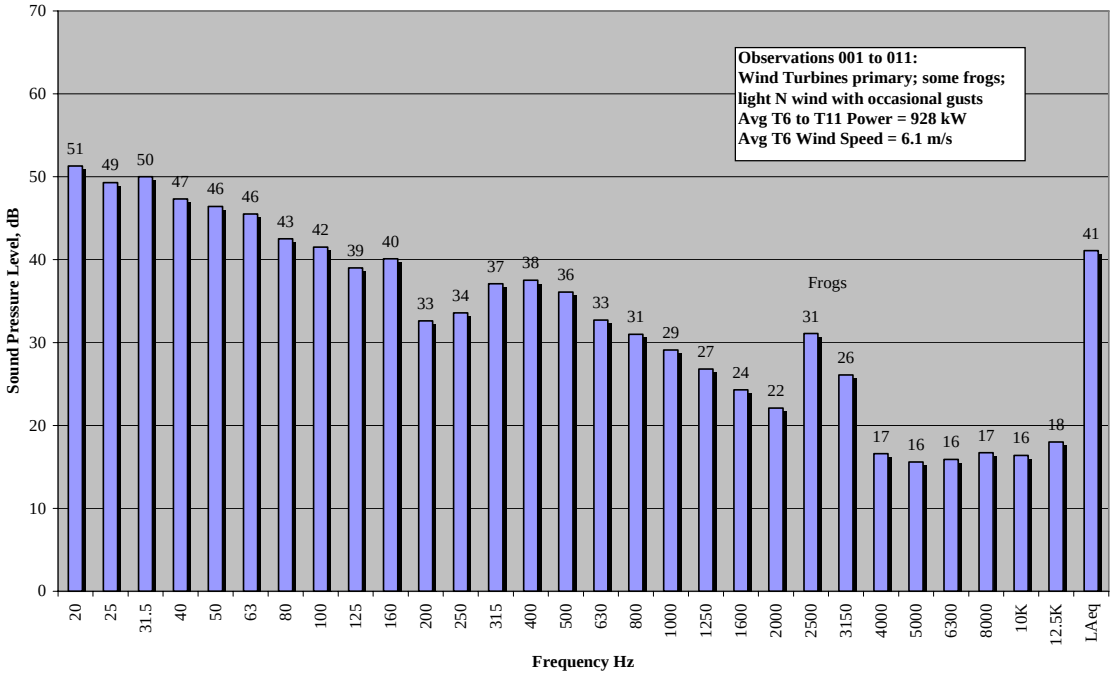
MP-6
9-May-07 17:47 to 17:59



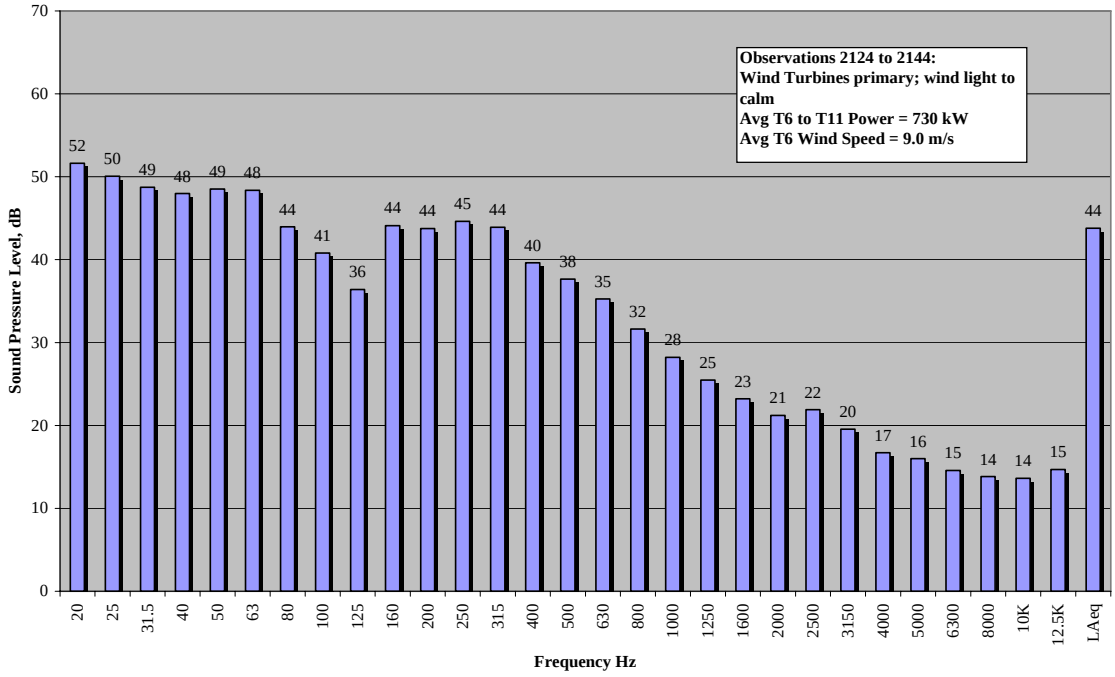
MP-6
10-May-07 23:03 to 23:08



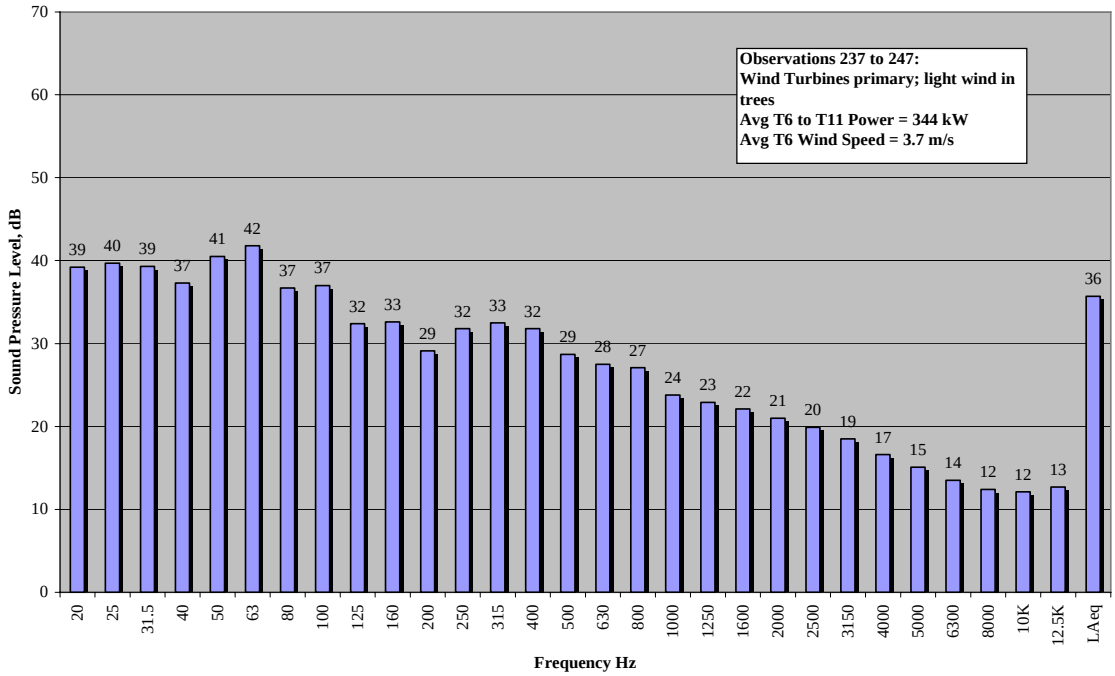
MP-6
12-May-07 0:01 to 0:11



