HGC ENGINEERING

Howe Gastmeier Chapnik Limited
2000 Argentia Road, Plaza One, Suite 203
Mississauga, Ontario, Canada L5N 1P7
t: 905.826.4044

FALL ACOUSTIC AUDIT - IMMISSION REPORT

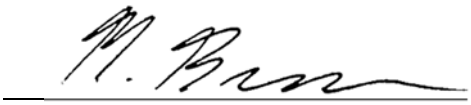
McLean's Mountain Wind Power Project

Manitoulin Island, Ontario

Prepared for:

Northland Power Inc.
30 St Clair Ave. West, 12th Floor
Toronto, ON
M4V 3A1

Prepared by



Matthew Brenner, EIT

and

Ian R. Bonsma, PEng

Revised: September 2015

VERSION CONTROL

McLean's Mountain Wind Power Project, Manitoulin Island, Ontario

Ver.	Date	Version Description	Prepared By
1	February 2015	Original Audit Immission Report	MB
2	September 2015	Updated based on comments from the MOECC and an increased minimum distance for turbine operation	MB

EXECUTIVE SUMMARY

Howe Gastmeier Chapnik Limited ("HGC Engineering") was retained by Northland Power Inc. to complete an Immission Audit of the McLean's Mountain Wind Power Project ("Wind Project") in the Municipality of Central Manitoulin. The project includes 21 General Electric GE 2.49-103, 2 General Electric GE 2.66-103 and 1 General Electric GE 2.38-103 wind turbine generators, rated at 2.49, 2.66 and 2.38 MW, respectively. The Immission Audit is required as a condition of Renewable Energy Approval number 7733-8XUNS5 issued by the Ontario Ministry of the Environment and Climate Change ("MOECC"). HGC Engineering has assessed the acoustic impact against the acoustic criteria of the MOECC and in accordance with the requirements of the MOECC's Compliance Protocol for Wind Turbine Noise. The Immission Audit requires measurements be performed during the fall and spring seasons. This report presents the results from the fall measurement campaign, completed between October 9 and December 23, 2014.

The sound level measurements and analysis, as performed in accordance with the MOECC's Compliance Protocol for Wind Turbine Noise, indicate that the project meets the applicable sound level limits at the considered receptors. Details of the measurements and analysis are provided herein.

TABLE OF CONTENTS

1 INTRODUCTION

Howe Gastmeier Chapnik Limited ("HGC Engineering") was retained by Northland Power Inc. ("Northland Power") to complete an Acoustic Audit – Immission of the McLean's Mountain Wind Power Project. The project is located in the Municipality of Central Manitoulin, Ontario and consists of 21 General Electric GE 2.49-103, 2 General Electric GE 2.66-103 and 1 General Electric GE 2.38-103 wind turbine generators, rated at 2.49, 2.66 and 2.38 MW, respectively, and with a hub height of 98 metres.

The Audit is required as part of the Renewable Energy Approval ("REA") number 7733-8XUNS5 [1] issued for the project by the Ontario Ministry of the Environment and Climate Change ("MOECC"). Specifically, this report summarizes measurements that were conducted in order to satisfy the first of two audits required under Condition E of the REA.

2 POINTS OF RECEPTION

The Environmental Noise Impact Assessment prepared by Aercoustics Engineering Ltd. [2] provided sound level predictions for receptors within 1500 metres of the project wind turbine generators. The following table provides a summary of the predicted sound levels at the closest receptors surrounding the project, based on the Aercoustics Report.

Table 1: Closest Receptor Locations

ID	Distance to nearest turbine [m]	Nearest turbine ID	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Suitable Audit Receptor	Comments
			6	7	8	9	10		
PR289	669	T11	38.8	38.8	38.8	38.8	38.8	Y	Used as alternate location for R282.
R288	748	T20	38.4	38.4	38.4	38.4	38.4	N	Significant topographical change on property. V252 used as alternate location.
R281	632	T23	38.1	38.1	38.1	38.1	38.1	N	Not accessible.
V209	642	T36	38.1	38.1	38.1	38.1	38.1	N	Not accessible.
VP019	700	T09	38.0	38.0	38.0	38.0	38.0	Y	Used as alternate location for V239.

ID	Distance to nearest	Nearest turbine ID	Calculated Sound Pressure Level at Receptor [dBA] at selected Wind Speed in m/s					Suitable Audit Receptor	Comments
V213	621	T35	37.9	37.9	37.9	37.9	37.9	N	Not accessible.
R282	889	T14	37.7	37.7	37.7	37.7	37.7	Y	No permission granted. PR289 used as alternate location.
V251	819	T20	37.7	37.7	37.7	37.7	37.7	N	Significant topographical change on adjacent property.
V241	664	T15	37.3	37.3	37.3	37.3	37.3	Y	Represented by V252.
V252	738	T19	37.3	37.3	37.3	37.3	37.3	Y	Selected Auditing Receptor.
V229	562	T17	37.1	37.1	37.1	37.1	37.1	Y	Represented by V252.
V208	832	T36	36.9	36.9	36.9	36.9	36.9	N	Not Accessible.
V240	660	T15	36.9	36.9	36.9	36.9	36.9	Y	Represented by V252.
R297	910	T20	36.8	36.8	36.8	36.8	36.8	N	Significant topographical change on property.
V256	819	T11	36.8	36.8	36.8	36.8	36.8	Y	Represented by PR289.
V216	867	T38	36.7	36.7	36.7	36.7	36.7	N	Not Accessible.
V235	719	T11	36.7	36.7	36.7	36.7	36.7	Y	Represented by PR289.
V254	695	T06	36.6	36.6	36.6	36.6	36.6	N	Not Accessible.
V215	796	T35	36.5	36.5	36.5	36.5	36.5	N	Not Accessible.
V244	706	T28	36.5	36.5	36.5	36.5	36.5	N	Not Accessible.
R296	822	T18	36.4	36.4	36.4	36.4	36.4	N	Not Prevailing Wind Direction.
V245	699	T28	36.4	36.4	36.4	36.4	36.4	N	Not Accessible.
R290	895	T11	36.2	36.2	36.2	36.2	36.2	Y	Represented by PR289.
R291	716	T11	36.1	36.1	36.1	36.1	36.1	Y	Represented by PR289.
V207	797	T25	36.0	36.0	36.0	36.0	36.0	N	Not Accessible.
V202	614	T25	35.8	35.8	35.8	35.8	35.8	N	Not Accessible.
V214	827	T35	35.8	35.8	35.8	35.8	35.8	N	Not Accessible.
V203	644	T25	35.4	35.4	35.4	35.4	35.4	N	Not Accessible.
V210	1013	T36	35.3	35.3	35.3	35.3	35.3	N	Not Accessible.
R287	850	T15	35.2	35.2	35.2	35.2	35.2	Y	Represented by V252.
V239	819	T20	37.7	37.7	37.7	37.7	37.7	N	No permission granted. VP019 used as alternate location.

The receptor locations identified above as "Not accessible" are located either on land locked agricultural lots or along unopened road allowances. The receptor locations selected for the Immission Audit (PR289, VP019, V252) satisfy the two requirements from the REA:

a) The Point of Reception should represent the location of the greatest predicted noise impact.
b) The Point of Reception should be located in the direction of prevailing winds from the Facility.

Based on the Aercoustics report, the predicted sound levels at the monitoring locations are 38.0, 37.3, and 38.8 dBA at locations VP019, V252, and PR289 respectively. Receptor VP019, is a participating vacant lot located on the north-east side of the project with the closest turbine, T09, approximately 700 metres south. This location conservatively represents the non-participating vacant lot V239 and additional receptors to the north. Receptor location V252 is a vacant lot located on the east side of the project with the closest wind turbine, T19, approximately 740 metres south. Receptor PR289 is a single storey home with the closest turbine, T11, approximately 670 metres north. This location conservatively represents the non-participating receptor R282. Photos of each receptor location are included in Appendix A.

Figure 1 shows the sound level monitoring locations. The placement of the sound level monitoring equipment at each location was selected based on consideration of local interference from foliage and other background sound sources. The site is rural in nature with infrequently travelled gravel roads.

3 INSTRUMENTATION

The MOECC document, *Compliance Protocol for Wind Turbine Noise – Guidelines for Acoustic Assessment and Measurement* [3] provides requirements for instrumentation for Acoustical Audits of wind energy projects. Instrumentation used for this acoustic audit satisfies the requirements provided in the Compliance Protocol. Sound level measurements were performed using a Norsonic Type 140 integrating sound level meter and two Svantek Type 971 sound level meters connected to their respective ½" microphones.

The energy-equivalent average sound level, denoted $L_{EQ,}$ and also the L_{90} sound level, the level exceeded 90% of the time during the measurement, were recorded by the instrumentation. The L_{90} sound level is commonly used to represent the background or steady-state sound level because it minimizes transient sounds such as occasional human voices, brief animal activity, and car pass-bys. The measurements are summarized in this report as the overall A-weighted sound levels as they are intended to represent the loudness of sounds as perceived by the human ear.

In addition to the acoustic instrumentation, various meteorological instruments were used. A Davis Instruments Vantage Pro 2 weather station was deployed at V252 to collect meteorological data including temperature, humidity, and precipitation. NRG anemometers and wind vanes were used to collect the 10 metre height wind speed and direction at each location

The various instruments deployed by HGC Engineering are summarized in Table 1 below, and their relative locations are shown in Figure 1.

Table 2: Sound Level Measurement Instrumentation

Receptor	Address	Instrumentation Make and Model	Serial Number
VP019	Morphets Side Road	Svantek Type 971	39022
		NRG#40 Anemometer with Campbell Scientific Data Logger	179500235174
V252	Green Bush Road East	Svantek Type 971	39101
		NRG#40 Anemometer with Campbell Scientific Data Logger	179500235190
		Davis Vantage Pro2 Weather Station	3788A-6312
PR289	Green Bush Road West	Norsonic Type 140	1403176
		NRG#40 Anemometer with Campbell Scientific Data Logger	179500221341

The sound level meters were configured to measure and document spectral (frequency-dependent) 1 minute L_{EQ} and 15 minute L_{90} sound level measurements at the receptor locations, and to also record audio files to allow for identification of dominant sources.

Correct calibration of the acoustic instrumentation was verified using an acoustic calibrator manufactured by Brüel & Kjær (B&K). Calibration was carried out at the start and end of the measurement period, as well as an intermediate period. Calibration certificates for the equipment are included under Appendix B.

Wind screens were used on all microphones, consistent with the requirements of MOECC technical publication NPC-103, *Procedures* [4]. Large wind screens, 175 mm in diameter, were utilized on each sound level monitor to minimize wind-induced microphone self-noise at higher wind speeds. Sound level data included herein has not been adjusted for the sound insertion loss of these large wind screens.

4 ASSESSMENT CRITERIA

The MOECC publication *Noise Guidelines for Wind Farms – Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities* [5] indicates the applicable sound level limit for wind energy projects. Additionally, the Compliance Protocol document and the REA approval include the same sound level limits which are shown in Table 2, below.

Table 3: Wind Turbine Noise Criteria [dBA]

Wind Speed (m/s) at 10 m Height	4	5	6	7	8	9	10
Wind Turbine Sound Level Limits Class 3 Area [dBA]	40.0	40.0	40.0	43.0	45.0	49.0	51.0

It should be noted that the sound level limits of the MOECC apply only to the sound level contribution of the sound source under assessment, in this case the sound from the wind turbine generators. Thus, where a sound level measured at a receptor includes significant sound due to the relevant sound source and unrelated background sound sources (i.e., road vehicles, air traffic, farming machinery, wind, etc.), some form of evaluation must be made to determine the sound level contribution of the source under assessment in the absence of the background sounds. Methodology prescribed by the MOECC to complete an assessment of wind energy projects is discussed below.

