

**Wind Law** -- To replace §17, Noise Standards and Setbacks for Wind Energy Conversion Systems in its entirety.

19 November 2010

NEW TITLE: **§17, Noise Standards and Enforcement for Wind Energy Conversion Systems**

- A. The equivalent level (LEQ) generated by a Wind Energy Conversion System (WECS) shall not exceed the limits listed in Table 1 when measured at the nearest off-site dwelling existing at the time of application, or for which a building permit has been issued, or for parcels zoned residential. If the A-weighted background sound pressure level, without the WECS, is within 5 dB of some or all of the limits in Table 1 or exceeds some or all of the limits in Table 1, then the A-weighted criterion to be applied to the WECS application for those affected limits shall be the A-weighted background level +5 dB. The remaining limits that are more than 5 dB above the A-weighted background shall remain as given in Table 1.

Note: For example, during daytime, if the background is less than or equal to 40 dB, then the limit is 45 dB. However, if the background is greater than 40 dB, say 44 dB, then the applicable WECS limit is the background level plus 5 dB which calculates to 49 dB for this example.

- B. In all cases, the corresponding C-weighted limit shall be the operable A-weighted limit (from Table 1 or based on the A-weighted background, as appropriate) plus 18 dB. The application shall include certification by an independent acoustical engineer as to the predicted A- and C-weighted WECS sound levels at potentially impacted residential sites. The firm with which the engineer is associated shall be a member of the National Council of Acoustical Consultants (NCAC) with a specialty in environmental noise, and the independent acoustical engineer shall be a Member, Board Certified of the Institute of Noise Control Engineering of the USA. The background shall be measured and predicted in accordance with clause C below.

Table 1. WECS noise limits at residential receivers

	Daytime 7 AM to 7 PM	Evening 7 PM to 10 PM	Nighttime 10 PM to 7 AM
A-weighted level (dB)	45	40	35
C-weighted level (dB)	63	58	53

- C. A-weighted background community noise levels shall be based on measured hourly L90 levels gathered continuously for at least 2 weeks. The day shall be divided into three time periods: (1) daytime, the hours from 7 AM to 7 PM, (2) evening, the hours from 7 PM to 10 PM, and (3) nighttime, the hours from 10 PM to 7 AM. If insect noise possibly can dominate some of the

hourly L90 measurements,<sup>1</sup> then Ai weighting (see Schomer *et al.*, 2010<sup>2</sup>) shall be used in lieu of the Standard A-weighting, or measurements shall not be made when insect noise possibly can dominate some of the hourly L90 measurements. The background shall be reported by time period, and computed as follows. The minimum hourly L90 shall be tabulated by time period and by day, and the arithmetic average by time period over all the days of measurement shall be computed. These three averages of daily minima shall be reported as that site's daytime, evening, and night time A-weighted background, respectively.

#### C.1 Parcels 3 acres or smaller

The A-weighted background measurements shall be made along the line from the nearest proposed WECS to the dwelling in question. If the parcel of land has no dwelling, then the line shall terminate within 25 ft of the center of the parcel. The actual position of the microphone shall be within the property in question and should be within 25 feet to either side of the line, no closer than 50 feet from the property boundary, and no closer than 25 feet from the house or any other structures. If positioning within this "measurement box" is not possible because of unique site conditions such as the position being underwater or the property being too small, then the unique conditions shall be fully documented and an alternate position selected and justified.

#### C.2 Parcels larger than 3 acres

The A-weighted background measurements shall be made along the line from the nearest proposed WECS to the dwelling in question. If the parcel of land has no dwelling then the line shall terminate within 50 ft of the center of the parcel. The actual position of the microphone shall be within the property in question, shall be within 50 to 500 feet of the dwelling or within 0 to 500 feet of the parcel center, as applicable, should be within 50 feet to either side of the line, shall be no closer than 50 ft from the house or any other structure, and shall be no closer than 50 feet from the property boundary. If positioning within this "measurement box" is not possible because of unique site conditions such as the position being underwater or the property being too small, then the unique conditions shall be fully documented and an alternate position selected and justified. The microphone shall be no closer than 50 ft from the house or any other structures.

