

Environmental Stakeholder Roundtable on Wind Power

June 16, 2009

Empire State Plaza

Meeting Room 1

Environmental Discussion – Daniel A. Driscoll’s response to the questions about noise:

Question 1. What research has justified the choice of 50 dBA as an appropriate noise criterion, particularly for rural areas of the state?

Question 2. Have studies been done in New York that identify the low frequency sounds (infra sound) from wind turbines, and their effects on humans and animals?

Before responding to the questions, it will help to give a brief explanation about how noise can be regulated.

1. Most town zoning ordinances prohibit “excessive” noise. While suitable for neighbor to neighbor disputes, the prohibition is vague and may not be enforceable in court.
2. Control how the noise source is operated, for example, distance (setback) from residences or property lines, hours of operation, wind speed, etc. This method is very effective and easy for towns to enforce, but it does not account for possible changes in wind turbine technology. Developers have proposed 500 and 1000 foot setbacks; towns are beginning to discover that setbacks on the order of 3000 feet or more are needed for industrial-scale wind turbines.
3. Specify a numerical noise limit. This allows for changes in wind turbine technology, but towns must hire qualified noise control engineers to help with creation and enforcement of the limit. Characterizing the sound produced by the wind turbine in a way that adequately protects the community is complex and also requires the assistance of a qualified professional to verify the applicant’s data.
4. Limiting the permissible increase in sound level above the background sound level is the most accurate way to control community noise and is the method recommended in DEC’s noise policy. But in addition to the complexities related to setting and enforcing a noise limit, the background sound level must be measured in a way that adequately protects the community. To characterize the background sound level in quiet suburban and rural communities, the commonly used Leq can be misleading; the L90, or residual sound level more accurately reflects the community’s baseline for judging the intrusiveness of a new noise source. The Noise-Con 2008 paper by Kamperman and James (Simple Guidelines for Siting Wind Turbines to Prevent Health Risks) describes this method of noise control and includes guidelines for measuring the background sound level.

Response to Question 1. One basis for a 50 dBA noise limit is the EPA's well-known publication, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, commonly known as the Levels Document, www.nonoise.org/epa.htm. In the Levels Document, the EPA uses the day/night sound level (Ldn) as a measure of noise; the Ldn is the sound level energy-averaged over 24-hours with a 10 dB penalty added to nighttime sound levels (10 pm to 7 am). Hypothetically, if a 2.5 MW wind turbine produced a constant energy-equivalent sound level (Leq) of 49 dBA at 500 feet (complying with a 50 dBA noise limit), its Ldn would be 55 dBA. (The Ldn for a constant sound source is about 6 dB greater than the Leq for that source.)

Based on extensive research, the EPA chose a day/night sound level (Ldn) of 55 dBA to protect people from "outdoor activity interference and annoyance." The limit applies to "residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use."

Figure D-7 from the Levels Document shows expected community reaction to noise; the dots represent different studies of various noise sources. It shows that there would be no community reaction to a noise with an Ldn of 55 dBA, although the noise would be generally noticeable. However, notice that horizontal axis in the Figure uses Normalized Ldn. Assuming an urban residential location, some prior exposure to the noise source, windows partially open, and no pure tone or impulsive character to the noise, the Normalized Ldn and the Ldn are the same.