5 METHODOLOGY

The REA requires the acoustic audit be completed in accordance with Part D of the Compliance Protocol for Wind Turbine Noise. Part D includes requirements for instrumentation, measurement and data reduction procedures to assist with determining compliance. A series of

one-minute energy equivalent sound level measurements are conducted with and without the turbines operating. Simultaneously, wind speed and direction at 10 metre height are measured in one minute intervals. The measured sound level data is separated into integer wind speed "bins" where the sound levels corresponding to each integer wind speed are arithmetically averaged to determine the average sound level when the wind turbines are operational and when they are parked. The ambient L_{EQ} (turbines parked) is logarithmically subtracted from the overall L_{EQ} (turbines operational) to determine the sound level contribution of the wind turbines alone. Supplementary data including wind speed at turbine hub height, wind speed at noise measurement height, turbine electrical power output, temperature, humidity, and statistical noise indices (L_n) can also be measured during the monitoring campaign to aid in the analysis.

The MOECC protocol requires that at least 120 one minute intervals be measured for each wind speed when the turbines are operating normally and at least 60 one minute intervals be measured for each 10 metre wind speed between 4 and 7 m/s when the turbines are parked. Prior to determining the number of data points measured in each wind speed bin the data is filtered to include data only during night time hours (between 22:00 and 05:00), data outside of rainfall (no rain within an hour of the measurement interval), and the maximum 10 metre wind speed must not differ from the average by more than 2 m/s.

The MOECC protocol allows for the removal of individual events to improve the signal to noise ratio. A review of the audio recordings allowed for the identification of the dominant noise source within a given one minute interval, and a subsequent removal of those with interference. Adjustments to the measured sound levels may be required based on wind turbine tonality, if any. If during the acoustic measurement campaign the project wind turbines exhibit tonal characteristics (a whine, screech, buzz or hum) then an assessment of the tonal audibility is required according to International Standards Organization 1996-2 [6]. The average tonal audibility correction must be determined for each integer wind speed and the correction added to the final noise contribution of the wind turbine at those wind speeds.

6 MEASUREMENTS AND RESULTS

Sound level measurements were conducted at the receptor locations between October 9 and December 23, 2014. The weather during the monitoring period varied, including several days with rain and snow. Temperatures ranged from -21 to 18° Celsius. Wind speeds at 10 metres in height ranged from 0 m/s up to 18 m/s. The prevailing wind direction during the measurement campaign was from the west. Figures 2a through 4b show the wind rose for receptor VP019, V252 and PR289 for the project ON and OFF conditions. Observations during the attended measurements conducted on a number of occasions throughout the measurement campaign indicated that the turbines were not tonal.

Data reductions discussed in Section 5 were applied to the measured sound levels at the three receptor locations. To confirm wind project ON and OFF conditions a number of additional items of information were reviewed/collected including electrical power production from the turbines, and audio recordings at the receptor locations. The analysis presented herein considers the ON condition as a valid data point when the closest turbines were in operation (those within approximately 1500 m).

The sound level summary for data collected at VP019 is shown in Tables 4a and 4b below and Figures 5a and 5b.

Table 4a: Sound Level Summary for Receptor VP019 [dBA]

	10 metre Wind Speed Bins							
L_{EQ} Sound Level [dBA]	**4 m/s**		**5 m/s**		**6 m/s**		**7 m/s**	
Average Operating (ON) / std dev.	36.8	3.9	40.7	3.4	43.7	3.2	46.2	2.8
Average Ambient (OFF) / std dev.	33.7	5.4	40.7	4.1	44.2	3.1	46.7	2.8
Wind Project Only / std dev.	33.8	4.2	13.5[1]	3.4	N/A[2]	-	N/A[2]	-
Criteria	40.0		40.0		40.0		43.0	
Excess	**0**		**0**		**0**		**0**	

[1]The calculated sound level does not represent the contribution of the wind project at this location, as the average operating and ambient sound levels were essentially equivalent.
[2] The wind project only sound level cannot be calculated, as the average ambient sound levels was greater than the average operating sound level.

Table 4b: Summary of Valid Data Points for Receptor VP019

Wind Project Condition	10 metre Wind Speed [m/s]			
	4	5	6	7
Operating (ON)	2372	2296	1543	826
Ambient (OFF)	282	168	135	70

Based on the data presented above and in Figures 5a and 5b, the wind energy facility is compliant with the MOECC sound level criteria at this location. Furthermore, the average operating sound levels at wind speeds 5 m/s and greater were generally equivalent to the average ambient sound levels at this location, as shown in Table 4a.

The sound level summary for data collected at V252 is presented in Tables 5a and 5b and Figures 6a and 6b.

Table 5a: Sound Level Summary for Receptor V252 [dBA]

	10 metre Wind Speed Bins							
L_{EQ} Sound Level [dBA]	**4 m/s**		**5 m/s**		**6 m/s**		**7 m/s**	
Average Operating (ON) / std dev.	36.0	3.4	38.6	3.1	40.8	3.2	42.9	3.6
Average Ambient (OFF) / std dev.	33.8	5.2	36.6	4.9	39.3	4.7	41.8	3.0
Wind Project Only / std dev.	31.8	3.7	34.2	3.4	35.5	3.4	36.5	3.5
Criteria	40.0		40.0		40.0		43.0	
Excess	**0**		**0**		**0**		**0**	

Table 5b: Summary of Valid Data Points for Receptor V252

Wind Project Condition	10 metre Wind Speed [m/s]			
	4	5	6	7
Operating (ON)	1952	1680	968	384
Ambient (OFF)	209	194	108	66

The sound level measurements at receptor V252 indicate that the wind energy facility is compliant with the MOECC sound level criteria at this location.

The sound level summary for data collected at PR289 is presented in Tables 6a and 6b and Figures 7a and 7b.

Table 6a: Sound Level Summary for Receptor PR289 [dBA]

	10 metre Wind Speed Bins							
L_{EQ} Sound Level [dBA]	**4 m/s**		**5 m/s**		**6 m/s**		**7 m/s**	
Average Operating (ON) / std dev.	37.4	3.9	40.3	3.8	43.4	3.7	45.8	3.5
Average Ambient (OFF) / std dev.	34.3	4.6	38.4	5.6	41.4	6.0	43.1	4.7
Wind Project Only / std dev.	34.4	4.0	35.7	4.1	39.0	4.2	42.3	4.1
Criteria	40.0		40.0		40.0		43.0	
Excess	**0**		**0**		**0**		**0**	

Table 6b: Summary of Valid Data Points for Receptor PR289 [dBA]

	10 metre Wind Speed [m/s]			
Wind Project Condition	**4**	**5**	**6**	**7**
Operating (ON)	1978	1636	664	200
Ambient (OFF)	194	207	138	74

Based on the data presented above and in Figures 7a and 7b, the wind energy facility is compliant with the MOECC sound level criteria at this location.

Appendix C includes a statement from Northland Power indicating the wind turbines were operating normally for the duration of the measurement campaign.

7 CONCLUSIONS

The measurements and analysis for the fall measurement campaign, performed in accordance with the methods prescribed by the Ontario Ministry of the Environment and Climate Change in publication *Compliance Protocol for Wind Turbine Noise* indicates that for the considered receptors, the wind energy facility is operating within compliance of the MOECC's sound level criteria.

REFERENCES

1. Ontario Ministry of the Environment and Climate Change, Renewable Energy Approval Number 7733-8XUNS5, October 31, 2013.
2. Aercoustics Engineering Ltd., McLean's Mountain Wind Farm Environmental Noise Impact Assessment. May 3, 2013.
3. Ontario Ministry of the Environment Publication, *Compliance Protocol for Wind Turbine Noise Guideline for Acoustic Assessment and Measurement.*
4. Ontario Ministry of the Environment Publication, NPC-103, *Procedures.*
5. Ontario Ministry of the Environment Publication, *Noise Guidelines for Wind Farms, Interpretation for Applying MOE NPC Publications to Wind Power Generation Facilities,* October 2008.
6. International Standards Organization 1996-2, *Acoustics – Description, assessment and measurement of environmental noise – Part 2: Determination of environmental noise levels,* 2007.

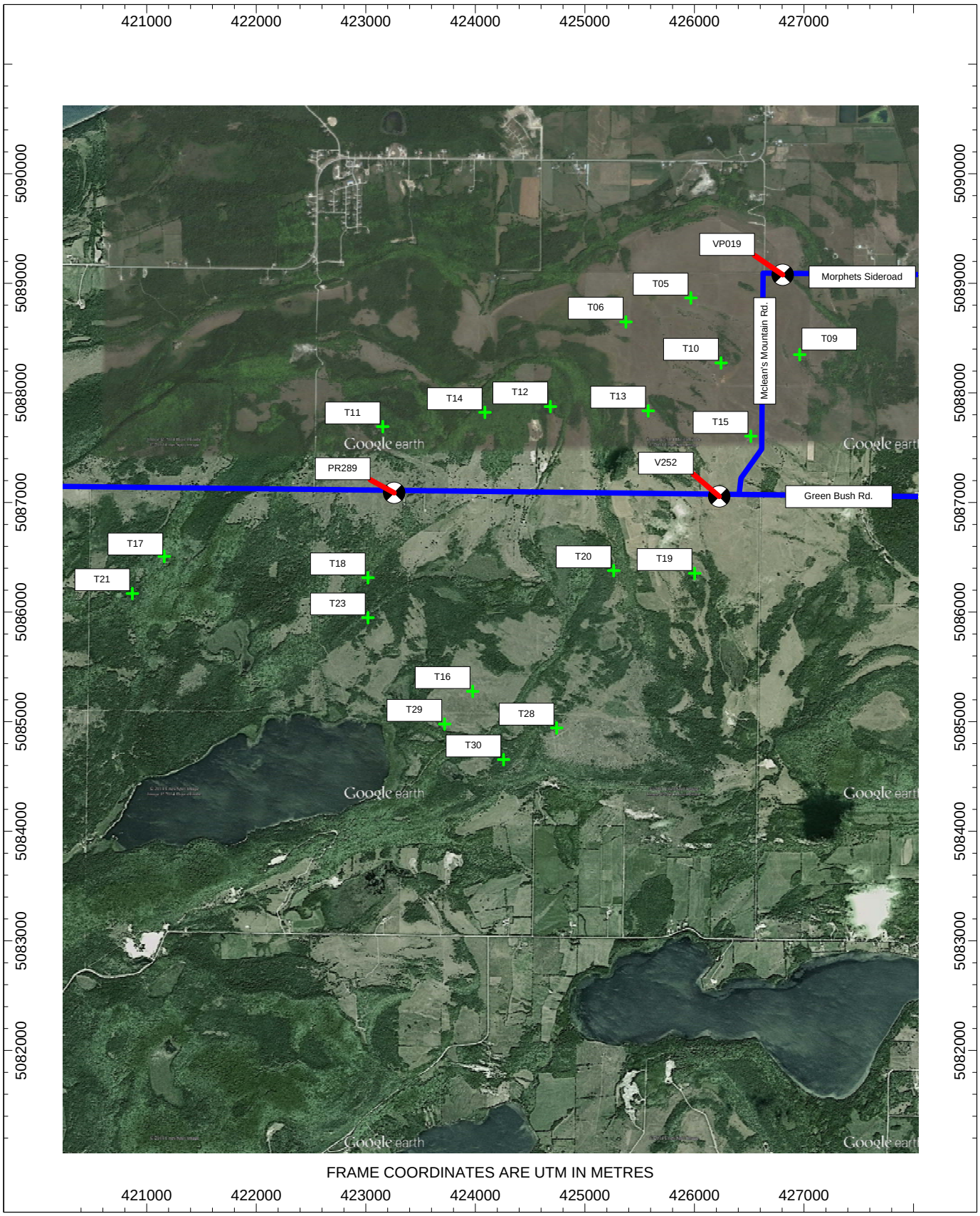


Figure 1: Wind Turbine and Sound Level Monitor Locations
Mclean's Mountain Wind Energy Project, Manitoulin Island, Ontario