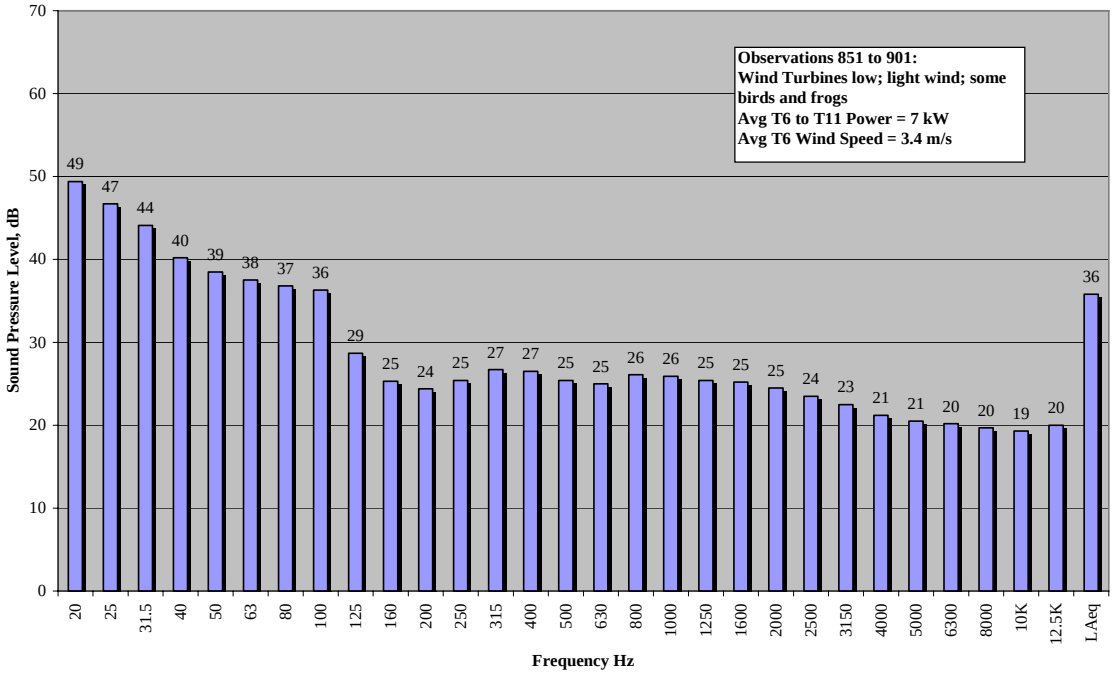
MP-6A
8-May-07 21:24 to 21:44



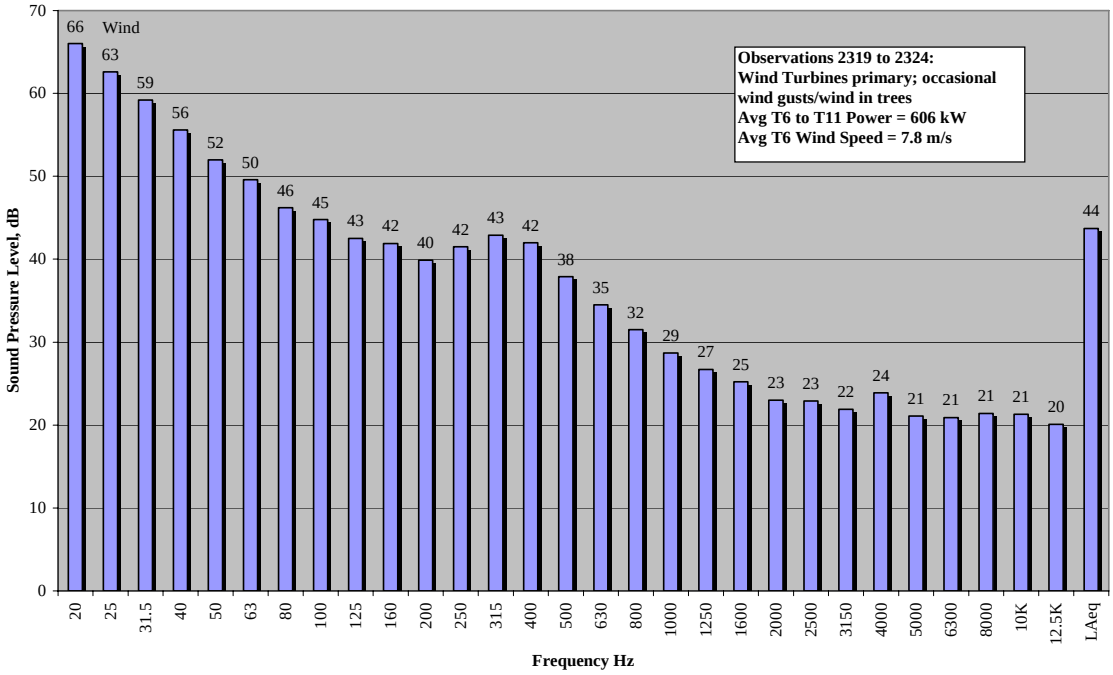
MP-6A
9-May-07 2:37 to 2:47



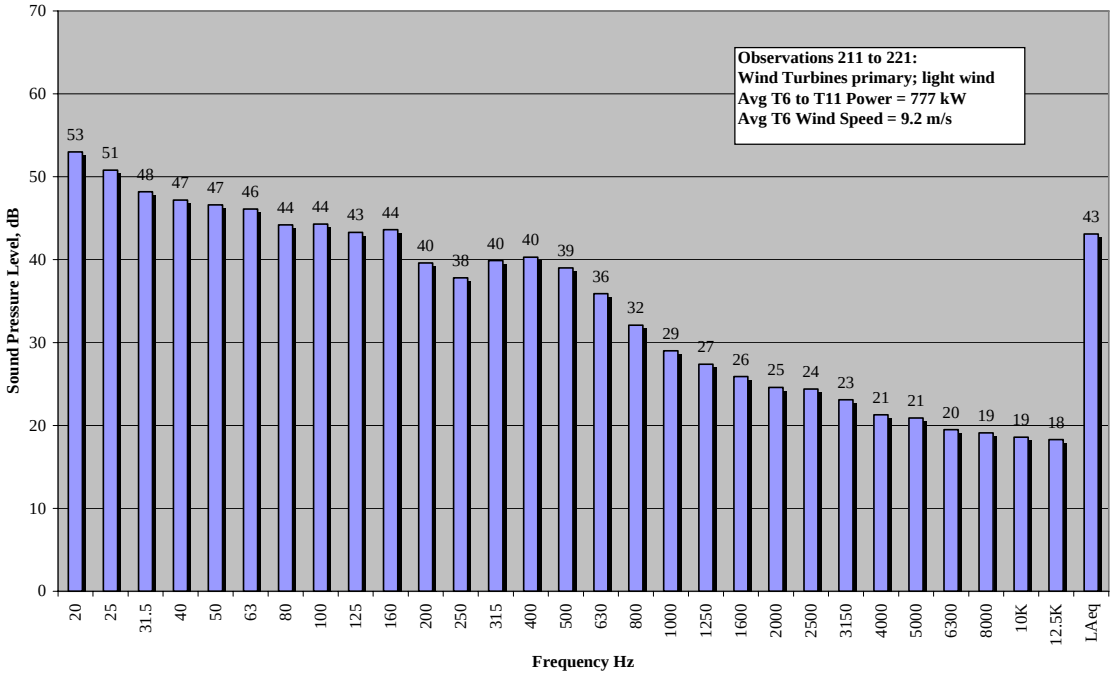
MP-6A
9-May-07 8:51 to 9:01



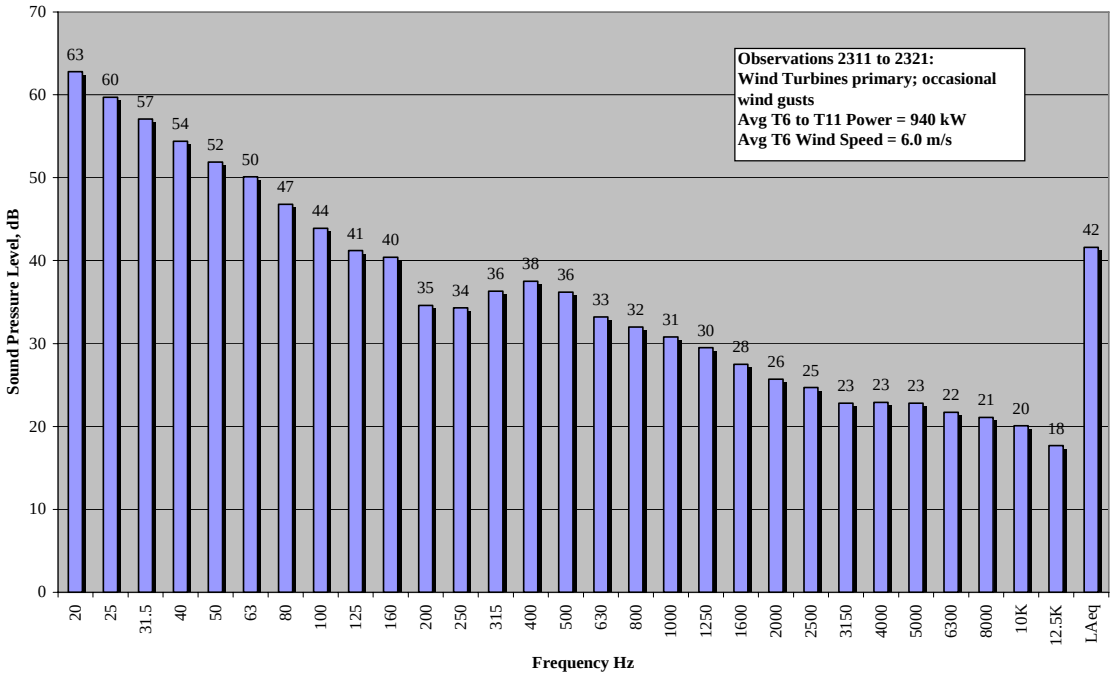