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<sup>1</sup> In relatively quiet areas insect noise, especially during summer months, can easily dominate the A-weighted ambient sound level. This domination occurs partly because the primary frequencies or tones of many, if not most, insect noises are in the range of frequencies where the A-weighting is a maximum, whereas, most mechanical and WECS noises primarily occur at the lower frequencies where the A-weighting significantly attenuates the sound. Also, insect noise and bird song do not mask WECS noise at all because of the large differences in frequencies or tones between them.

<sup>2</sup> Schomer, Paul D. *et al.*, "Proposed 'Ai'-Weighting; a weighting to remove insect noise from A-weighted field measurements," InterNoise 2010, Lisbon Portugal, 13-16 June 2010.

### C.3 Measurement requirements

The microphone shall be situated between 4 and 4.5 ft above the ground. Measurements shall be conducted within the general provisions of ANSI S1.13-2005, and using a meter that meets at least the Type 2 requirements of ANSI S1.4 and S1.4A-1985 (R2006). The meter noise floor shall be 20 dB(A) or lower. The report shall include each hourly measured A-weighted L90 level, the tabulated daily minima by time period, and the three time period averages. The report also shall include a sketch of the site showing distances to the structure(s), to the property line, etc., and several photographs showing the structure(s), the property, and the acoustical instrumentation. All instrumentation shall be listed by manufacturer, model, and serial number. This instrumentation listing also shall include the A-weighted noise floor and the one third octave band noise floors, if utilized, for each meter used.

### C.4 Background prediction and measurement

Background measurements shall be conducted throughout the area using sufficient sites to generally characterize the background in various areas of the community such as along busy roads, in town, near the river, and in the countryside. The town, using the services of the town engineer, shall contract for the background measurements and determination of background levels for general areas of the township such that every parcel is assigned a background level for daytime, evening, and nighttime. The contractor shall be a member of the National Council of Acoustical Consultants (NCAC) with a specialty in environmental noise, and the consultant's project leader shall be a Member, Board Certified of the Institute of Noise Control Engineering of the USA. The WECS applicant shall pay for the contract to measure and determine background levels. This payment shall include the cost of the contract, the cost of letting the contract, and the cost of supervising the contractor. The number of measurement sites and study plan shall be developed jointly between the town and the contractor with input from the public and from the applicant.

NOTE It is anticipated that background measurements will be performed at on the order of 9 to 12 locations.

- D. The starting point for predicting WECS A- and C-weighted levels at potentially impacted residential parcels shall be the manufacturer-supplied octave band sound power levels as measured by the manufacturer in accordance with International Standard for Acoustic Noise Measurement Techniques for Wind Generators (IEC 61400-11). At a minimum, the octave band data shall include the 10 octave bands with nominal center frequencies ranging from 16 Hz to 8000 Hz (see ANSI S1.6-1984), and the sound power levels for these bands shall be tabulated in the report. Any data not available from the manufacturer shall be estimated from field measurements on like wind turbines already in use. Any such field measurements shall be described fully and documented in the report. Predictions for certain times of the day such as nighttime may use manufacturer certified lower

sound power levels that correspond to a reduced wind turbine output power setting, if the application warrants and affirms that this reduced power setting always will be used during the time of the day in question (e.g., nighttime).

For sites at which A-weighted background measurements were performed, the A- and C-weighted WECS sound level predictions shall be made at the same point and for the nearest WECS. For all other sites, a prediction point shall be selected that is as close as possible to the nearest WECS while being within the “measurement box” delineated above. The octave band sound pressure levels shall be predicted at the prediction point for at least each of the four nearest proposed WECS using the sound propagation algorithms given by ISO 9613–2, with G and  $G_m$  in Table 3 of ISO 9613-2 set to 0.35. That is, the coefficients for delineating between an acoustically hard and an acoustically soft surface are each set to 0.35 for the source, middle, and receiver regions. Calculations for the 16 and 31.5 Hz octave bands shall use the 63 Hz octave band algorithms contained in ISO 9613-2 with no factor included for *air absorption*. No *sound barrier* shall be included in the calculations. For each such prediction, the A- and C-weighted level shall be calculated by applying the A- and C-weighting values from ANSI S1.4, then by adding the weighted mean square pressures, and finally by converting back to decibels. The overall predicted A- and C-weighted levels shall be the sum of the individual levels added on the basis of the mean square pressures.