Figure 2a: Wind Direction - Receptor VP019

10 m Height, Wind Speeds 4-7 m/s

ON Condition, October 9 to December 23, 2014

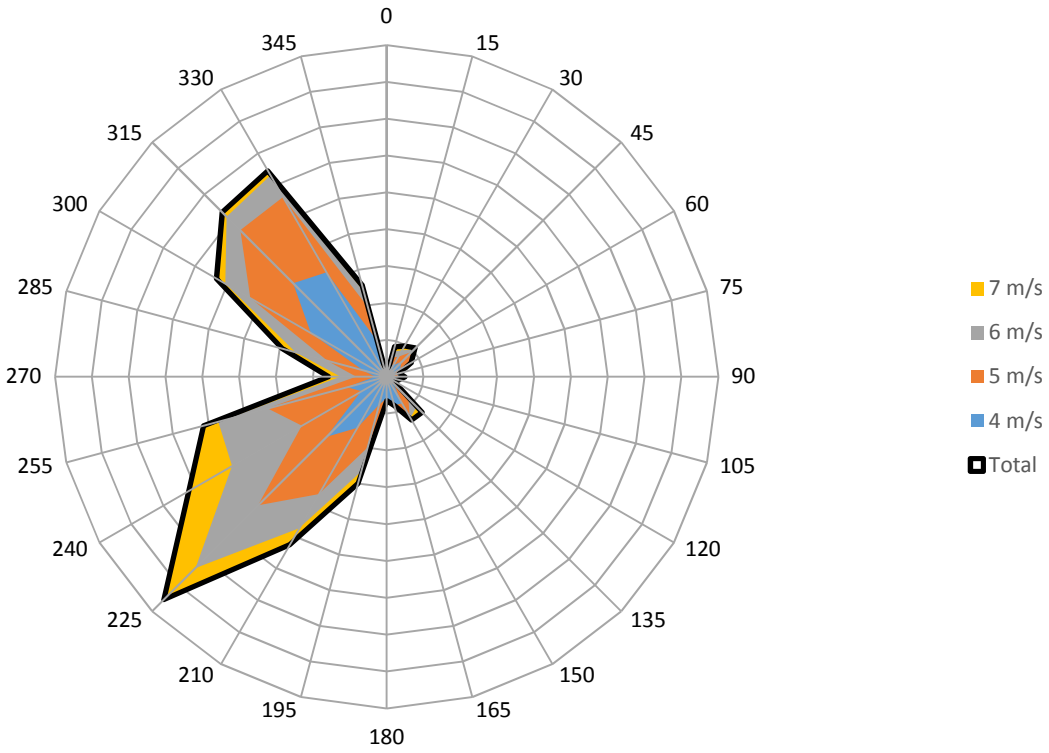


Figure 2b: Wind Direction Receptor VP019

10 m Height, Wind Speeds 4-7 m/s

OFF Condition, October 9 to December 23, 2014

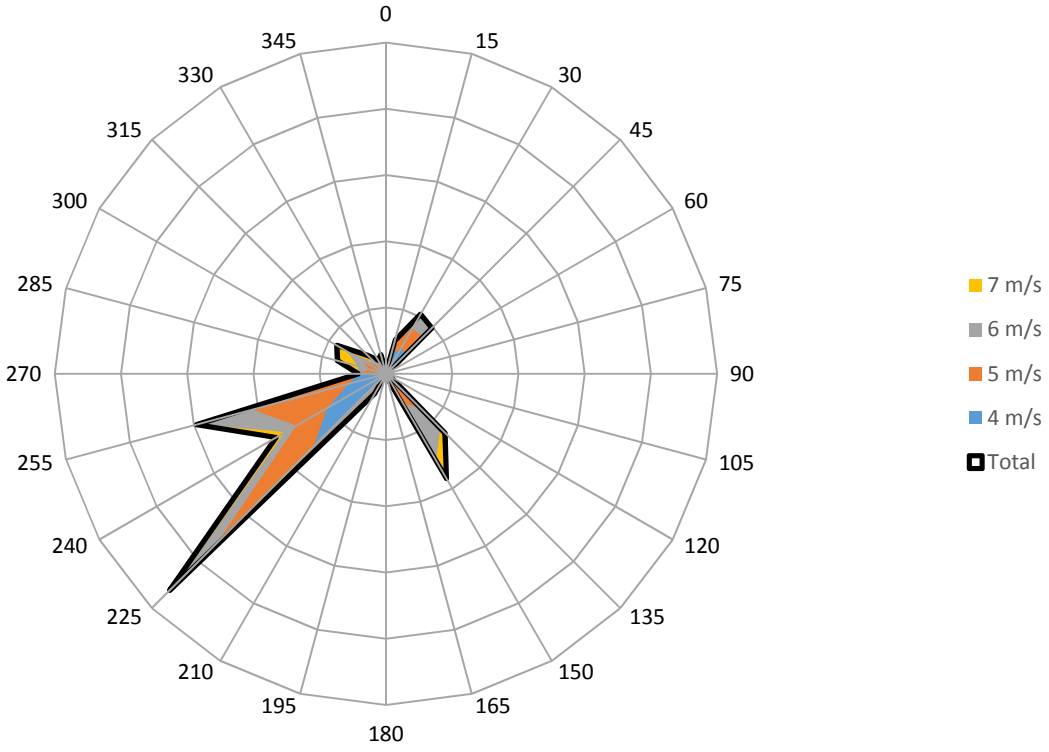


Figure 3a: Wind Direction - Receptor V252

10 m Height, Wind Speeds 4-7 m/s

ON Condition, October 9 to December 23, 2014

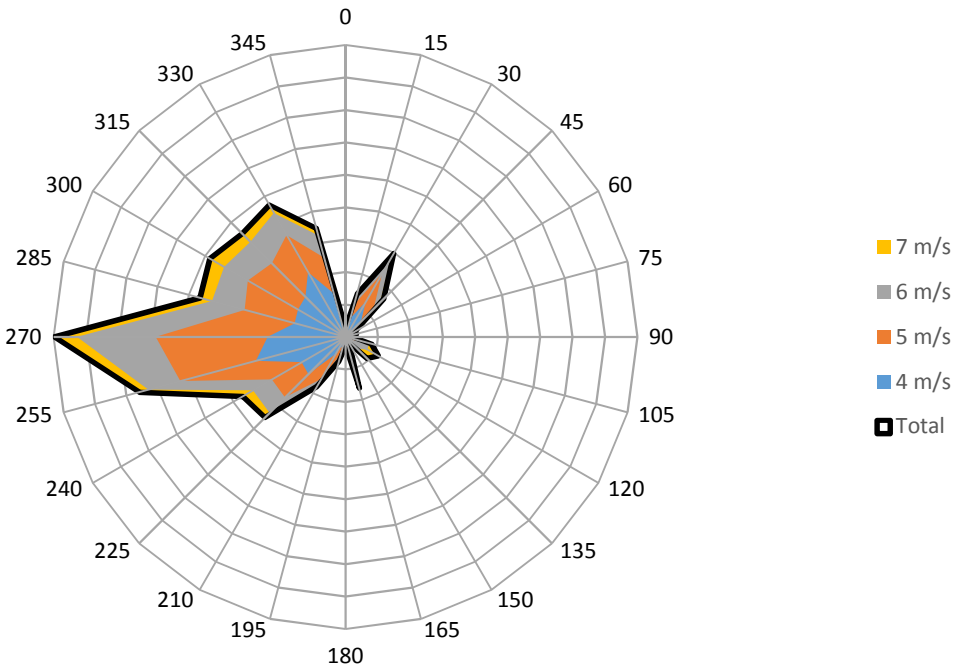


Figure 3b: Wind Direction - Receptor V252

10 m Height, Wind Speeds 4-7 m/s

OFF Condition, October 9 to December 23, 2014

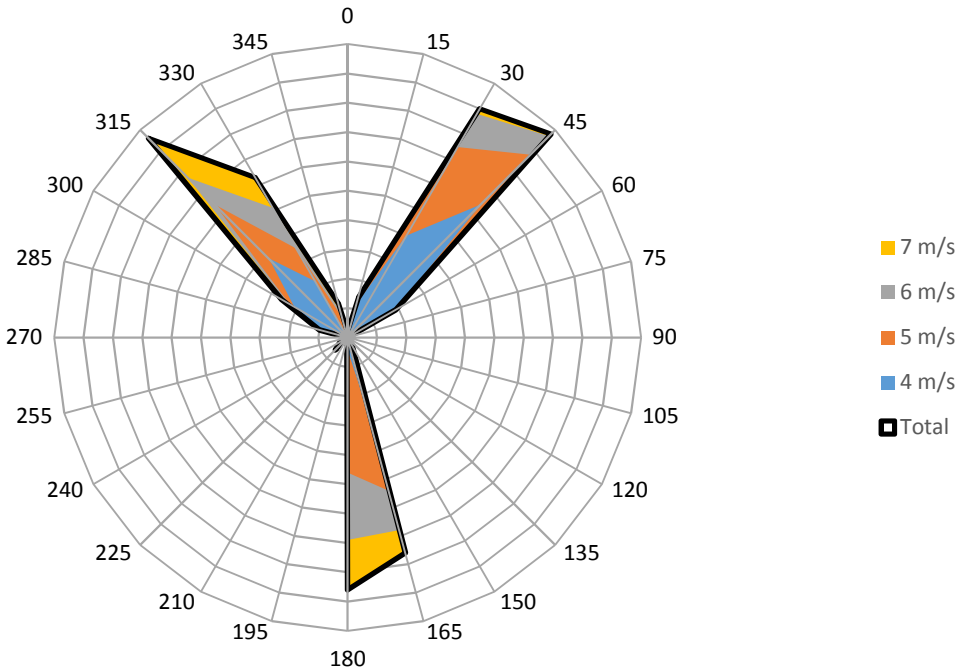


