Enclosure #1

National Wind Watch

Press Release -- Noise
Noise Complaints On Rise with New Industrial Wind Power Projects

National Wind Watch calls for minimum 1-mile setbacks

Press Release

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Rowe, Mass., April 2, 2007 -- Noise created by commercial-scale wind turbines has become a major concern around the world as wind power development continues to proliferate. Although the industry claims that modern turbines are quieter -- even as they grow ever larger -- complaints are increasing from people who live near new projects.

While the wind itself may mask some of the noise under some atmospheric conditions, the deep unnatural thumping as the giant blades pass their supporting tower is particularly intrusive. Testimony from hundreds of turbine neighbors confirms this, most recently from Maine, Massachusetts, New York, Pennsylvania, Illinois, Wisconsin, Texas, Canada, the U.K., and New Zealand. Reports can be found at www.wind-watch.org/news and www.wind-watch.org/documents.

The noise is especially intrusive because wind energy facilities are often built in rural areas where the ambient sound level may be quite low, especially at night. On the logarithmic decibel (dB) scale, an increase of 10 dB is perceived as a doubling of the noise level. An increase of 6 dB is considered to be a serious community issue. Since a quiet night in the country is typically around 25 dB, the common claim by wind developers of 45 dB at the nearest home would be perceived as a noise four times louder than normal. And because it is intermittent and directional, those affected assert that one can never get used to it. The disruption of sleep alone presents serious health and human rights issues.

The problem is worse than the industry admits. Frits van den Berg, a physicist at the University of Groningen in The Netherlands, studied noise levels around a German facility of 17 turbines. In a paper published in the November 2004 *Journal of Sound and Vibration*, he found that at night, because the surface air is often more still than the air at the height of the blades, the noise from the turbines is 15 to 18 dB higher than during the day and carries farther. He noted that residents 1.9 kilometers (6,200 feet or 1.2 miles) away expressed strong annoyance with noise from the facility.

The French National Academy of Medicine has called for a halt of all large-scale wind development within 1.5 kilometers of any residence, because the sounds emitted by the blades constitute a permanent risk for people exposed to them. The U.K. Noise Association studied the issue and agreed with the recommendation of a 1-mile setback.

In the U.S., the National Wind Coordinating Committee could not avoid the conclusion that "those affected by noise generated by wind turbines live within a few miles of a large wind power plant or within several thousand feet of a small plant or individual turbine. Although the noise at these distances is not great, it nevertheless is sufficient to be heard indoors and may be especially disturbing in the middle of the night when traffic and household sounds are diminished."

National Wind Watch calls on the commercial wind industry to respect the people who reside in targeted development regions, to honor their right to healthy lives and peaceful enjoyment of their homes, by adopting meaningful setbacks -- measured in miles, not in feet.

National Wind Watch information and contacts are available at www.wind-watch.org.

Enclosure #2

Health, hazard, and quality of life near wind power installations

How close is too close?

Nina Pierpont, MD, PhD*

Malone (New York, USA) Telegram,

March 2, 2005, p. 5

Falling over

A nacelle (generator and gearbox) weighing up to 60 tons atop a 265 ft. metal tower, equipped with 135 ft. blades, is a significant hazard to people, livestock, buildings, and traffic within a radius equal to the height of the structure (400 ft) and beyond. In Germany in 2003, in high storm winds, the brakes on a wind turbine failed and the blades spun out of control. A blade struck the tower and the entire nacelle flew off the tower. The blades and other parts landed as far as 1650 ft (0.31 mile) from the base of the tower.[1] (Note that all turbines discussed in this article are "upwind," three-bladed, industrial-sized turbines. "Downwind" turbines have not been built since the 1980's.) Given the date, this turbine was probably smaller than the ones proposed for current construction, and thus could not throw pieces as far. This distance is nearly identical to calculations of ice throw from turbines with 100 ft blades rotating 20 times per minute (1680 ft).[2]

Fires

Most fires in wind turbines are started by lightning and fueled by up to 200 gallons of hydraulic oil in the nacelle. Fire-fighting at 265 ft (26 stories) may not be possible with the equipment of a rural town. A fire may leave wind turbine controls malfunctioning until the equipment in the nacelle is repaired or replaced, making it more susceptible to the kind of accident described above.

Lightning and power surges

Wind turbines themselves cause irregularities in the power supply as wind speed changes. Within the power grid, supply and demand must always be balanced; there is no storage of electricity on this scale. When the wind dies, there is less power (brown-out) until a coal- or gas-powered plant at some distance from the wind installation fires up to increase production. When the wind gusts, there are power surges. Residents living near a new wind turbine installation in

Meyersdale, PA, which came on-line in December 2003, have had to replace stove elements and small appliances due to power surges which started at that time. Residents of Lincoln Township, WI, near a wind installation noticed an increase in lightning strikes in their area after the turbines went on-line in June 1999. Two computers protected by surge protectors and a TV set, all in different houses, were simultaneously "fried" one evening when lightning struck a nearby wind turbine tower.[3]

Flicker

When turning with the sun behind them, turbine blades cast moving shadows across the landscape and houses, described as a strobe effect within houses, which can be difficult to block out. Some people lose their balance or become nauseated from seeing the movement. As with car or sea sickness, this is because the three organs of position perception (the inner ear, eyes, and stretch receptors in muscles and joints) are not agreeing with each other: the eyes say there is movement, while the ears and stretch receptors do not. People with a personal or family history of migraine, or migraine-associated phenomena such as car sickness or vertigo, are more susceptible to these effects. The strobe effect can also provoke seizures in people with epilepsy.