- E. (This shall be the current text of **§17**, paragraph B, of the current 2009 law of the Town of Hammond: Wind Energy Facilities.)

NOTE In the current 2009 law, paragraph E deals with setbacks. Minimum distances or setbacks are a very inexact means to limit WECS noise. It is far more appropriate to deal with each application on its own merits, taking into account the ground surface in the area, the number and placement of the wind turbines, and the sound power produced by the particular model of the WECS. Thus, this proposed revision to section **§17** of the current wind law contains no minimum distances or setbacks.

- F. Any noise level falling between two whole decibels shall be rounded to the nearest whole decibel.
- G. Enforcement (separate attachment)

## **Wind Law** -- To replace **§31**, paragraphs E and I.

- E. All parts of the system and its tower, including the guy-wire anchors, shall be on the WECS property and shall be more than 10 feet from the closest part of the WECS property boundary.

Additionally, the outer and innermost guy-wires shall be marked and clearly visible to a height that extends from ground level to eight feet above the guy-wire anchors.

- I. Decibel levels for the system shall not exceed the limits in Table 1 of section **§17** when measured at the nearest point of any residential property.<sup>3</sup> For purposes of this clause, residential property shall include property that contains one or more existing residences and/or a building permit has been issued for a residence on said property, and/or said property is zoned for residential use.

Commentary: The WECS community noise level criteria are based on numerous national and international criteria and standards. With the exception of airports and highways, all cognizant authorities in the United States recommended a basic day night-sound level (DNL) of 55 dB which implies a daytime equivalent level (LEQ) of 55 dB and a nighttime LEQ of 45 dB. Similar recommendations are made by such international authorities as the World Health Organization (WHO) and the World Bank. However, both the relevant national standard, ANSI S.12.9 Part 4 and the relevant international standard, ISO 1996 Part 1, contain recommended adjustments to these criteria based on the nature of the community and the newness of the noise source. Each of these standards contains a 10 dB adjustment for very quiet, typically rural communities for which peace and quiet is an expected value and amenity, and each contains a 5 dB adjustment for a new noise source for which the community has no experience. This latter adjustment is obviously “temporary” because after some number of years, the sound is no longer new, so the full 5 dB adjustment may not be justified. Also, the DNL, with the values cited, assumes continuous or near-continuous sound. If the WECS noise was only present half the time, this would imply a 3 dB increase to the criteria. Thus, the 5 dB adjustment for a “new” source is counterbalanced by the transient nature of the adjustment and the adjustment to the criteria for the duty cycle of the WECS. The resulting suggested criterion is a slight variant of DNL equal to 45 dB, which is the general limit of 55 dB minus 10 dB for the quiet rural nature of the area.

The minor variant is that this recommendation is for the use of DENL, the day-evening-night sound level. DENL is used in California and all of Europe, and it divides the day into three time periods: (1) day, 7 AM to 7 PM, (2) evening, 7 PM to 10 PM, and (3) night, 10 PM to 7 AM. In contrast, DNL divides the day into two time periods: (1) day, 7 AM to 10 PM, and (2) night, 10 PM to 7 AM; there is no separate evening limit.<sup>4</sup> DENL is chosen because of the large use of outdoors during the warmer-weather months in the Hammond area. This 45 dB DENL criterion is broken out as 45 dB during daytime, 40 dB during evening, and 35 dB during nighttime.

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<sup>3</sup> "Table 1 of section **§17**" means Table 1 in the proposed amendment to section **§17** herein.

<sup>4</sup> The time periods for LDEN given herein are those used in California; each European country uses its own variation to these time periods, e.g., evening as 7 pm to 11 pm or 8 pm to 10 pm, etc.