Figure 4a: Wind Direction - Receptor PR289

10 m Height, Wind Speeds 4-7 m/s

ON Condition, October 9 to December 23, 2014

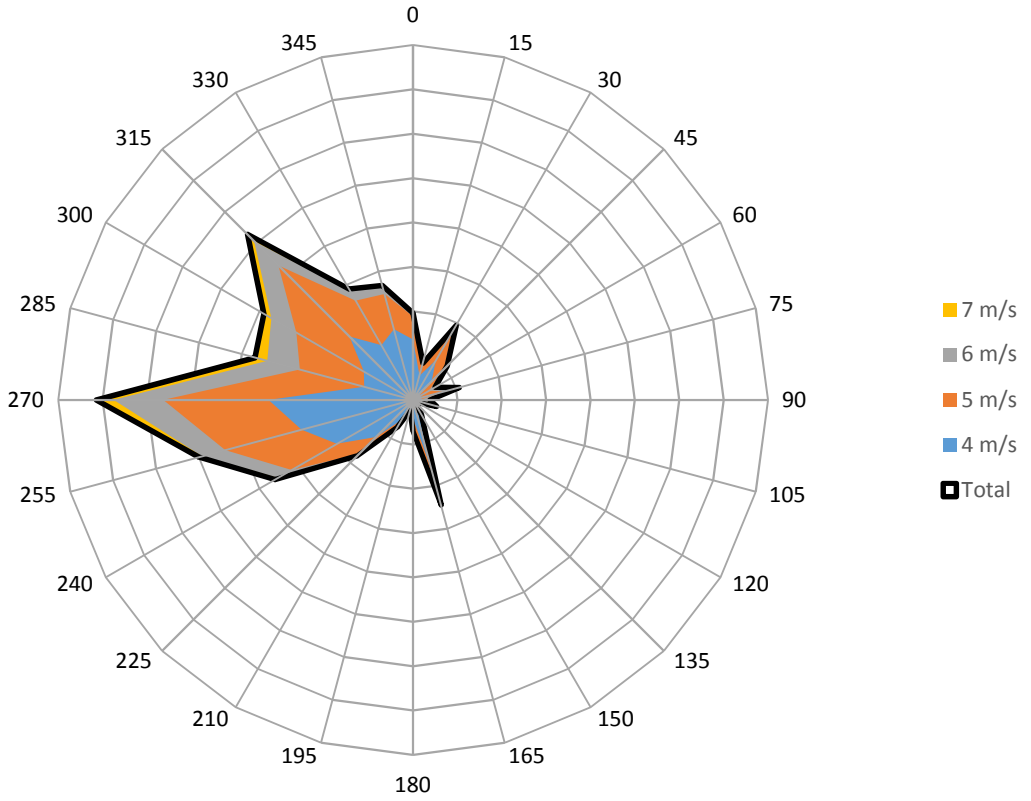


Figure 4b: Wind Direction - Receptor PR289

10 m Height, Wind Speeds 4-7 m/s

OFF Condition, October 9 to December 23, 2014

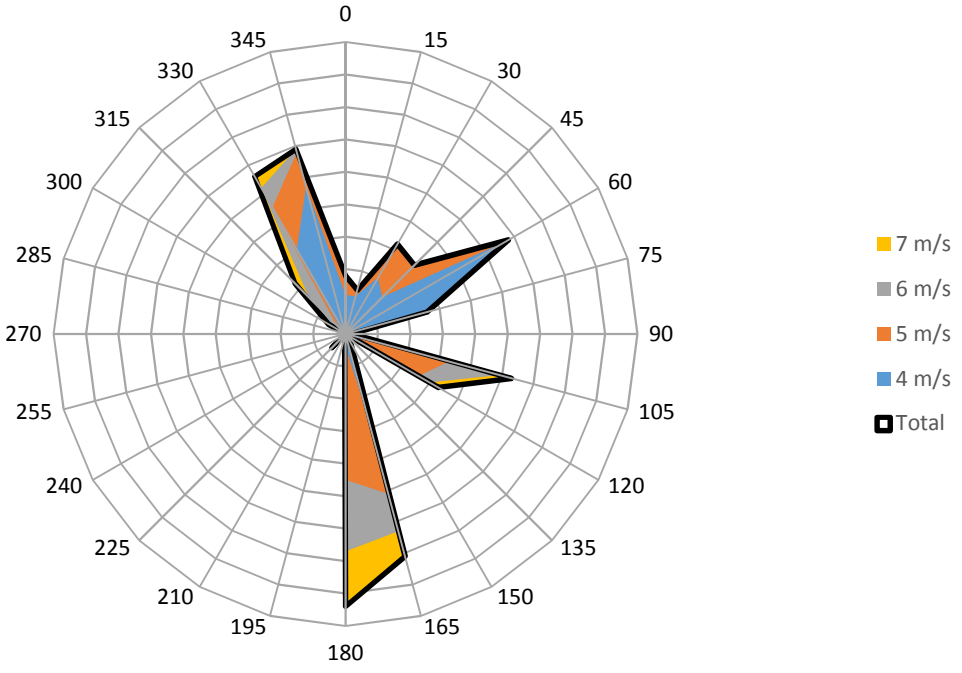


Figure 5a: McLeans Mountain Wind Power Project
Receptor VP019, October 9 to December 23, 2014

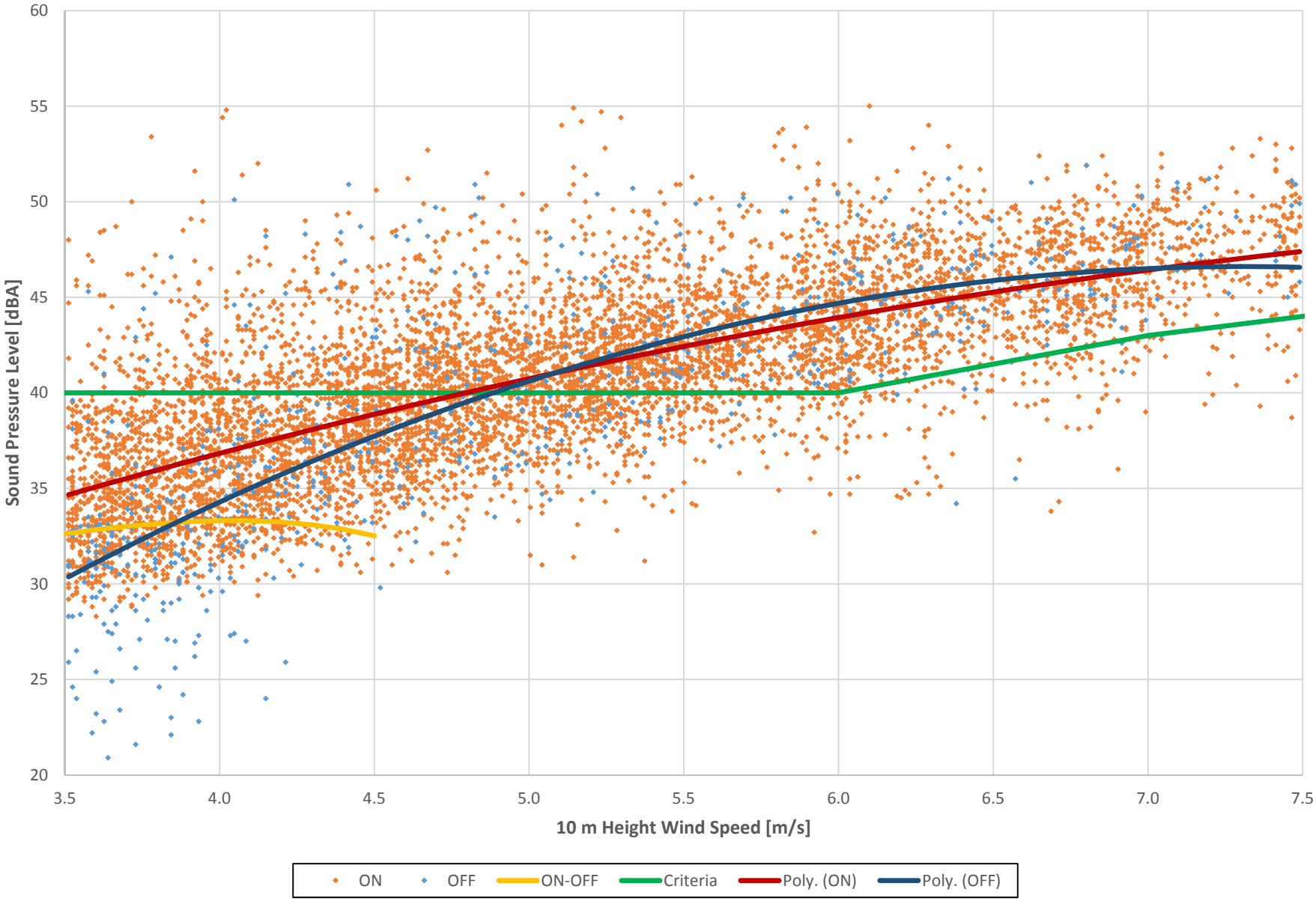


Figure 5b: McLeans Mountain Wind Power Project
Receptor VP019, October 9 to December 23, 2014

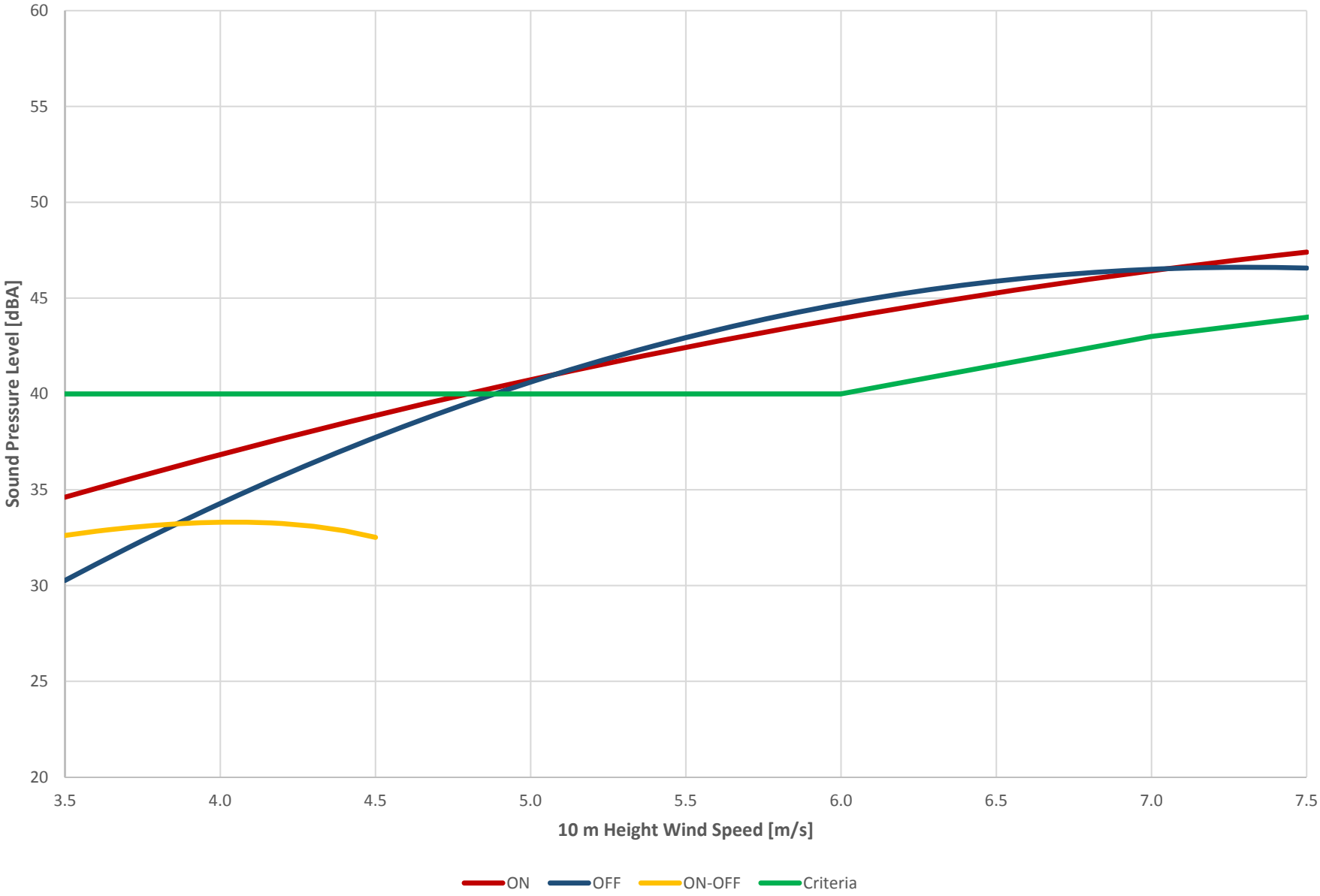


Figure 6a: McLeans Mountain Wind Power Project
Receptor V252, October 9 to December 23, 2014