MP-6A
10-May-07 23:19 to 23:24



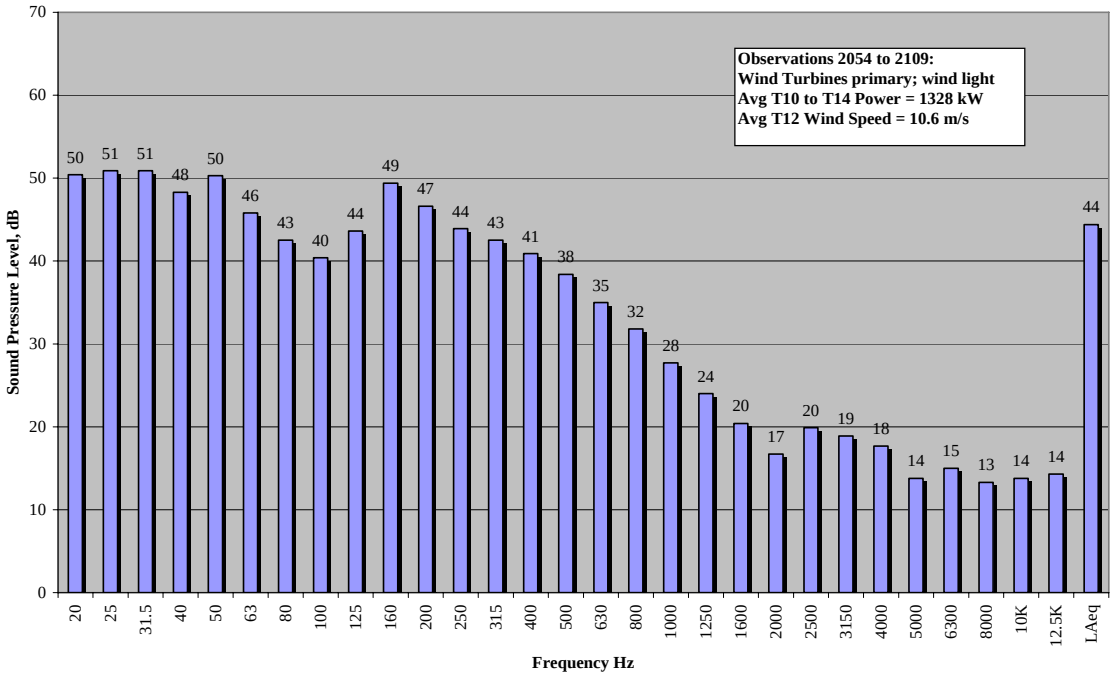
MP-6A
11-May-07 2:11 to 2:21



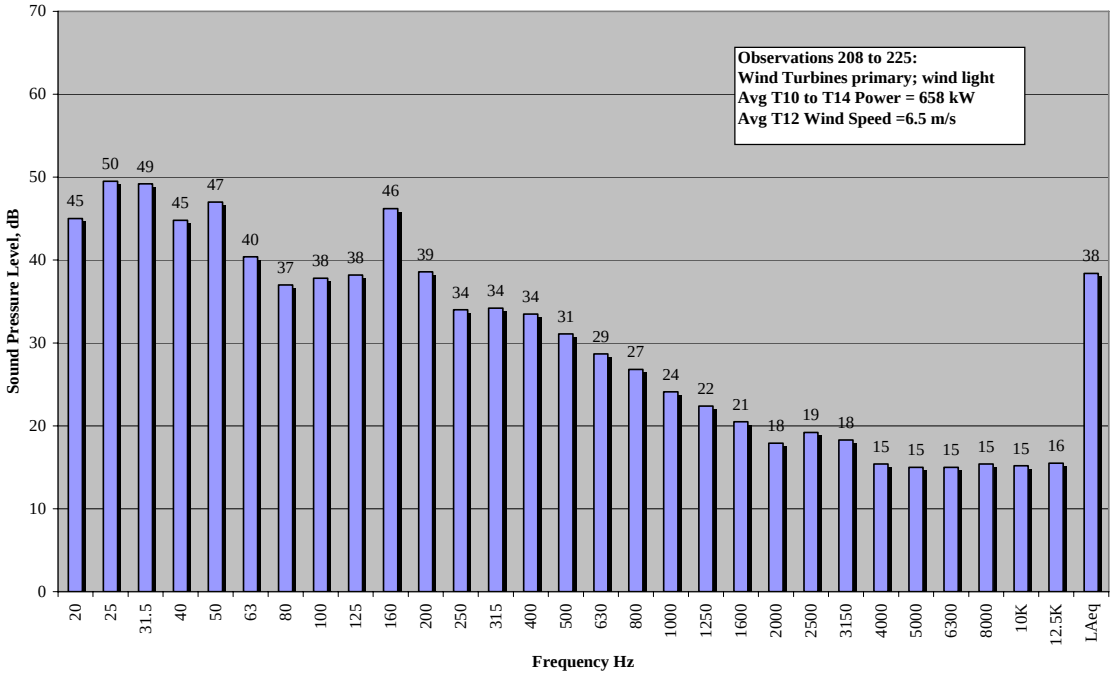
MP-6A
11-May-07 23:11 to 23:21



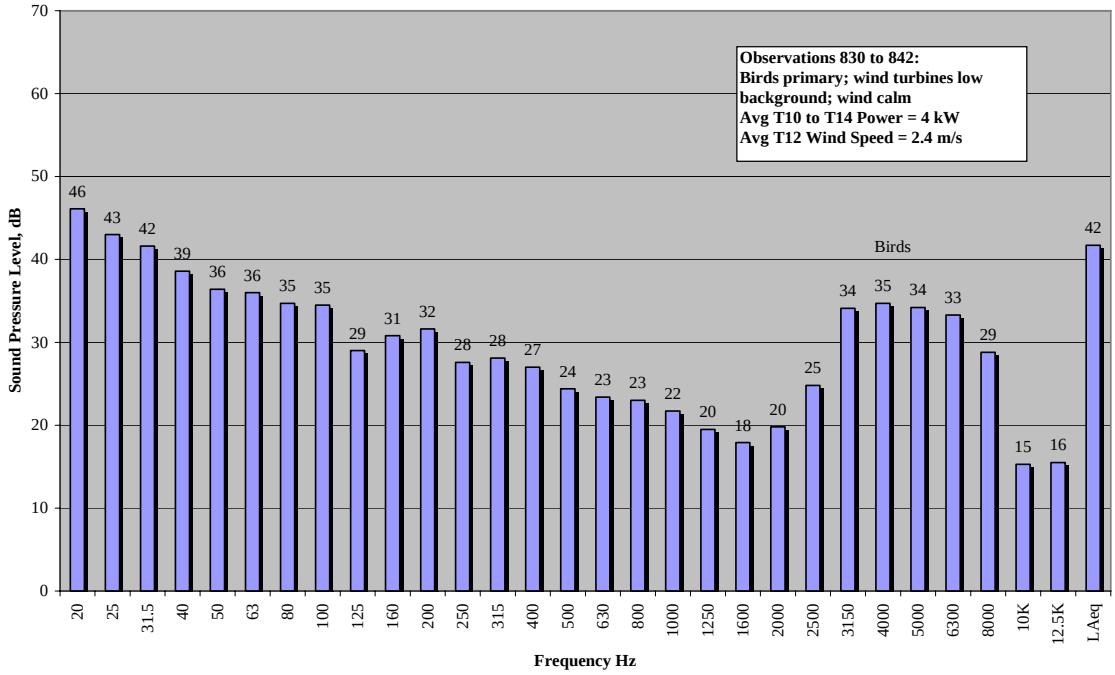
