Appendix A

Shawano County Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Wind Energy Conversion Systems

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Introduction

The potential sound and vibration impact associated with the operation of wind powered electric generators is often a primary concern for citizens living near proposed wind energy conversion systems (WECS). This is especially true of projects located near homes, residential neighborhoods, schools, and hospitals. Determining the likely sound and vibration impacts is a highly technical undertaking and requires a serious effort in order to collect reliable and meaningful data for both the public and decision makers.

This protocol is based in part on criteria published in the Standard Guide for Selection of Environmental Noise Measurements and Criteria.[1] and the Public Service Commission of Wisconsin publication Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Electric Power Plants (February 2002).[2] The purpose is to first establish a consistent and scientifically sound procedure for estimating existing ambient sound and vibration levels in a project area, and second to determine the likely impact that operation of a new wind energy conversion system project will have on the existing sound and vibration environment.

The characteristics of the proposed WECS project and the features of the surrounding environment will influence the design of the sound and vibration study. Site layout, types of wind energy conversion units (WECU) selected and the existence of the significant local sound and vibration sources and sensitive receptors should be taken into consideration when designing a sound and vibration study. It will be necessary to have a qualified consultant conduct the sound and vibration study.

Note: Consult with Shawano County Planning and Development Department Administration prior to conducting any sound and vibration measurements.
These guidelines are meant to be general in nature and may need to be modified (with approval of the PD&Z committee) to accommodate unique site characteristics. Consult with Planning and Development Department staff assigned to the project for guidance on study design before you begin the sound and vibration study. During consultation, good quality maps or diagrams of the site will be necessary. Maps and diagrams should show the proposed project area layout and boundaries[5], and identify important landscape features as well as significant local sound and vibration sources and sensitive receptors.

Measurement of the Existing Sound and Vibration Environment

An assessment of the proposed WECS project areas existing sound and vibration environment is necessary in order to predict the likely impact resulting from a proposed project. The following guidelines must be used in developing a reasonable estimate of an area's existing sound and vibration environment. All testing is to be performed by an acoustical testing engineer approved by the Shawano County PD&Z Committee. All measurements are to be conducted with industry certified testing equipment[4]. All test results must be reported to the Shawano County PD&Z Committee.

Sites with No Existing Wind Energy Conversion Units

Sound level measurements shall be taken as follows:

At all properties within the proposed WECS project boundaries[5]

At all properties within a one mile radius of the proposed WECS project boundaries[5].

One test must be performed during each season of the year.

Spring March 15 – May 15

Summer June 1 – September 1

Fall September 15- November 15

Winter December 1- March 1

All measurement points (MPs) shall be located in consultation with the property owner(s) and such that no significant obstruction (building, trees, etc.) blocks sound and vibration from the site.

Duration of measurements shall be a minimum of ten continuous minutes for each criterion (See Item C below) at each location.

One set of measurements shall be taken during each of the following four periods:

Morning (6 - 8 a.m.)

Midday (12 noon – 2 p.m.)

Evening (6 – 8 p.m.)

Night (10 p.m. – 12 midnight)

Sound level measurements must be made on a weekday of a non-holiday week.

Measurements must be taken at 6 feet above the ground and at least 15 feet from any reflective surface[3].

For each MP and for each measurement period, provide each of the following measurement criteria:

Unweighted octave-band analysis (16^2, 31.5, 63, 125, 250, 500, 1K, 2K, 4K, and 8K Hz)

L_{ave}, L_{10}, L_{50}, and L_{90}, in dBA

L_{ave}, L_{10}, L_{50}, and L_{90}, in dBC

A narrative description of any intermittent sounds registered during each measurement

Wind speed at time of measurement

Wind direction at time of measurement

Description of the weather conditions during the measurement

Provide a map and/or diagram clearly showing:

The layout of the project area, including topography, the project boundary lines[5], and property lines

The locations of the MPs

The minimum and maximum distance between any MPs

The location of significant local sound and vibration sources

The distance between all MPs and significant local sound and vibration sources

The location of all sensitive receptors including but not limited to: schools, day-care centers, hospitals, residences, residential neighborhoods, places of worship, and elderly care facilities.

Sites with Existing Wind Energy Conversion Units

Two complete sets of sound level measurements must be taken as defined below:

One set of measurements with the wind generator(s) off.

One set of measurements with the wind generator(s) running.

Sound level measurements shall be taken as follows:

At all properties within the proposed WECS project boundaries[5]

At all properties within a one mile radius of the proposed WECS project boundaries[5].

One test must be performed during each season of the year.