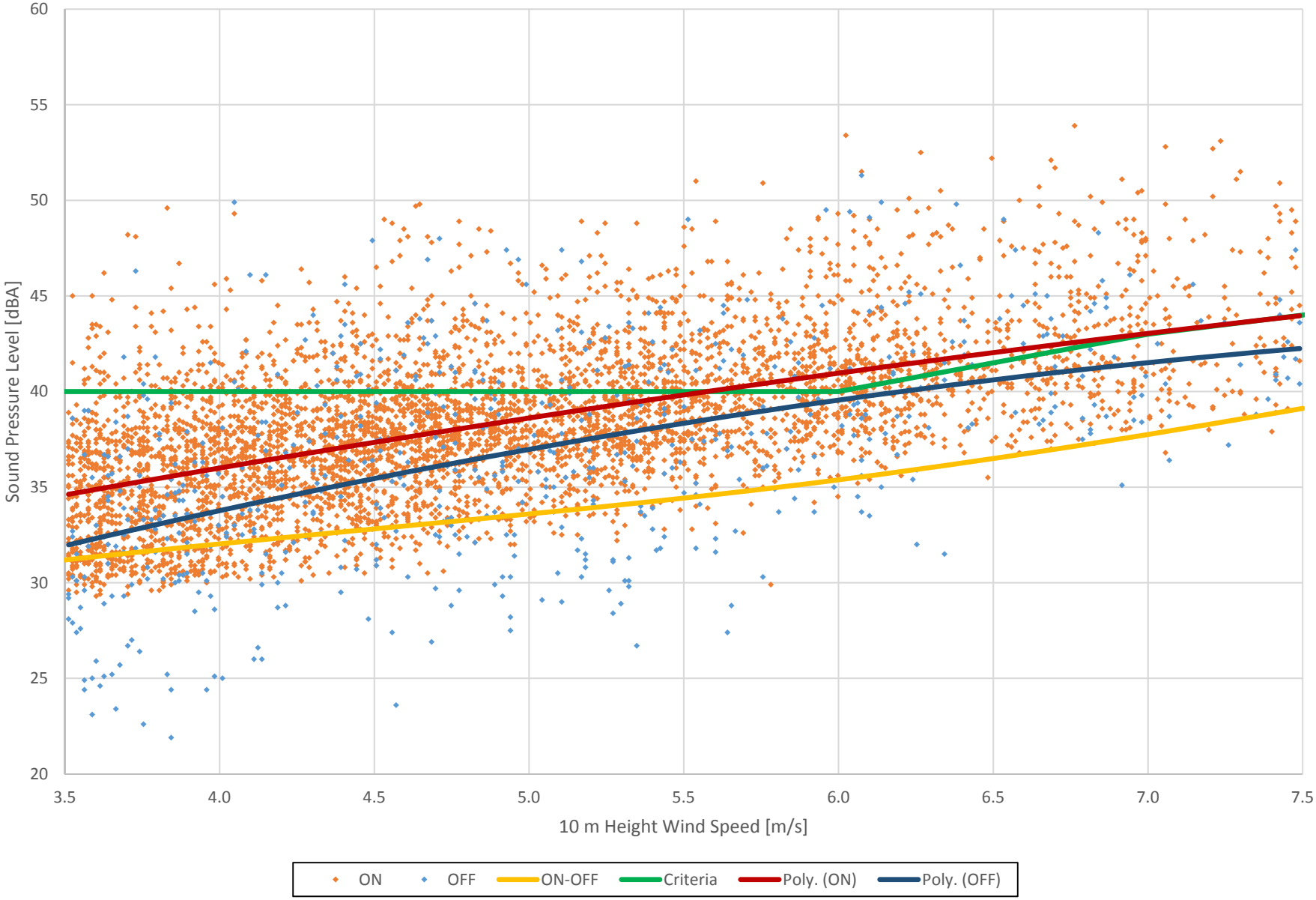


Figure 6b: McLeans Mountain Wind Power Project
Receptor V252, October 9 to December 23, 2014

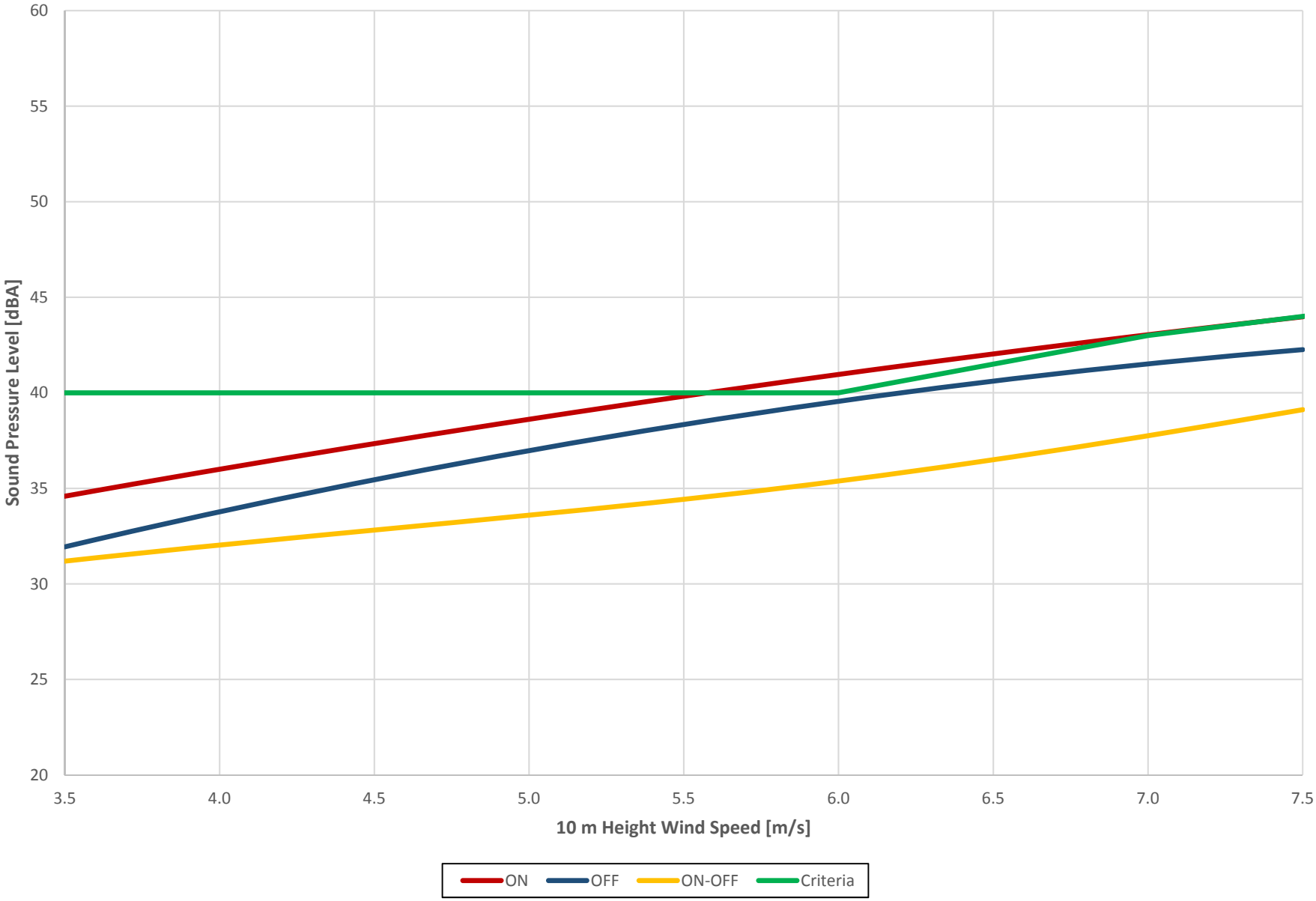


Figure 7a: McLeans Mountain Wind Power Project
Receptor PR289, October 9 to December 23, 2014