MP-7
8-May-07 20:00 to 21:00



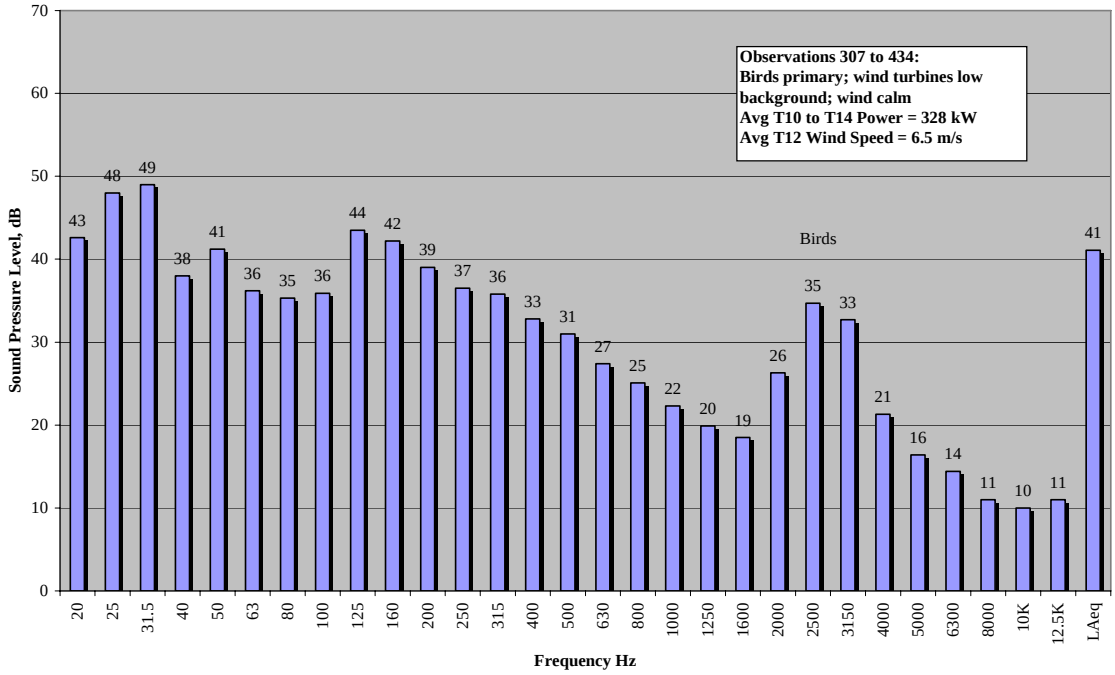
MP-7
9-May-07 2:00 to 3:00



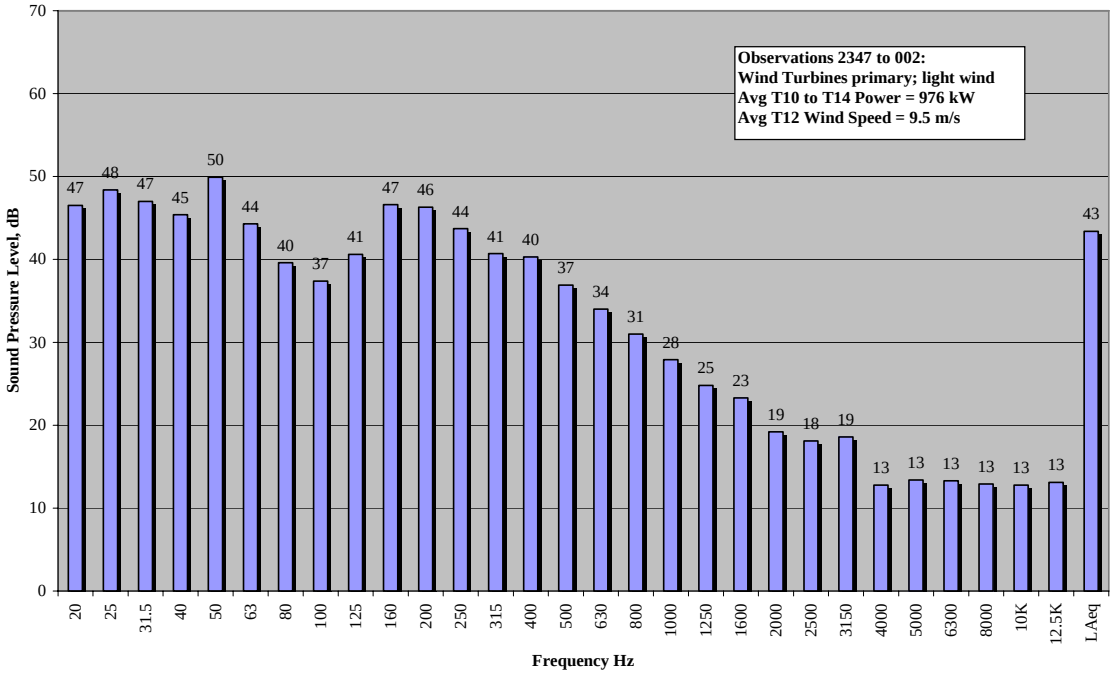
MP-7
9-May-07 8:00 to 9:00



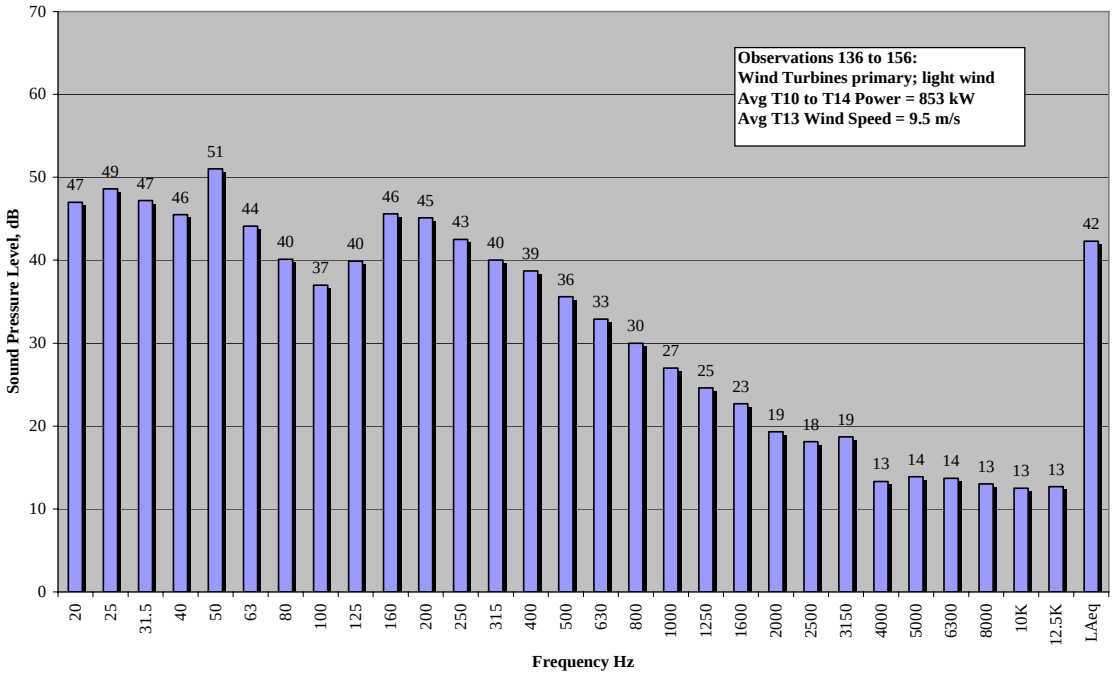