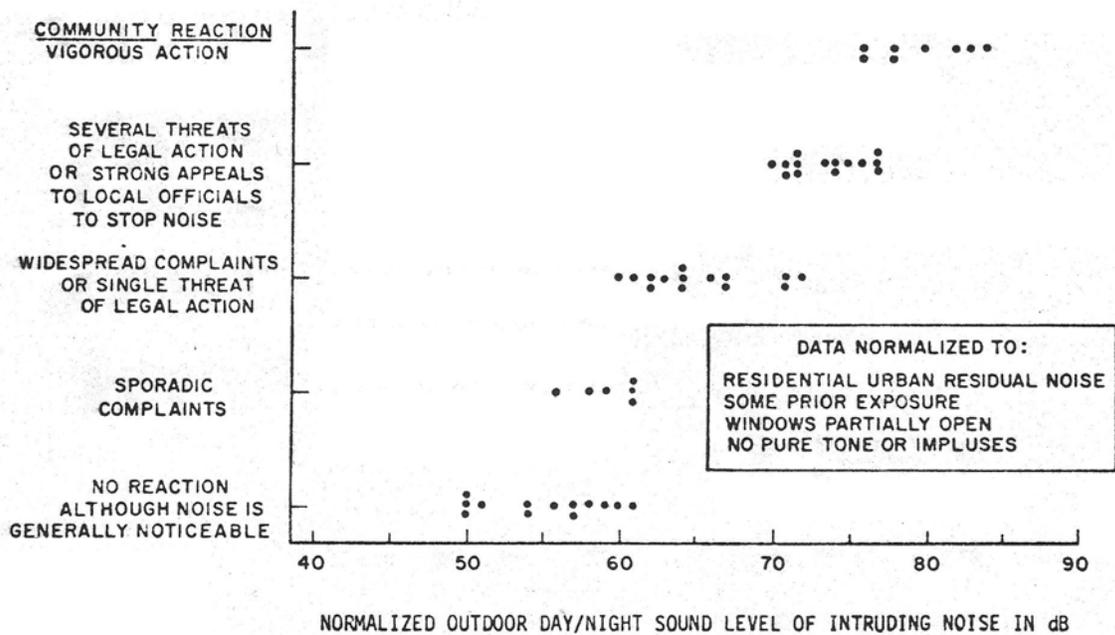


Figure D-7. Community Reaction to Intensive Noises of Many Types as a Function of the Normalized Outdoor Day/Night Sound Level of the Intruding Noise ^{D-3}

Table D-7 shows the normalization process. If the noise source having an Ldn of 55 dBA were operated in a quiet suburban or rural community having no prior experience with the noise source, and if the noise source has a pure tone or impulsive character (an appropriate correction for the modulated low-frequency sound of industrial-scale wind turbines), the Normalized Ldn would be 75 dBA. From Figure D-7, the expected community response under those circumstances would be “several threats of legal action or strong appeals to local officials to stop [the] noise.”

This discussion is intended to illustrate the expected community response to noise; it is not a recommendation that Ldn or Normalized Ldn be used to regulate wind turbine noise. For noise sources that may change throughout the day, a long-term average sound level (such as Ldn) can be misleading by averaging periods of relative quiet with periods of maximum noise.

What should be done? In the noise control profession it is generally considered adequate to reduce expected community response to “sporadic complaints” assuming that most of those complainants are using noise as a surrogate for visual impact or general dislike of the noise source. So, if the Normalized Ldn could be reduced to about 59 dBA (see Figure D-7) the community reaction would be acceptable. Working back through the normalization process gives an Ldn of 39 dBA. Therefore, the Leq of the hypothetical wind turbine should be 33 dBA; a setback of about 3000 feet or 1 kilometer would achieve that. It should be noted that this result is consistent with the Kamperman/James paper.

Response to Question 2. I am not aware of any research in New York State dealing with the effects of low-frequency sound (20 – 200 Hz) or infrasound (below 20 Hz) on humans or animals. However there are extensive interviews and first-person reports, available on the internet and elsewhere, from people living near industrial-scale wind turbines in New York describing their experiences with the wind turbine noise. The reports I have read are generally consistent with the known effects of low-frequency sound and infrasound. For example, the sound is often more noticeable indoors; the sound is occasionally felt in the chest rather than heard; and the effects can be a mixture of sleep interference, headache, dizziness, nausea, etc. A similar situation is found in some urban apartment buildings where low frequency traffic noise resonates in stairwells and hallways.

What should be done? When low-frequency noise or infrasound is a concern it is advisable to control both A-weighted sound levels (which emphasize speech frequencies) and C-weighted sound levels (which include more low frequencies). The C-weighted measurement should not exceed the A-weighted measurement by more than 20 dB.

Table D-7
CORRECTIONS TO BE ADDED
TO THE MEASURED DAY-NIGHT SOUND LEVEL (L_{dn})
OF INTRUDING NOISE
TO OBTAIN NORMALIZED L_{dn}^{D-3}

Type of Correction	Description	Amount of Correction to be Added to Measured L_{dn} in dB
Seasonal Correction	Summer (or year-round operation)	0
	Winter only (or windows always closed)	-5
Correction for Outdoor Noise Level Measured in Absence of Intruding Noise	Quiet suburban or rural community (remote from large cities and from industrial activity and trucking)	+10
	Normal suburban community (not located near industrial activity)	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas)	0
	Noisy urban residential community (near relatively busy roads or industrial areas)	-5
Correction for Previous Exposure & Community Attitudes	Very noisy urban residential community	-10
	No prior experience with the intruding noise	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good	-5
Pure Tone or Impulse	Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
	No pure tone or impulsive character	0
	Pure tone or impulsive character present	+5