Spring March 15 – May 15

Summer June 1 – September 1

Fall September 15- November 15

Winter December 1- March 1

All measurement points (MPs) shall be located in consultation with the property owner(s) and such that no significant obstruction (building, trees, etc.) blocks sound and vibration from the site.

Duration of measurements shall be a minimum of ten continuous minutes for each criterion (See Item D below) at each location.

Measurements shall be taken during each of the following four periods:

Morning (6 - 8 a.m.)

Midday (12 noon – 2 p.m.)

Evening (6 – 8 p.m.)

Night (10 p.m. – 12 midnight)

Sound level measurements must be made on a weekday of a non-holiday week.

Measurements must be taken at 6 feet above the ground and at least 15 feet from any reflective surface[3].

For each MP and for each measurement period, provide each of the following measurement criteria:

Unweighted octave-band analysis (16[4], 31.5, 63, 125, 250, 500, 1K, 2K, 4K, and 8K Hz)

L_{ave}, L_{10}, L_{50}, and L_{90}, in dBA

L_{ave}, L_{10}, L_{50}, and L_{90}, in dBC

A narrative description of any intermittent sounds registered during each measurement

Wind speed at time of measurement

Wind direction at time of measurement

Description of the weather conditions during the measurement

Provide a map and/or diagram clearly showing:

The layout of the project area, including topography, the project boundary lines[5], and property lines

The locations of the MPs

The minimum and maximum distance between any MPs

The location of significant local sound and vibration sources

The distance between all MPs and significant local sound and vibration sources

The location of all sensitive receptors including but not limited to: schools, day-care centers, hospitals, residences, residential neighborhoods, places of worship, and elderly care facilities.

Sound level Estimate for Proposed Wind Energy Conversion System

In order to estimate the sound and vibration impact of the proposed WECS project on the existing environment an estimate of the sound and vibration produced by the proposed WECU(s) must be provided.

Provide the manufacturer's sound level characteristics for the proposed WECU(s) operating at full load. Include an unweighted octave-band (16^4, 31.5, 63, 125, 250, 500, 1K, 2K, 4K, and 8K Hz) analysis for the WECU(s) at full operation for distances of 500, 1000, 1500, 2000, 2500 feet from the WECU(s).

Estimate the sound levels for the proposed WECU(s) in dBA and dBC at distances of 500, 1000, 1500, 2000, 2500 feet from the WECU(s). For projects with multiple WECUs, the combined sound level impact for all WECU's operating at full load must be estimated.

Provide a contour map of the expected sound level from the new WECU(s), using 5dBA increments created by the proposed WECU(s) extending out to a distance of 2500 feet.

Determine the impact of the new sound and vibration source on the existing environment. For each MP used in the ambient study (note the sensitive receptor MPs):

Report expected changes to existing sound levels for L_{ave}, L_{10}, L_{50}, and L_{90}, in dBA

Report expected changes to existing sound levels for L_{ave}, L_{10}, L_{50}, and L_{90}, in dBC

Report all assumptions made in arriving at the estimate of impact and any conclusions reached regarding the potential effects on people living near the project area.

Include an estimate of the number of hours of operation expected from the proposed WECU(s) and under what conditions the WECU(s) would be expected to run.

Post-Construction Measurements

1. Within twelve months of the date when the project is fully operational, and within two weeks of the anniversary date of the Pre-construction ambient noise

measurements, repeat the existing sound and vibration environment measurements taken before the project approval. Post-construction sound level measurements shall be taken both with all WECU(s) running and with all WECU(s) off.

2. Report post-construction measurements to the Shawano County PD&Z Committee (available for public review) using the same format as used for the Pre-approval sound and vibration studies.

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[1] Standard Guide for Selection of Environmental Noise Measurements and Criteria (Designation E 1686-96). July 1996. American Society for Testing and Measurements.

[2] Measurement Protocol for Sound and Vibration Assessment of Proposed and Existing Electric Power Plants. February 2002. Public Service Commission of Wisconsin.

[3] Environmental Noise Guidelines: Wind Farms. (ISBN 1 876562 43 9). February 2003. Environment Protection Authority, Adelaide SA.

[4] The Public Service Commission of Wisconsin Staff acknowledges that few sound level meters are capable of measurement of the 16 Hz center frequency octave band. However, because noise complaints from the public most likely involve low frequency noise associate with proposed WECS [power plants], we encourage applicants to pursue the collection of this important ambient noise data. If obtaining the 16 Hz data presents a problem contact PSCW Staff prior to collection of any field ambient measurement data.

[5] Project Boundary: A continuous line encompassing all WECU's and related equipment associated with the WECS project.

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Shawano County WTCAC