MP-7
10-May-07 3:17 to 4:17



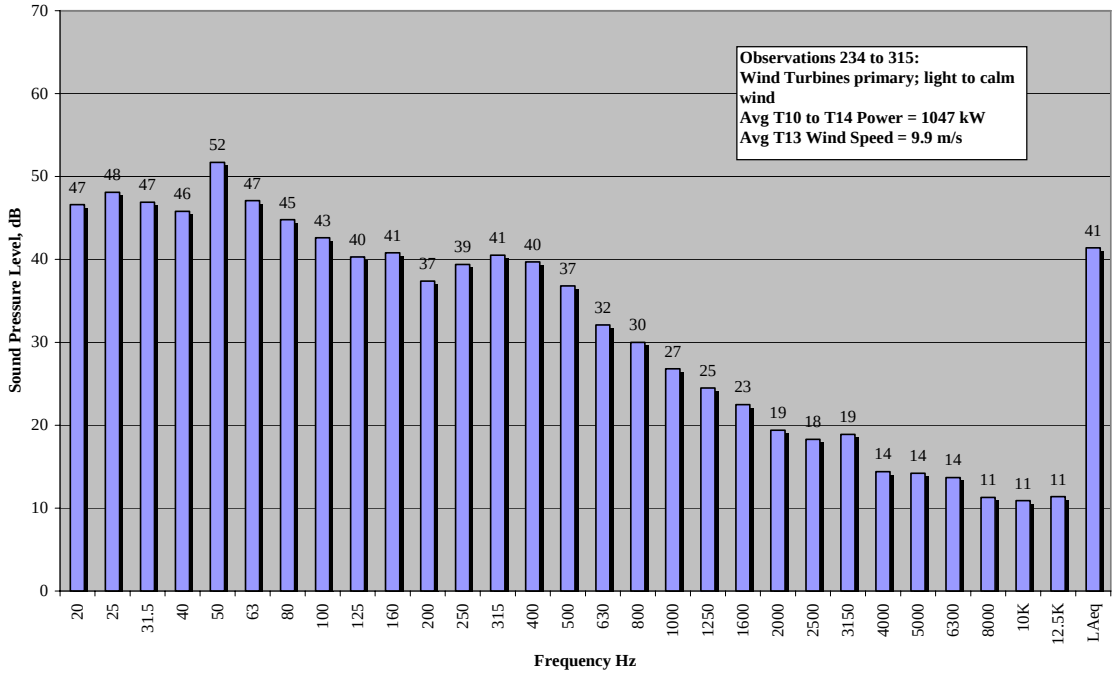
MP-7
10-May-07 23:00 to 0:00



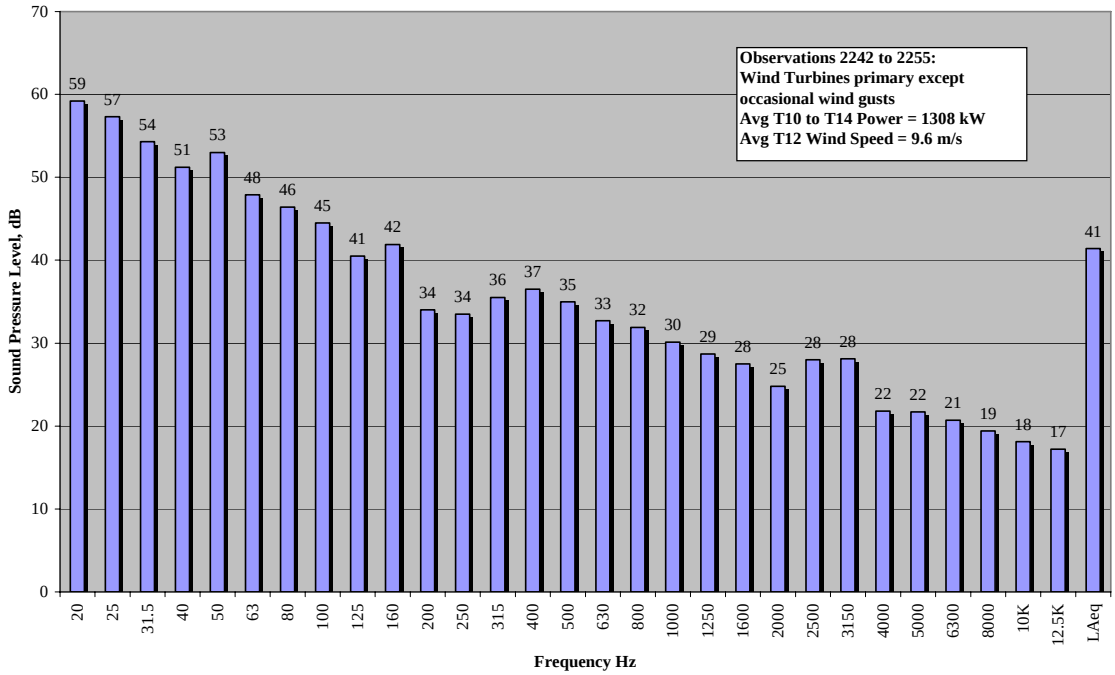
MP-7
11-May-07 1:00 to 2:00



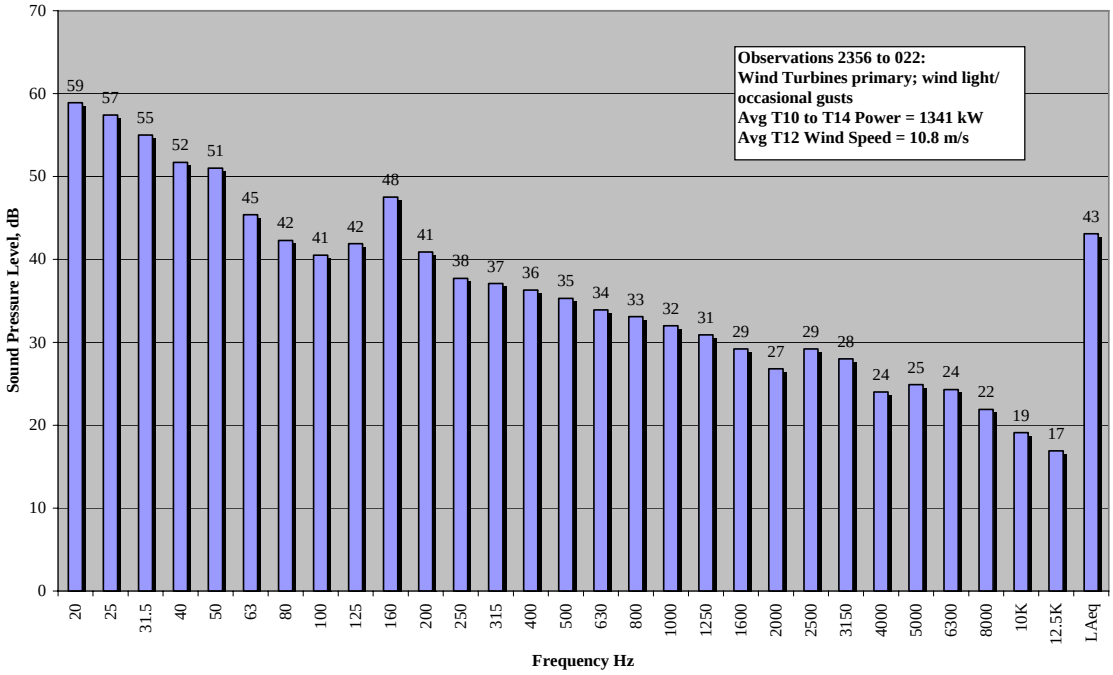
MP-7
