

**Health Impacts of Industrial Wind Projects:
Presentations by Rob Rand and Jerry Punch, PhD.
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1. Industrial Wind Turbines are a major noise problem.

- Wind turbines are sited mostly in quiet rural areas.
<https://eerscmap.usgs.gov/uswtodb/>
- Wind turbines are promoted as pollution-free but have significant noise pollution emissions.
- Neighbors living near wind turbines in rural areas report adverse noise impacts; sleep disturbance, sickness.
- Meters measure sound levels but don't measure noise impacts.
- Regulators assess noise *levels*, ignoring noise *impacts*.

2. Most people, including legislators in New York State, think wind turbines are silent.

- 2015 New York State Energy Plan does not mention noise or include a plan to reduce noise pollution health impacts on communities, children or elderly. Environmental Justice communities appear to exclude people living near wind turbines.
- The New York State DEC website on Wind Power describes industrial wind turbines as pollution-free, failing to acknowledge the noise pollution emissions.

3. Wind turbines emit audible and low frequency sound that is annoying to a statistically significant portion of residents.

- Industrial wind turbines produce pulsed, amplitude-modulated, tonal sounds that are unpredictable, uncontrollable (by receptors), and sleep-disturbing.
- Amplitude Modulation is the variation in the noise caused by things like the partial stall on the blades or the interaction of the blade with the structure. Wind turbines emit changing noises. This has been described as a “swish” or “thump”.
- Amplitude-modulated and impulsive noises are more easily perceived and more annoying than constant-level noise (Sutherland & Burke, 1979; Bradley, 1994).
- Tonal sounds are more annoying than sounds containing energy across a broad range of frequencies (Moorhouse et al, 2005; Bray, 2007; Swinbanks, 2012).

- Sounds that are unpredictable and uncontrollable increase noise annoyance (Geen & McCown, 1984; Hatfield et al, 2002).
- Nighttime noise is more annoying than daytime noise (Berger et al, 2015; Berglund et al, 1999; WHO, 2009).

4. Wind turbines cause harm if too close.

- An Ontario Environmental Review Tribunal decision in 2011 stated: “This case has successfully shown that the debate should not be simplified to one about whether wind turbines can cause harm to humans. The evidence presented to the Tribunal demonstrates that they can, if facilities are placed too close to residents. The debate has now evolved to one of degree.” Ontario Case 10-121/10-122, Feb 2011, *Erickson v. Director, Ministry of the Environment Environmental Review Tribunal*, Decision, p 207.
- A 1.25-mile (2 km) setback has most often been recommended to avoid annoyance and AHEs; some scientists and regulatory authorities are now recommending longer setbacks.

5. Locations in quiet rural areas increase the harm.

- Siting is currently in rural areas that typically have 20-25 dBA nighttime noise.
- Wind turbines are sited with noise levels reaching 40-60 dBA in quiet rural areas at property lines or residences. This guarantees complaints as listed in below table.
- Complaints and lawsuits mean that regulators and consultants have failed.
- Unlike other power plant technologies which have other noise control options, the only reliable noise control option for wind turbines is DISTANCE.
- In most places, there isn't enough distance to avoid impacts.

Community Response	
Increase in Noise	Estimated Community Response
5 dB	Sporadic Complaints
10 dB	Widespread Complaints
15 dB	Threats of Community Action
20 dB	Vigorous Community Action

International Standards Organization, ISO/TC 43

- Current siting criteria - levels between 45-60 dBA - are over 20 dBA above existing rural levels. And they exceed American National Standards Institute (ANSI) standard levels (see table below).
- Faulty models and inaccurate assumptions lead to noise at levels that cause complaints.
- Example: Assuming that noise is reduced by 15 dBA from outdoors to indoors when actual reduction is 1-6 dBA means that some homes experience noise that becomes a nuisance/annoyance.

ANSI S12.9: Compatibility of Noise with Land Use

6. Annoyance is a health impact according to the World Health Organization (WHO).

- The WHO defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.”
- The WHO in 2011 stated, “a high level of annoyance caused by environmental noise should be considered as one of the environmental health burdens.”
- The WHO treats nuisance and annoyance as essentially the same thing, defining annoyance as “any sound that is perceived as irritating or a nuisance.”
- Annoyance defined by ANSI and Acoustical Society of America (ASA): “Any sound that is perceived as irritating or a nuisance.” ANSI, 1995.

- In the United States people do not understand “annoyance” as having this meaning and so dismiss the problem.
7. **Wind turbines Low Frequency Noise (LFN) causes annoyance and is not accurately modeled or measured.**
- When the common A-weighted sound measurement is used then most of the LFN is not captured.
 - As turbines get bigger, they get a slower blade pass rate. This puts them in a range of LFN sound that can cause nausea.
 - LFN travels a longer distance than other types of noise.
 - Industrial wind turbines produce LFN that can be higher levels inside of a residence than outside.

Presenter Bios

Dr. Jerry Punch holds a Ph.D. degree in Audiology; he has been a certified audiologist for over 50 years. Throughout his career, he has held positions as a faculty member, clinical audiologist, teacher, researcher, and administrator in several universities, served as Research Director at the national headquarters of the American Speech-Language-Hearing Association, and as a researcher on the developmental team at Nicolet Instrument Corporation that developed the world’s first digital hearing aid. He has been affiliated with the Department of Communicative Sciences and Disorders at Michigan State University for the past 30 years, officially retiring from that faculty position in 2011. Although much of his research has been in the areas of diagnostic audiology and hearing aids, he has had a career-long interest in community noise. Even though retired, he continues to conduct and publish audiological research at Michigan State University. He has written on the topic of wind turbine noise and human health, and has often served as an expert witness on that topic.

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Robert W. Rand, ASA, INCE (Member Emeritus) is owner of Rand Acoustics, LLC, Brunswick, Maine. He is a Member of the Acoustical Society of America (ASA) and a Member Emeritus of the Institute of Noise Control Engineers (INCE) with over thirty-nine years of professional experience providing environmental and technical consulting services to power generation, commerce, industry, regulators and communities.

Mr. Rand's breadth of experience in general acoustics includes industrial noise control, environmental impact assessment, interior acoustics, and electro-acoustics, with ten years in the Noise Control Group at Stone & Webster Engineering Corporation. He has conducted

environmental acoustic analyses, community noise impact assessment, project engineering and cost analyses, permitting reviews, acoustic testing, noise control design and costing, and operations monitoring activities for power generation and commercial projects. He has provided an independent professional acoustic consultancy to industry, commercial, regulatory and community clients since 1996.

Mr. Rand's wind turbine experience spans from 2009 to present day with investigations and testing of acoustic emissions and infrasonic barometric pressure pulsations and community noise impact assessment for industrial wind turbines at multiple facilities. Significant testing reported in the literature includes independent peer-reviewed investigations in Falmouth, Massachusetts in April 2011, and the Cooperative Measurement Study in Shirley, Wisconsin in December 2012.

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