NW100 Acoustic Noise

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Approved Use

External Use - NDA Required	**X**
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Revision History

Revision	Date	Description of Change
A	6/9/2010	Initial Release
B	6/15/2010	Addition of 8 m/s data, clarification of references.

Contents

1 Introduction and Discussion of Noise Calculations

1.1 Purpose

The purpose of this document is to characterize the acoustic noise of the NW100 wind turbine based on third party measurements and a standard formula for projecting sound pressure at a given distance.

1.2 Introduction

When using this projection the following concepts are important background information.

- Sound power is the amount of sound being produced at a source.
- Sound pressure is the observed noise level at a given location.

The sound power of a source can be used to calculate the sound pressure at a particular location using a known relationship.

The measurement of sound power has been standardized by the International Electrotechnical Commission (IEC) in standard 61400-11 Edition 2.1. The data discussed in the next section of this document has been collected by a third party (DNV-GEC) according to that standard. Measurements were taken on a standard NW100 with a 21m rotor and 37m tower. The testing was performed on turbine serial number 11 in Ashmore, IL.

1.3 Discussion of Noise Calculation

Based on the third party measurements taken according to IEC 61400-11 Edition 2.1 an apparent sound power level at the turbine has been found to be 96.7 dB(A) at a wind speed of 6 m/s and 100.8 dB(A) at a wind speed of 8 m/s. These sound power numbers can be converted into sound pressure using the following equation[1]:

$$L_p = L_w - 10\log_{10}(2\pi R^2) - \alpha R$$

Where:

L_p = Sound Pressure

L_w = Apparent Sound Power

R = Slant Distance, which is the diagonal distance from the turbine nacelle to the location of concern on the ground. This can be calculated using the Pythagorean Theorem.

α = broadband sound absorption coefficient, generally assumed to be 0.005 dB(A)/m

[1] From: *Wind Turbine Acoustic Noise*, Renewable Energy Research Laboratory, J. Manwell, S. Wright, 2006.

2 Appendix A - Calculated Sound Pressure vs. Radial Distance

6 m/s wind speed, 37m tower

Radial distance from tower (m)	Radial Distance from Tower (ft)	Sound Pressure (dB(A))
1	3.3	57.2
5	16.4	57.1
7.63	25.0	57.0
10	32.8	56.9
15	49.2	56.5
20	65.6	56.0
25	82.0	55.5
30	98.4	54.9
35	114.8	54.3
40	131.2	53.7
45	147.6	53.1
47.5	155.8	52.8
50	164.1	52.5
60	196.9	51.4
75	246.1	49.9
100	328.1	47.6
125	410.1	45.8
150	492.2	44.2
175	574.2	42.8
200	656.2	41.5
225	738.2	40.4
250	820.3	39.4
275	902.3	38.5
300	984.3	37.6
325	1066.3	36.8
350	1148.4	36.0
375	1230.4	35.3
400	1312.4	34.6
425	1394.4	34.0
450	1476.5	33.4
475	1558.5	32.8
500	1640.5	32.2

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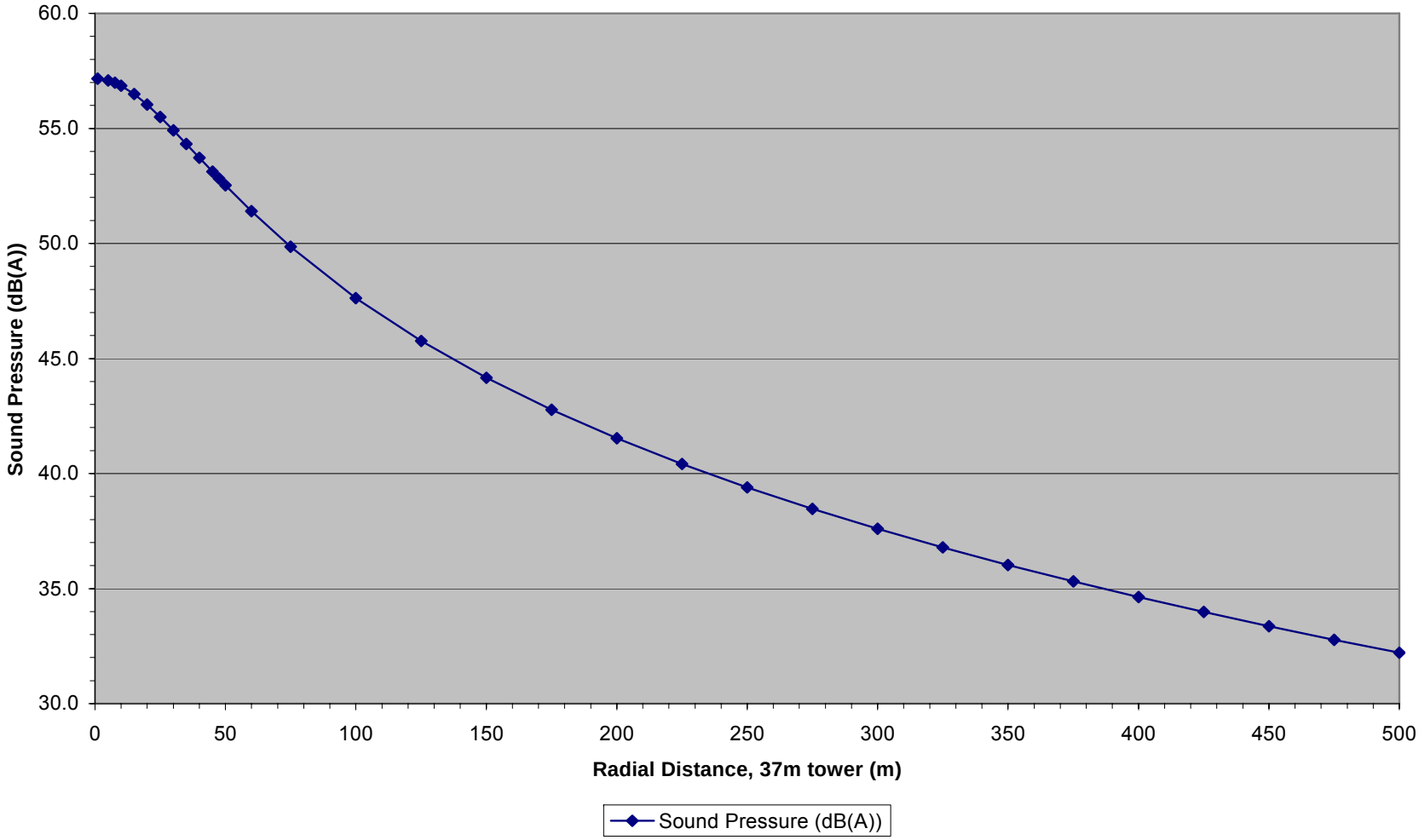
Sound Pressure vs. Distance, 6 m/s



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8 m/s wind speed, 37m tower

Radial distance from tower (m)	Radial Distance from Tower (ft)	Sound Pressure (dB(A))
1	3.3	61.3
5	16.4	61.2
7.63	25.0	61.1
10	32.8	61.0
15	49.2	60.6
20	65.6	60.1
25	82.0	59.6
30	98.4	59.0
35	114.8	58.4
40	131.2	57.8
45	147.6	57.2
47.5	155.8	56.9
50	164.1	56.6
60	196.9	55.5
75	246.1	54.0
100	328.1	51.7
125	410.1	49.9
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400	1312.4	38.7
425	1394.4	38.1
450	1476.5	37.5
475	1558.5	36.9
500	1640.5	36.3

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Sound Pressure vs. Distance, 8 m/s