11-May-07 2:46 to 3:15



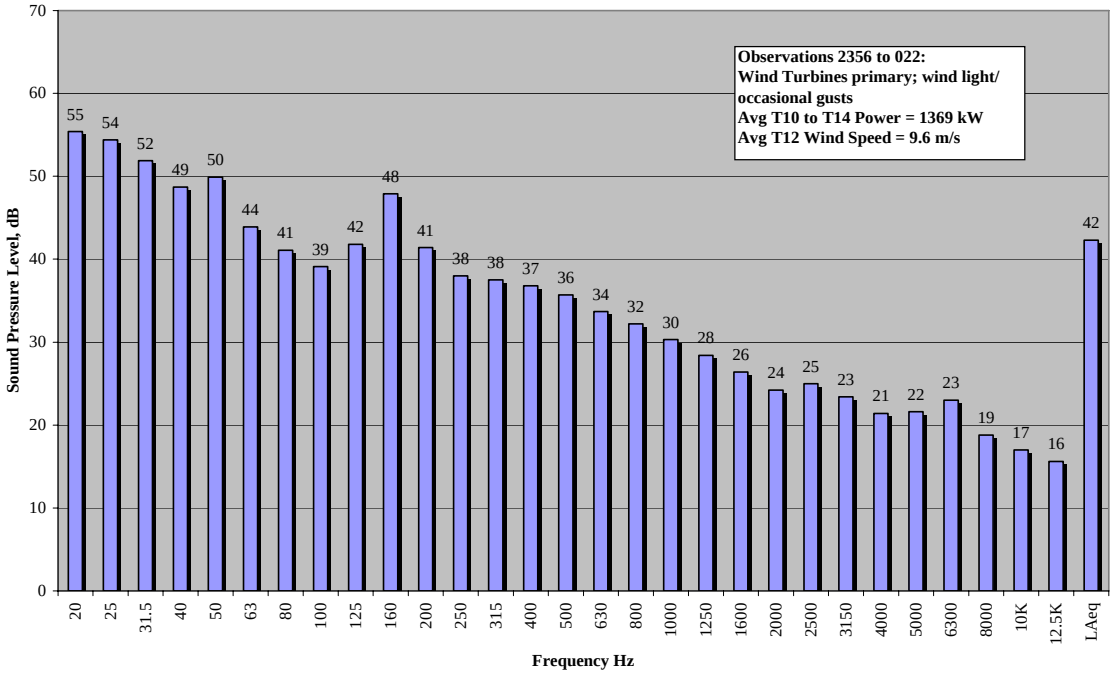
MP-7
11-May-07 22:42 to 22:55



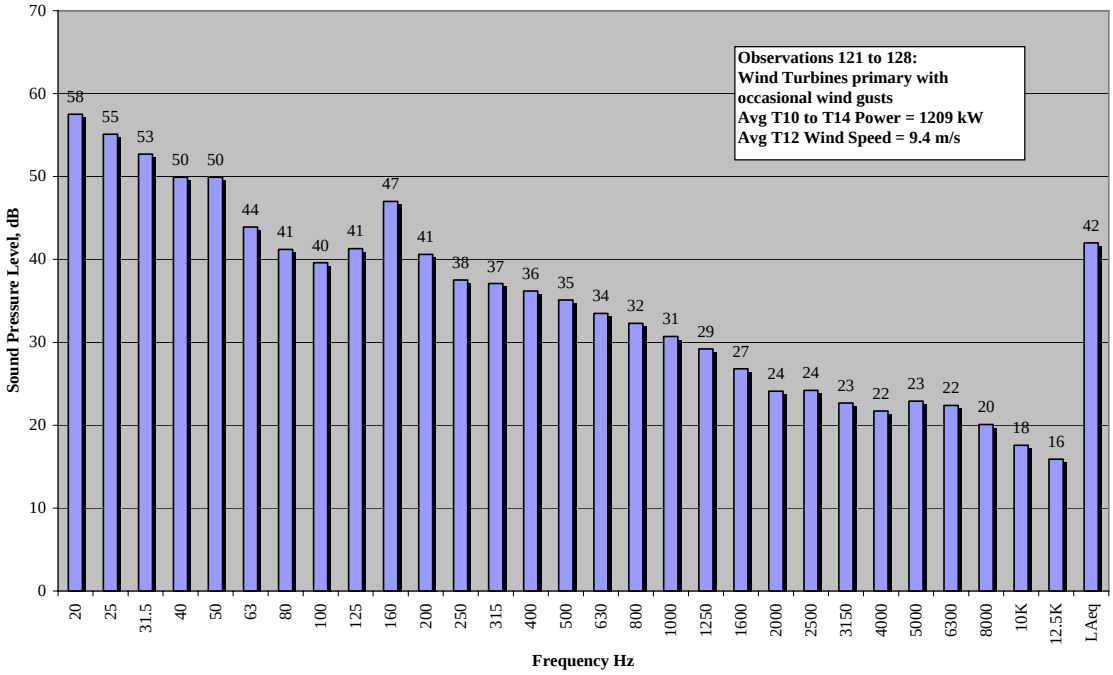
MP-7
11-May-07 23:00 to 0:00



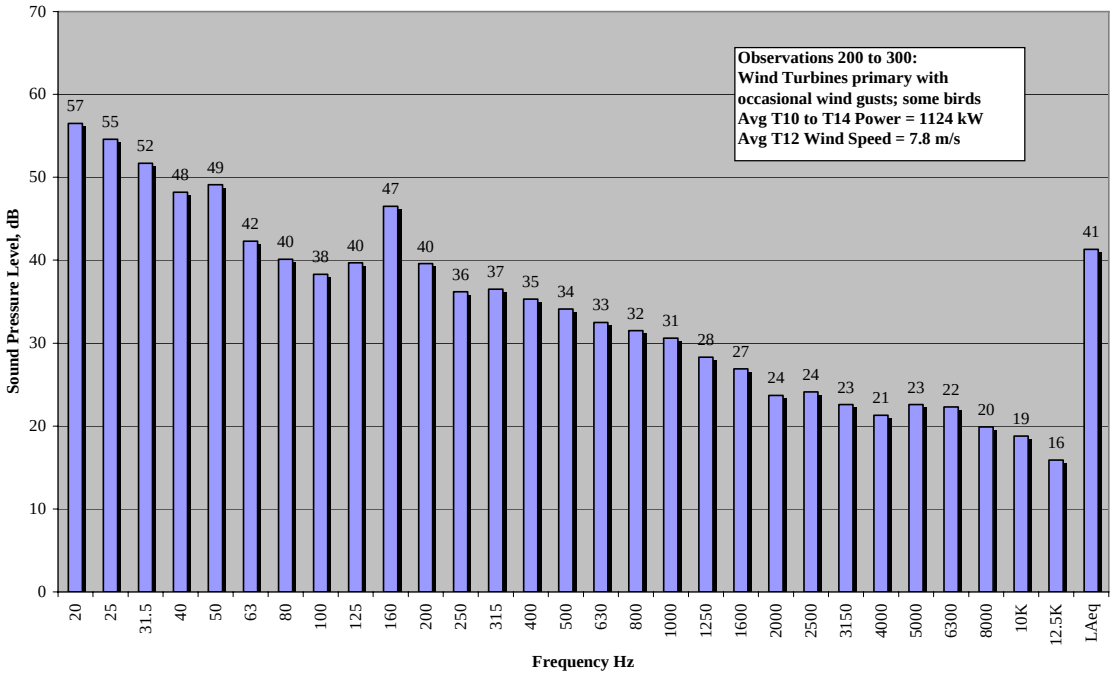
MP-7
12-May-07 0:00 to 1:00