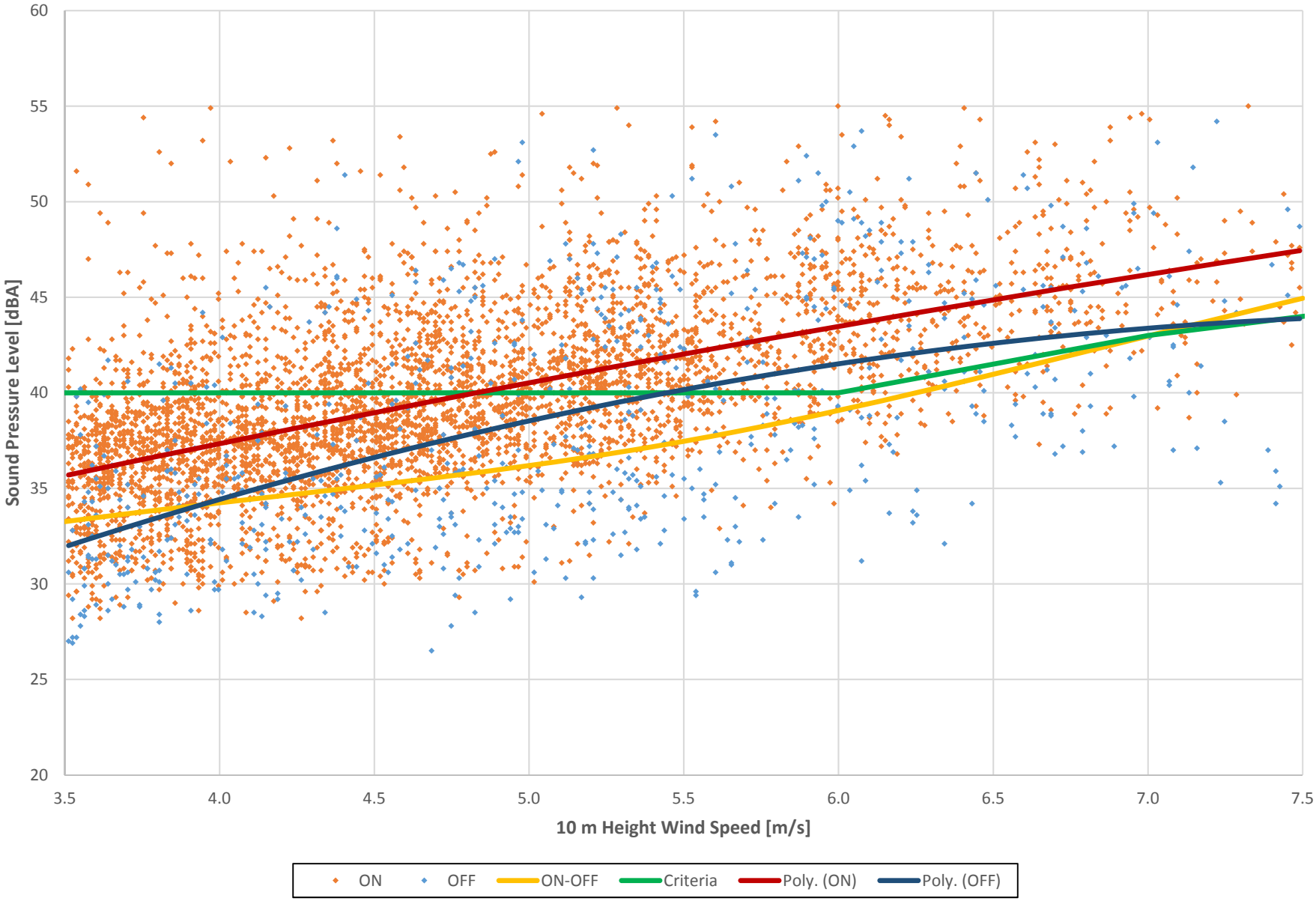
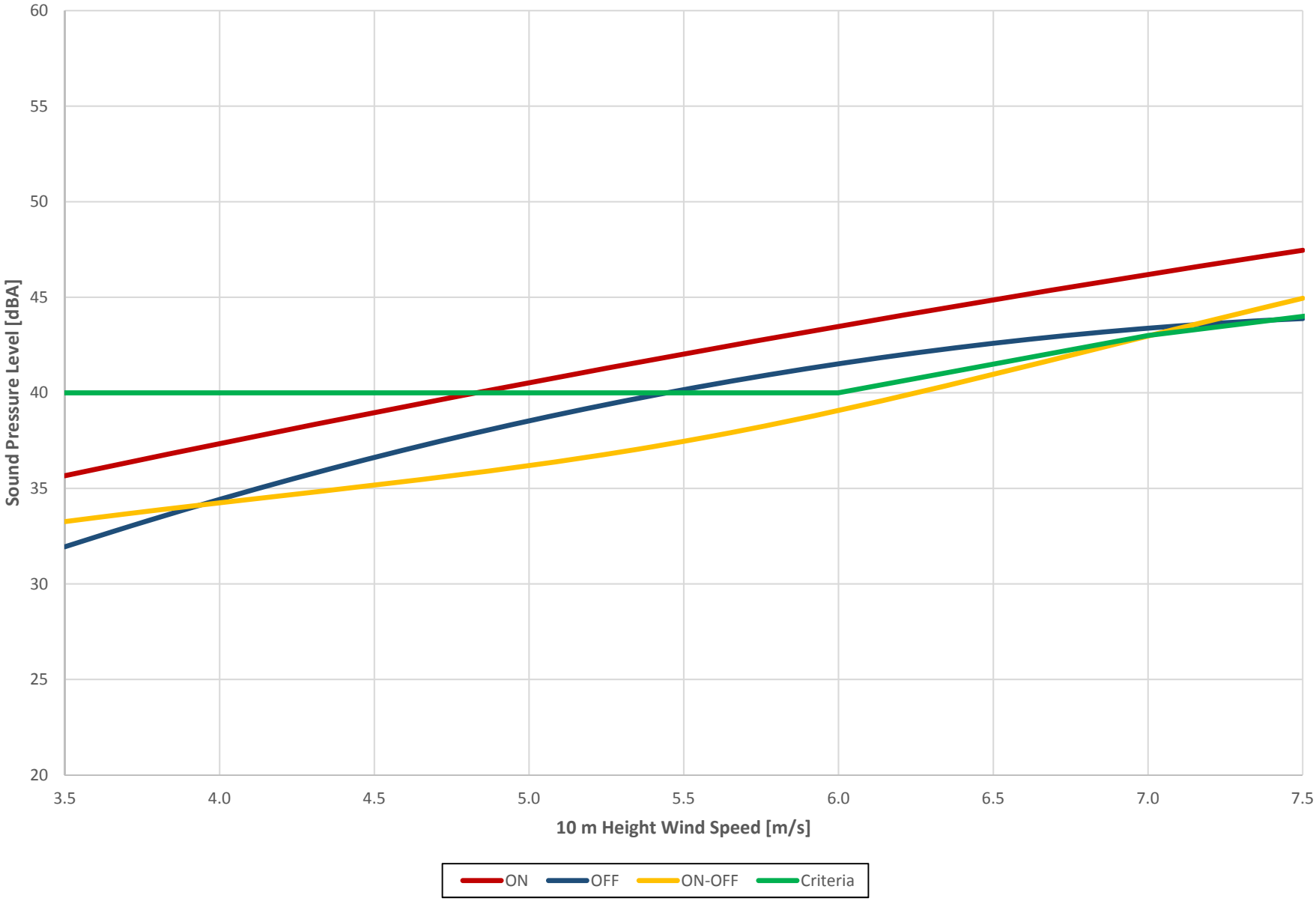


Figure 7b: McLeans Mountain Wind Power Project
Receptor PR289, October 9 to December 23, 2014



APPENDIX A:
RECEPTOR LOCATION PHOTOS

Receptor VB019

Receptor PR289

Receptor V252

APPENDIX B:

CALIBRATION CERTIFICATES

CERTIFICATE of CALIBRATION

Make :	Norsonic	Reference # :	132996
Model :	NOR140	Customer :	HGC Engineering Mississauga, ON
Descr. :	SLM Type 1		
Serial # :	1403176	P. Order :	Sean Richardson
Asset # :	N-140-1		

Cal. status : Received out of spec's, adjustments made.
Level cal. done.

Navair Technologies certifies that the above listed instrument was calibrated on date noted and was released from this laboratory performing in accordance with the specifications set forth by the manufacturer.

Unless otherwise noted in the calibration report a 4:1 accuracy ratio was maintained for this calibration.

Our calibration system complies with the requirements of ISO-17025 standard, working standards used for calibration are certified by or traceable to the National Research Council of Canada or the National Institute of Standards and Technology.

Calibrated : Dec 23, 2013 By : T. Beilin

Cal. Due : Dec 23, 2014

Temperature : 23 °C ± 2 °C Relative Humidity : 30% to 70%

Standards used : J-216

Navair Technologies

REPAIR AND CALIBRATION TRACEABLE TO NRC AND NIST
6375 Dixie Rd. Mississauga, ON, L5T 2E7 http: // www.navair.com
Phone : 905 565 1584 Fax: 905 565 8325 e-Mail: navair @ navair.com

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN971 *No. 39022*

with preamplifier SVANTEK type SV18 No. 38412 and with microphone ACO type 7052E No. 56832

1. CALIBRATION* (acoustical)

LEVEL METER function; Range: Low; Reference frequency: 1000Hz; Sound Pressure Level: 113.93 dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.93	113.99	0.06
A	113.93	113.99	0.06
C	113.93	113.99	0.06

Calibration measured with the microphone ACO type 7052E No. 56832. Calibration factor: -0.42 dB.

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	83.0
Error [dB]	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	123.0
Error [dB]	0.1	0.1	0.0	0.0	-0.0	-0.0	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	122.0
Error [dB]	0.1	0.0	0.0	-0.0	-0.1	-0.1	-0.0	-0.0	0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	34.0	35.0	36.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.0	0.0	0.0	0.0	0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	34.0	35.0	36.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	-0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.0	-0.0	-0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	34.0	35.0	36.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.0	0.0	-0.0	-0.0

1/3 OCTAVE (1kHz); Range: Low; f_{sin}= 1000 Hz

Nominal result [dB]	25.0	30.0	40.0	60.0	80.0	100.0	120.0	123.0
Error [dB]	0.1	-0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{sin}= 4000 Hz; Burst duration: 2s

Range: Low; Steady level nominal result = 120dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	120.0	119.9	119.0	117.4	115.2	111.7	108.8	105.9	102.0	99.0	95.9	92.9
		Error [dB]	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	117.9	115.9	112.5	109.7	106.8	102.9	99.9	96.9	92.9	-	-	-
		Error [dB]	-0.1	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-	-	-
SEL	-	Indication [dB]	120.0	117.0	113.0	110.0	107.0	103.0	100.0	97.0	93.0	89.9	86.9	83.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.1

ge: **Low**; Steady level nominal result = 60dB

esult	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5
MAX	Fast	Indication [dB]	60.0	59.9	59.0	57.4	55.2	51.7	48.8	45.9	42.0	39.0	35.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.0	-0.1
	Slow	Indication [dB]	57.9	55.9	52.5	49.7	46.8	42.8	39.9	36.8	32.9	-	-
		Error [dB]	-0.1	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-	-
SEL	-	Indication [dB]	60.0	57.0	53.0	50.0	47.0	43.0	40.0	37.0	33.0	30.0	27.0
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	0.0

ge: **Low**; Steady level nominal result = 35dB

esult	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	35.0	34.9	34.0
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	32.9	30.8	27.5
		Error [dB]	-0.0	-0.0	-0.1
SEL	-	Indication [dB]	35.0	32.0	28.1
		Error [dB]	0.0	0.0	0.1

ge: **High**; Steady level nominal result = 134dB

esult	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.1	125.7	122.8	119.9	115.9	112.9	109.9	106.8
		Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	131.9	129.8	126.5	123.7	120.7	116.8	113.8	110.8	106.8	-	-	-
		Error [dB]	-0.1	-0.0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.1	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	110.9	106.9	103.9	100.9	97.8
		Error [dB]	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.2

ge: **High**; Steady level nominal result = 54dB

esult	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	53.9	53.8	53.0	51.4	49.1
		Error [dB]	-0.0	-0.0	-0.0	-0.0	-0.1
	Slow	Indication [dB]	51.9	49.8	46.4	43.6	40.7
		Error [dB]	-0.1	-0.1	-0.1	-0.1	-0.2
SEL	-	Indication [dB]	53.9	50.9	47.0	44.0	40.9
		Error [dB]	-0.0	-0.1	-0.0	-0.0	-0.0

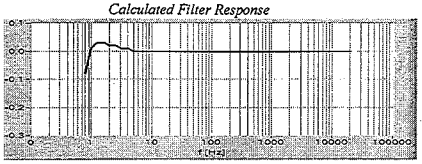
ge: **High**; Steady level nominal result = 46dB

esult	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	46.0	45.9	45.0
		Error [dB]	0.0	-0.0	0.0
	Slow	Indication [dB]	43.9	41.8	38.6
		Error [dB]	-0.1	-0.1	0.0
SEL	-	Indication [dB]	46.0	43.0	39.0
		Error [dB]	-0.0	-0.0	0.0

REQUENCY RESPONSE* (electrical)

EL METER function; Characteristic: Z; Range: Low; Input signal =120 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV18 (f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
10	-0.1	63	0.0	4000	-0.0
12.5	0.0	125	0.0	8000	-0.0
16	0.0	250	0.0	16000	-0.0
20	0.0	500	0.0	20000	-0.0
25	0.0	1000	0.0		
31.5	0.0	2000	-0.0		

All frequencies are nominal center values for the 1/3 octave bands

NTERNAL NOISE LEVEL* (electrical - compensated)

EL METER function; Range: Low; (Back-light – off) ; Calibration factor: 0dB

aracteristic	Z	A	C
vel [dB]	≤20	≤12	≤12

asured with preamplifier SVANTEK type SV18 No. 38412.

7. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	≤15	19.4

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
23 °C	35%	998 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	65	Signal generator
2.	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	7449	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.