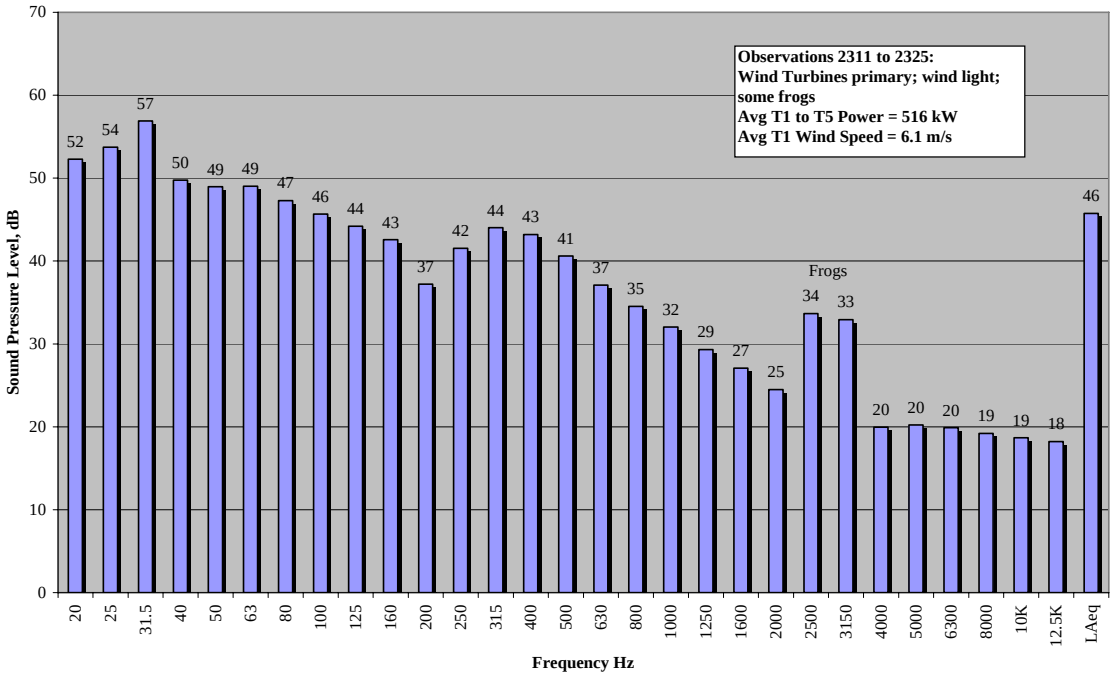
MP-7
12-May-07 1:00 to 2:00



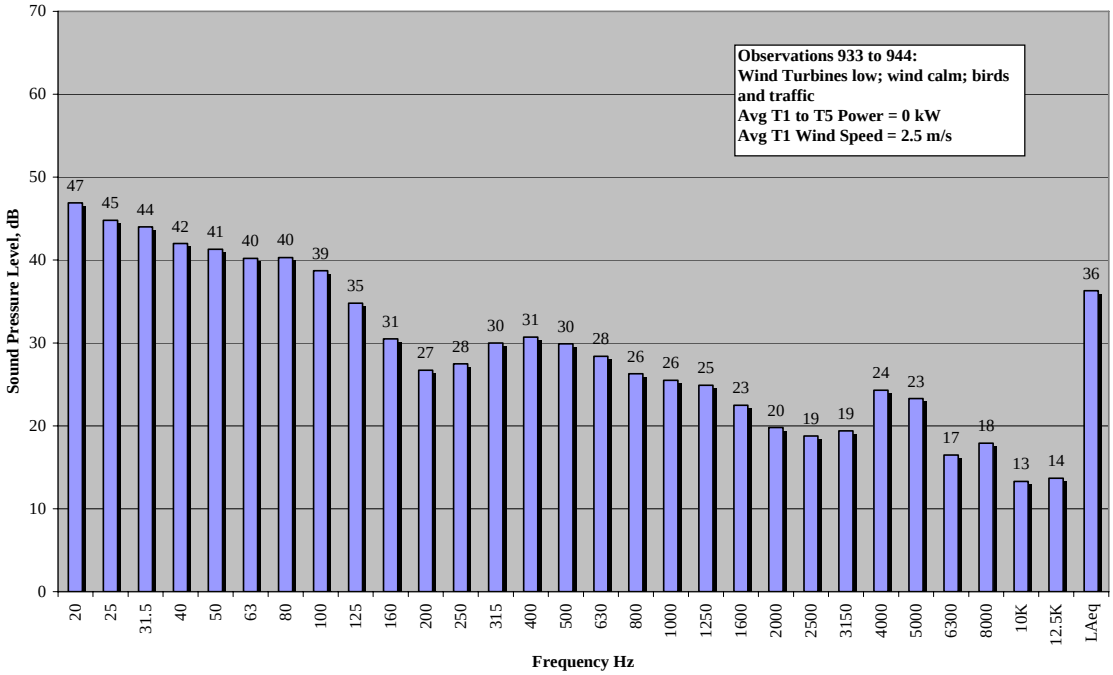
MP-7
12-May-07 2:00 to 3:00



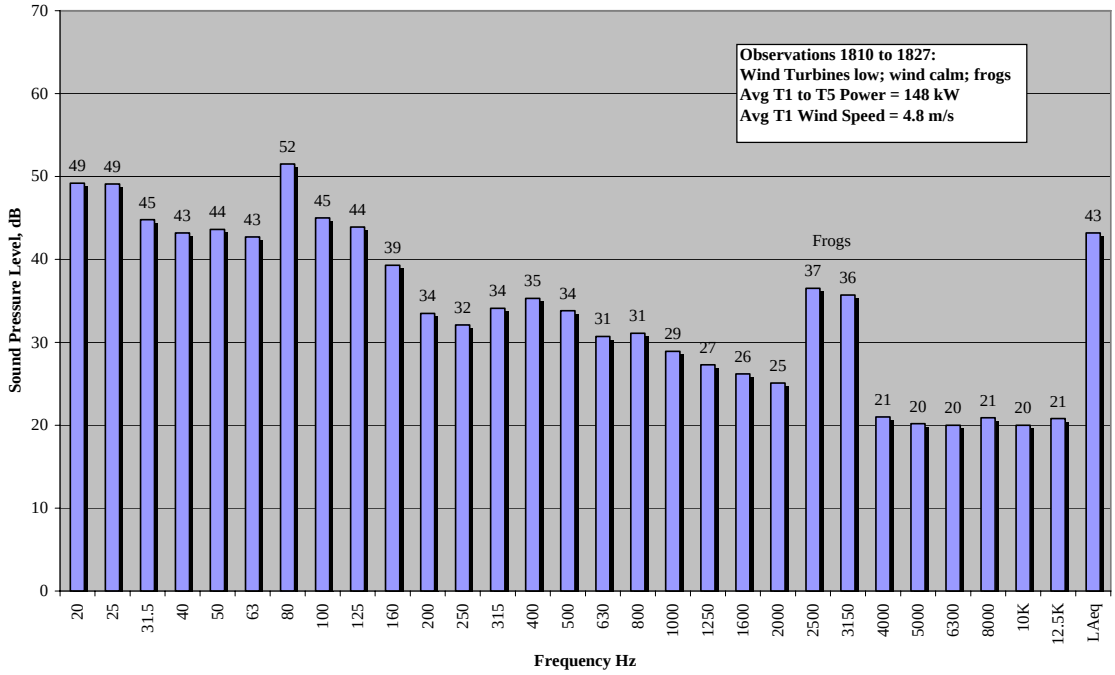
MP-8
8-May-07 23:11 to 23:25



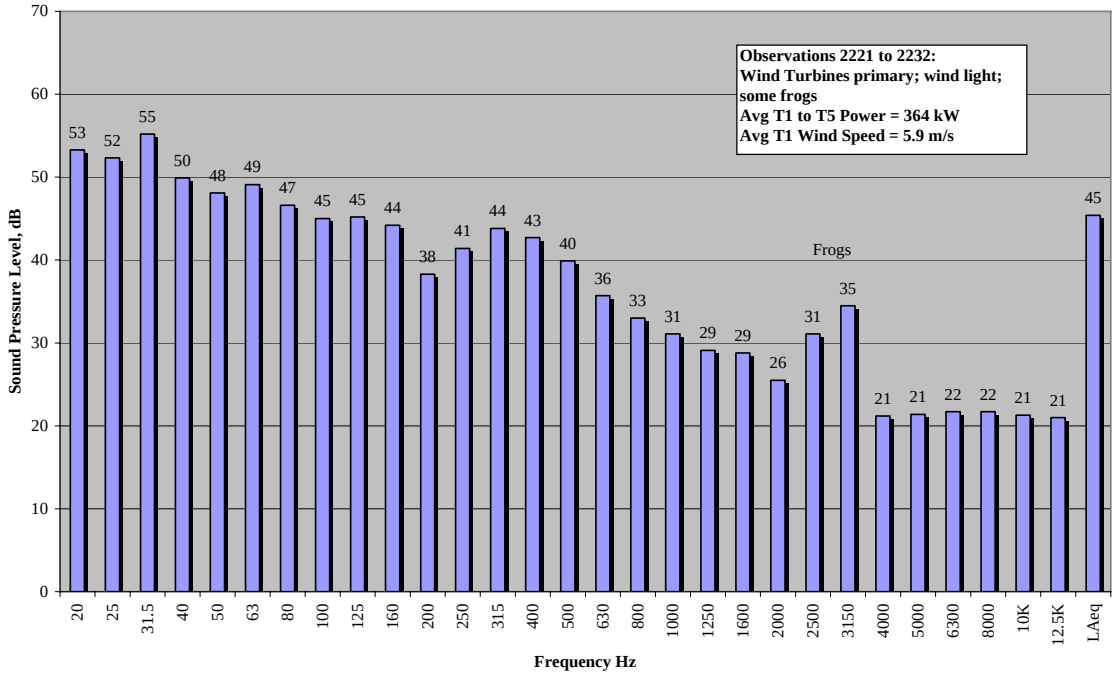
MP-8
9-May-07 9:33 to 9:44



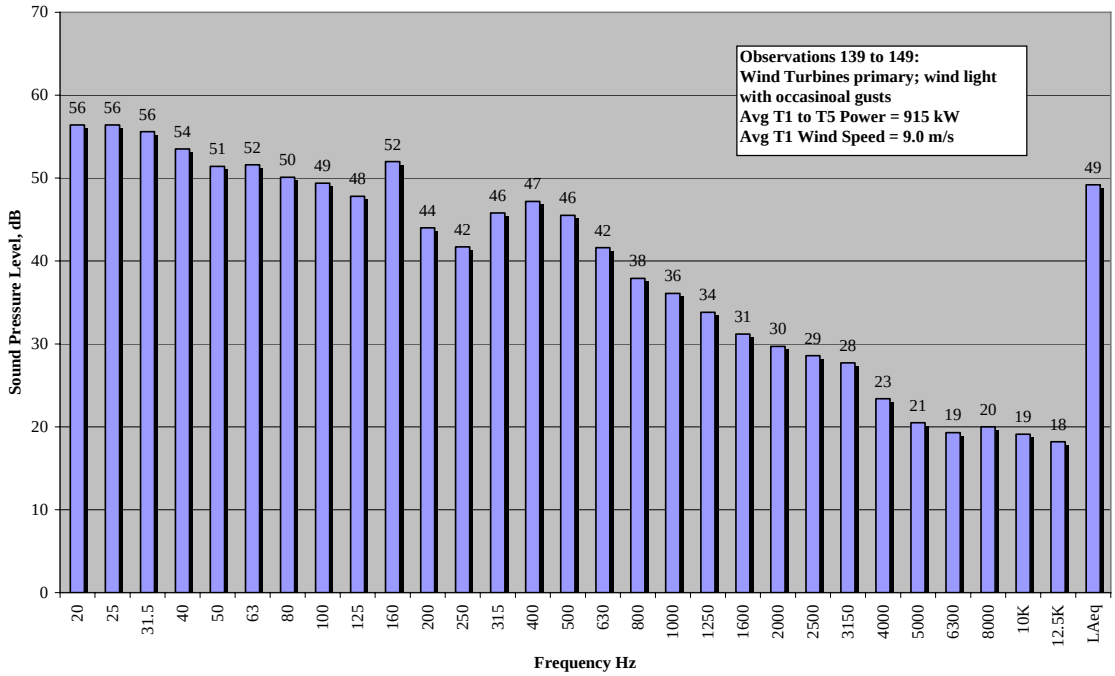
MP-8
9-May-07 18:24 to 18:27



MP-8
10-May-07 22:21 to 22:32



MP-8
11-May-07 1:39 to 1:49



MP-8
12-May-07 0:57 to 1:07