2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.

3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.

4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.

5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Ryszard Leoniak .....

Test date: 2014-02-21

SVANTEK

ISO9001 certified

FACTORY CALIBRATION DATA OF THE SVAN971 *No. 39101*

with preamplifier SVANTEK type SV18 No. 38514 and with microphone ACO type 7052E No. 58047

1. CALIBRATION* (acoustical)

LEVEL METER function; Range: Low; Reference frequency: 1000Hz; Sound Pressure Level: 113.93 dB.

Characteristic	Correct value [dB]	Indication [dB]	Error [dB]
Z	113.93	113.92	-0.01
A	113.93	113.92	-0.01
C	113.93	113.92	-0.01

Calibration measured with the microphone ACO type 7052E No. 58047. Calibration factor: 1.32 dB.

3. LINEARITY TEST* (electrical)

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	83.0
Error [dB]	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	123.0
Error [dB]	0.2	0.1	0.1	0.1	0.0	0.0	-0.0	0.0	0.0	-0.0

LEVEL METER function; Range: Low; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	24.0	25.0	26.0	28.0	30.0	40.0	60.0	80.0	100.0	122.0
Error [dB]	0.2	0.1	0.1	0.0	0.0	-0.0	-0.0	0.0	0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 31.5 Hz

Nominal result LEQ [dB]	34.0	35.0	36.0	38.0	40.0	60.0	80.0	97.0
Error [dB]	0.1	0.1	0.0	0.0	0.0	0.0	-0.0	0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 1000 Hz

Nominal result LEQ [dB]	34.0	35.0	36.0	38.0	40.0	60.0	80.0	100.0	120.0	137.0
Error [dB]	0.1	0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0

LEVEL METER function; Range: High; Characteristic: A; f_{sin}= 8000 Hz

Nominal result LEQ [dB]	34.0	35.0	36.0	38.0	40.0	60.0	80.0	100.0	120.0	136.0
Error [dB]	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	-0.0	0.0

1/3 OCTAVE (1kHz); Range: Low; f_{sin}= 1000 Hz

Nominal result [dB]	25.0	30.0	40.0	60.0	80.0	100.0	120.0	123.0
Error [dB]	0.1	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0

4. TONE BURST RESPONSE*

LEVEL METER function; Characteristic: A; f_{sin}= 4000 Hz; Burst duration: 2s

Range: Low; Steady level nominal result = 120dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	120.0	119.9	119.0	117.4	115.2	111.7	108.8	105.9	102.0	98.9	95.9	92.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	0.0	-0.0	0.0	-0.0	-0.0	-0.1	-0.1
	Slow	Indication [dB]	117.9	115.9	112.5	109.7	106.8	102.8	99.9	96.9	92.9	-	-	-
		Error [dB]	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-	-	-
SEL	-	Indication [dB]	120.0	117.0	113.0	110.0	107.0	103.0	100.0	97.0	93.0	89.9	86.9	83.9
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	-0.1

nge: Low; Steady level nominal result = 60dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5
MAX	Fast	Indication [dB]	60.0	59.9	59.0	57.4	55.2	51.7	48.9	45.9	42.0	39.0	35.9
		Error [dB]	0.0	0.0	0.0	0.0	-0.0	-0.0	-0.0	0.0	-0.0	-0.0	-0.1
	Slow	Indication [dB]	58.0	55.9	52.5	49.7	46.8	42.9	39.9	36.9	32.9	-	-
		Error [dB]	-0.0	-0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-	-
SEL	-	Indication [dB]	60.0	57.0	53.0	50.0	47.0	43.0	40.0	37.0	33.0	30.0	27.1
		Error [dB]	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	-0.0	0.0	0.0	0.0

nge: Low; Steady level nominal result = 35dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	35.0	35.0	34.1
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	33.0	30.9	27.6
		Error [dB]	-0.1	-0.0	-0.0
SEL	-	Indication [dB]	35.0	32.1	28.2
		Error [dB]	0.0	0.0	0.1

nge: High; Steady level nominal result = 134dB

Result	Detector	Duration [ms]	1000	500	200	100	50	20	10	5	2	1	0.5	0.25
MAX	Fast	Indication [dB]	134.0	133.9	133.0	131.4	129.2	125.7	122.8	119.9	116.0	112.9	109.9	106.9
		Error [dB]	-0.0	0.0	0.0	-0.0	-0.0	-0.0	-0.1	0.0	-0.0	-0.1	-0.1	-0.1
	Slow	Indication [dB]	131.9	129.9	126.5	123.7	120.8	116.8	113.9	110.8	106.9	-	-	-
		Error [dB]	-0.1	-0.0	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.1	-	-	-
SEL	-	Indication [dB]	134.0	131.0	127.0	124.0	121.0	117.0	114.0	111.0	107.0	103.9	100.9	97.8
		Error [dB]	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0	-0.1	-0.1	-0.2

nge: High; Steady level nominal result = 54dB

Result	Detector	Duration [ms]	1000	500	200	100	50
MAX	Fast	Indication [dB]	54.0	53.9	53.0	51.4	49.2
		Error [dB]	0.0	0.1	0.1	0.0	0.0
	Slow	Indication [dB]	51.9	49.9	46.5	43.7	40.9
		Error [dB]	-0.0	0.0	-0.1	-0.1	0.0
SEL	-	Indication [dB]	54.0	51.0	47.0	44.0	41.0
		Error [dB]	0.0	0.0	0.1	0.1	0.0

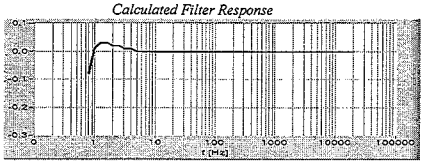
nge: High; Steady level nominal result = 45dB

Result	Detector	Duration [ms]	1000	500	200
MAX	Fast	Indication [dB]	45.1	45.0	44.1
		Error [dB]	0.0	0.0	0.0
	Slow	Indication [dB]	43.0	40.9	37.6
		Error [dB]	-0.1	-0.0	-0.1
SEL	-	Indication [dB]	45.1	42.1	38.1
		Error [dB]	0.0	0.0	0.1

FREQUENCY RESPONSE* (electrical)

VEL METER function; Characteristic: Z; Range: Low; Input signal =120 dB;

Calculated Filter Response



Measured Filter Response with Preamplifier SV18 (f-frequency, L-level)

f [Hz]	L [dB]	f [Hz]	L [dB]	f [Hz]	L [dB]
10	-0.1	63	0.0	4000	-0.0
12.5	0.0	125	0.0	8000	-0.0
16	0.0	250	0.0	16000	-0.0
20	0.0	500	0.0	20000	-0.0
25	0.0	1000	0.0		
31.5	0.0	2000	0.0		

All frequencies are nominal center values for the 1/3 octave bands

INTERNAL NOISE LEVEL* (electrical - compensated)

VEL METER function; Range: Low; (Back-light – off) ; Calibration factor: 0dB

aracteristic	Z	A	C
vel [dB]	≤20	≤12	≤12

asured with preamplifier SVANTEK type SV18 No. 38514.

7. INTERNAL NOISE LEVEL (acoustical - compensated)

LEVEL METER function; Characteristic: A; (Backlight – off)

Range	Low	High
Indication [dB]	≤15	21.2

Noise measured in special chamber, with reference microphone G.R.A.S type 40AN No. 73421

ENVIRONMENTAL CONDITIONS

Temperature	Relative humidity	Ambient pressure
23 °C	33%	1001 hPa

TEST EQUIPMENT

Item	Manufacturer	Model	Serial no.	Description
1.	SVANTEK	SVAN 401	65	Signal generator
2.	SVANTEK	SVAN 912A	6120	Sound &Vibration Analyser
3.	KEITHLEY	2000	0910165	Digital multimeter
4.	SVANTEK	SV30A	7449	Acoustic calibrator
5.	SVANTEK	ST02	-	Microphone equivalent electrical impedance (18pF)

CONFORMITY & TEST DECLARATION

1. Herewith Svantek company declares that this instrument has been calibrated and tested in compliance with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass them.
2. The acoustic calibration was performed using the Sound Calibrator and is traceable to the GUM (Central Office of Measures) reference standard - sound level calibrator type 4231 No 2292773.
3. The vibrational calibration was performed using the Back-to-Back Comparison method and is traceable to the GUM (Central Office of Measures) reference standard - accelerometer type 8305 No 1435233.
4. The information appearing on this sheet has been compiled specifically for this instrument. This form is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
5. This calibration sheet shall not be reproduced except in full, without written permission of the SVANTEK Ltd.

Calibration specialist: Ryszard Leoniak .....

Test date: 2014-04-10

SOH Wind Engineering LLC
141 Leroy Road · Williston, VT 05495 · USA
Tel 802.999.3309 · Fax 802.735.9106 · www.sohwind.com

SUPPLEMENT TO CERTIFICATE FOR CALIBRATION OF ANEMOMETER

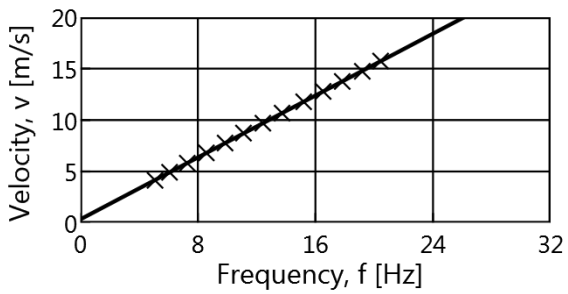
Original certificate number: 13.US2.07359 **Original date of issue:** July 17, 2013
Supplement certificate number: 13.US2.97359 **Supplement date of issue:** August 30, 2013
Type: NRG #40 **Serial number:** 179500221341
Manufacturer: NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA

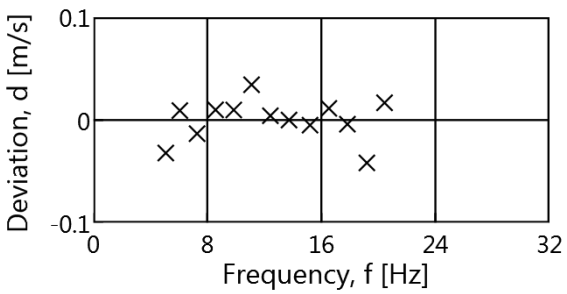
Client: NRG Systems, Inc., 110 Riggs Road, Hinesburg, VT 05461, USA
Anemometer received: July 5, 2013 **Anemometer calibrated:** July 17, 2013
Calibrated by: mej **Calibration procedure:** IEC 61400-12-1:2005(E) Annex F
Certificate prepared by: ReCert 1.0 **Approved by:** Calibration engineer, rds

Calibration equation obtained: v [m/s] = 0.75945 · f [Hz] + 0.34819
Standard uncertainty, slope: 0.00159 **Standard uncertainty, offset:** 0.04678
Covariance: -0.0000180 (m/s)²/Hz **Coefficient of correlation:** ρ = 0.999986
Absolute maximum deviation: 0.042 m/s at 14.880 m/s

Barometric pressure: 1008.3 hPa **Relative humidity:** 57.6%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	10.06	29.3	28.0	4.181	5.0885	-0.032	0.047
4	14.23	29.4	28.0	4.971	6.0753	0.009	0.039
6	19.79	29.4	28.0	5.864	7.2811	-0.014	0.034
8	27.20	29.4	28.0	6.875	8.5802	0.010	0.029
10	35.39	29.4	28.0	7.843	9.8545	0.010	0.026
12	44.74	29.4	28.0	8.817	11.1055	0.034	0.024
13-last	55.14	29.4	28.0	9.788	12.4239	0.004	0.023
11	66.83	29.4	28.0	10.777	13.7315	0.000	0.022
9	81.35	29.4	28.0	11.890	15.2045	-0.005	0.022
7	95.89	29.4	28.0	12.910	16.5247	0.012	0.022
5	110.89	29.4	28.0	13.883	17.8264	-0.004	0.022
3	127.40	29.3	28.0	14.880	19.1903	-0.042	0.022
1-first	145.19	29.3	27.9	15.884	20.4349	0.017	0.023





AC-1746
Standard: ISO/IEC 17025

EQUIPMENT USED

Serial Number	Description
Njord 2	Wind tunnel, blockage factor = 1.001
13924	Control cup anemometer
-	Mounting tube, D = 12.7 mm
TT002	Summit RT-AUI, wind tunnel
TP001	Summit RT-AUI, differential pressure box
DP004	Setra Model 239 pressure transducer
HY001	Dwyer Instruments RHP-2D20 humidity transmitter
BP001	Setra Model 278 barometer
PL4	Pitot tube
XB002	Computer Board. 16 bit A/D data acquisition board
66GSPS1	PC dedicated to data acquisition

Traceable calibrations of the equipment are carried out by external accredited institutions: Hayes Instrument Service, Inc., TRANSCAT, Atlantic Scale, & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.

Photo of the wind tunnel setup. The cross-sectional area is 2.5 x *2.5 m.*

UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.12.01.004 for further details.

Supplement certificate number: 13.US2.97359

SOH Wind Engineering LLC

141 Leroy Road · Williston, VT 05495 · USA

Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

CERTIFICATE FOR CALIBRATION OF ANEMOMETER

Certificate number: 14.US2.04558 **Date of issue:** June 2, 2014

Type: NRG #40C **Serial number:** 179500235174

Manufacturer: Renewable NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA

Client: Renewable NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA

Anemometer received: May 13, 2014 **Anemometer calibrated:** June 2, 2014

Calibrated by: mej **Calibration procedure:** IEC 61400-12-1:2005(E) Annex F

Certificate prepared by: Software Revision 3 **Approved by:** Calibration engineer, rds

Calibration equation obtained: v [m/s] = 0.76290 · f [Hz] + 0.31112

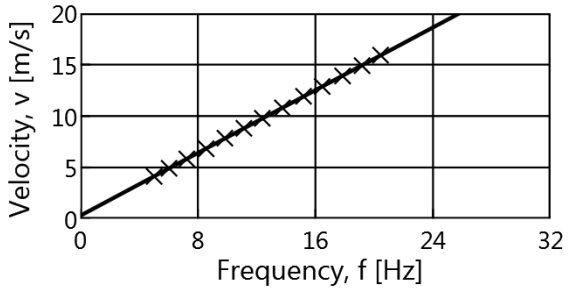
Standard uncertainty, slope: 0.00179 **Standard uncertainty, offset:** 0.05925

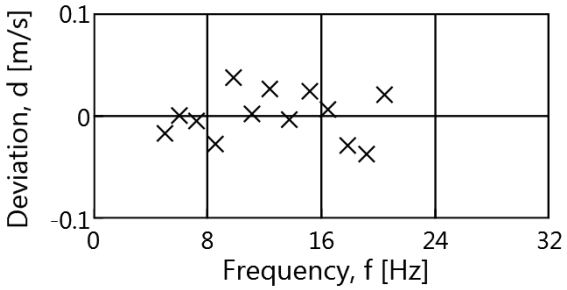
Covariance: -0.0000235 (m/s)²/Hz **Coefficient of correlation:** ρ = 0.999982

Absolute maximum deviation: 0.037 m/s at 7.855 m/s

Barometric pressure: 1006.9 hPa **Relative humidity:** 40.4%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	10.06	23.5	25.4	4.133	5.0318	-0.017	0.046
4	14.27	23.6	25.4	4.923	6.0441	0.001	0.039
6	20.04	23.6	25.4	5.834	7.2456	-0.005	0.033
8	27.40	23.6	25.4	6.823	8.5712	-0.027	0.029
10	36.31	23.6	25.4	7.855	9.8387	0.037	0.026
12	45.66	23.6	25.5	8.808	11.1349	0.002	0.024
13-last	56.37	23.6	25.5	9.787	12.3863	0.026	0.023
11	68.64	23.6	25.5	10.800	13.7530	-0.003	0.022
9	83.68	23.6	25.4	11.925	15.1916	0.024	0.022
7	97.56	23.6	25.4	12.876	16.4617	0.006	0.022
5	113.69	23.6	25.4	13.900	17.8494	-0.029	0.022
3	130.69	23.5	25.4	14.903	19.1746	-0.037	0.022
1-first	149.18	23.5	25.4	15.920	20.4329	0.021	0.023





AC-1746

Standard: ISO/IEC 17025

EQUIPMENT USED

Serial Number	Description
Njord 2	Wind tunnel, blockage factor = 1.001
13924	Control cup anemometer
-	Mounting tube, D = 12.7 mm
TT003	Summit RT-AUI, wind tunnel
TT002	Summit RT-AUI, differential pressure box
DP007	Setra Model 239 pressure transducer
HY003	Dwyer Instruments RHP-2D20 humidity transmitter
BP003	Setra Model 278 barometer
PL4	Pitot tube
XB002	Computer Board. 16 bit A/D data acquisition board
66GSPS1	PC dedicated to data acquisition

Traceable calibrations of the equipment are carried out by external accredited institutions: TRANSCAT, Atlantic Scale, & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.

Photo of the wind tunnel setup. The cross-sectional area is 2.5 x *2.5 m.*

UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.DC.016 for further details.

Certificate number: 14.US2.04558

SOH Wind Engineering LLC

141 Leroy Road · Williston, VT 05495 · USA

Tel 802.316.4368 · Fax 802.735.9106 · www.sohwind.com

CERTIFICATE FOR CALIBRATION OF ANEMOMETER

Certificate number: 14.US2.04573 **Date of issue:** June 2, 2014

Type: NRG #40C **Serial number:** 179500235190

Manufacturer: Renewable NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA

Client: Renewable NRG Systems Inc, 110 Riggs Road, Hinesburg, VT 05461, USA

Anemometer received: May 13, 2014 **Anemometer calibrated:** June 2, 2014

Calibrated by: mej **Calibration procedure:** IEC 61400-12-1:2005(E) Annex F

Certificate prepared by: Software Revision 3 **Approved by:** Calibration engineer, rds

Calibration equation obtained: v [m/s] = 0.76184 · f [Hz] + 0.34381

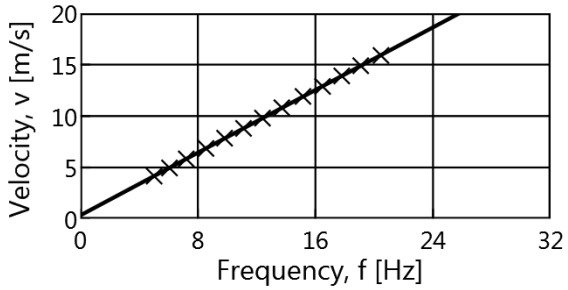
Standard uncertainty, slope: 0.00152 **Standard uncertainty, offset:** 0.04516

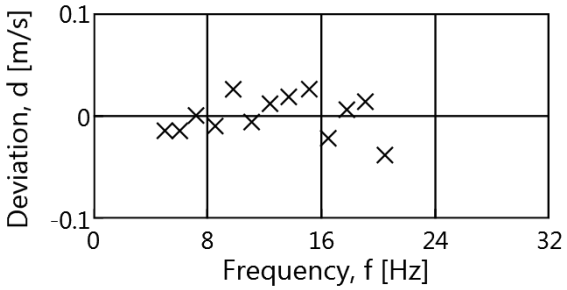
Covariance: -0.0000167 (m/s)²/Hz **Coefficient of correlation:** ρ = 0.999987

Absolute maximum deviation: 0.038 m/s at 15.893 m/s

Barometric pressure: 1001.5 hPa **Relative humidity:** 40.9%

Succession	Velocity pressure, q. [Pa]	Temperature in wind tunnel [°C]	d.p. box [°C]	Wind velocity, v. [m/s]	Frequency, f. [Hz]	Deviation, d. [m/s]	Uncertainty u_c (k=2) [m/s]
2	10.04	26.2	25.5	4.161	5.0286	-0.014	0.047
4	14.23	26.3	25.5	4.955	6.0718	-0.014	0.040
6	19.75	26.3	25.5	5.838	7.2104	0.001	0.034
8	27.21	26.4	25.6	6.853	8.5568	-0.010	0.030
10	35.71	26.4	25.6	7.851	9.8192	0.026	0.027
12	44.88	26.4	25.6	8.801	11.1090	-0.006	0.025
13-last	55.66	26.4	25.6	9.802	12.3990	0.012	0.023
11	67.69	26.4	25.6	10.810	13.7131	0.019	0.022
9	82.23	26.4	25.6	11.914	15.1533	0.026	0.022
7	96.15	26.3	25.5	12.883	16.4875	-0.022	0.022
5	111.97	26.3	25.5	13.902	17.7888	0.006	0.022
3	128.59	26.3	25.5	14.897	19.0844	0.014	0.023
1-first	146.43	26.1	25.4	15.893	20.4601	-0.038	0.023





AC-1746

Standard: ISO/IEC 17025

EQUIPMENT USED

Serial Number	Description
Njord 2	Wind tunnel, blockage factor = 1.001
13924	Control cup anemometer
-	Mounting tube, D = 12.7 mm
TT003	Summit RT-AUI, wind tunnel
TT002	Summit RT-AUI, differential pressure box
DP007	Setra Model 239 pressure transducer
HY003	Dwyer Instruments RHP-2D20 humidity transmitter
BP003	Setra Model 278 barometer
PL4	Pitot tube
XB002	Computer Board. 16 bit A/D data acquisition board
66GSPS1	PC dedicated to data acquisition

Traceable calibrations of the equipment are carried out by external accredited institutions: TRANSCAT, Atlantic Scale, & Furness Controls. A real-time analysis module within the data acquisition software detects pulse frequency.

Photo of the wind tunnel setup. The cross-sectional area is 2.5 x *2.5 m.*

UNCERTAINTIES

The documented uncertainty is the total combined uncertainty at 95% confidence level (k=2) in accordance with EA-4/02. The uncertainty at 10 m/s comply with the requirements in the IEC 61400-12-1:2005 procedure. See Document US.DC.016 for further details.

Certificate number: 14.US2.04573

APPENDIX C:

STATEMENT OF OPERATION

NORTHLAND POWER

McLean's Mountain Wind Farm

February 25, 2015

To whom it may concern,

Re: Statement of Operation
McLean's Mountain Wind Farm Project, Manitoulin Island, Ontario

This letter is to confirm that the wind turbine generators at the McLean's Mountain Wind Farm Project were functioning in their standard operational mode during the post-construction acoustic audit, conducted between October 9 and December 23, 2014. The only exception was between October 21st and October 27th, when the turbines were parked due to a directive from the electricity grid operator.

Yours truly,

Rick Martin
Manager,
McLean's Mountain Wind Farm

13 Worthington Street, P.O. Box 73, Little Current , Ontario, Canada P0P 1K0 t: 705.368.0303 f: 705.368.0606