In Lincoln Township, WI, two years after installation, 33% of residents 800 ft to ¼ mile from the turbines found shadows from the blades to be a problem, 40% ¼ to ½ mile away, 18% ½ to 1 mile away, and 3% 1 to 2 miles away (230 people sampled).

Noise

In the same survey in Lincoln Township in 2001, 44% of residents 800 ft to ¼ mile from the turbines found noise to be a problem in their households, 52% ¼ to ½ mile away, 32% ½ to 1 mile away, and 4% 1 to 2 miles away (229 people sampled). Under certain conditions the turbines could be heard up to 2 miles away. These numbers correspond well to measurements made by a sound engineer near a more recent 30 MW, 17 turbine installation on the Dutch-German border, where residents living 500 m (1640 ft, or 0.31 mile) and more from the turbines were reacting strongly to the noise, and residents up to 1900 m (1.2 miles) away expressed annoyance. The engineer found that measured sound levels were higher than predicted by standard models because of differences in daytime and nighttime wind patterns, and that annoyance was increased by the impulsive nature or rhythmic thumping of the sound, a pattern found at a distance from the turbines (documented at 1500 m, or 0.9 mile) but not immediately under or among the turbines.[4] This was described as a "low pitched thumping sound."

Noise levels sufficient to prevent or interrupt sleep, even with windows closed, are reported in dwellings close to wind power installations in all surveys. Low frequency sound, defined as 10-200 Hz, travels farther and comes through walls and around obstacles because of its long wavelength; sounds in the range of 25-150 Hz have wavelengths similar to room dimensions, and can reverberate in rooms. Low frequency sound is especially bothersome, according to the World Health Organization:[5]

"Low frequency noise, for example from ventilation systems, can disturb rest and sleep even at low sound levels."

"For noise with a large proportion of low frequency sounds a still lower [measurement] guideline (than 30dBA) is recommended." [This means 30 dB total sound pressure using an "A" filter.]

"When prominent low frequency components are present, noise measures based on A-weighting are inappropriate." [An "A" filter, which filters out low-frequency sounds, is standard in loudness measurement.]

"Since A-weighting underestimates the sound pressure level of noise with low frequency components, a better assessment of health effects would be to use C-weighting." [A "C" filter filters out less of the low-frequency sound.]

"It should be noted that a large proportion of low frequency components in a noise may increase considerably the adverse effects on health."

In other words, the World Health Organization recommends that threshold standards for noise in communities be set lower than 30dB (as measured with the standard "A" filter) whenever the noise has a substantial low-pitched component---as it does from wind turbines. Again, this is because low-pitched noise is more disturbing and has a greater impact on health at low levels than higher-pitched noise. When measuring such noise, a "C" filter will give a more accurate reading of loudness by including more of the low-frequency sounds.

Dr. Amanda Harry, a British physician, found (near a 16-turbine installation in 2003) that 13 out of 14 people surveyed reported an increase in headaches, and 10 reported sleep problems and anxiety. Other symptoms included migraine, nausea, dizziness, palpitations, stress, and depression.[6]

Noise itself can induce dizziness and loss of balance in people with a previous history of noise-induced hearing loss, since, when people damage their hearing through too much exposure to loud (e.g., machine) noise, the balance organs in the inner ear may also be damaged. This is known as the Tullio phenomenon.

Dizziness (specifically, vertigo) and anxiety are neurologically linked phenomena.[7] Hence the anxiety and depression seen in association with other symptoms near wind installations are not a neurotic response to symptoms, but rather a neurologically linked response to the balance disturbances people experience from shadow flicker or low-frequency noise. Sleep deprivation, by the way, also causes anxiety and depression.

Older people, who often sleep less soundly, are more likely to have their sleep disturbed by turbine noise. They may also suffer more disturbances in equilibrium near turbines because of age-related problems with the function of the inner ear (e.g., dizziness and tinnitus: ringing in the ears) or from the nerves or parts of the brain receiving signals from the inner ear. It is noteworthy that among healthy people age 57 to 91, 5% have chronic dizziness, and 24% tinnitus.[8]

Setback

Based on these health effects and hazards, turbines should not be placed within 1700 feet of any road or dwelling. Those living within ½ mile (2640 ft) should be apprised that they are likely to experience very bothersome levels of noise and flicker, which continue (though to a lesser degree) to a mile or more from the turbines. At 2 miles, noise is sometimes heard, but few people are bothered. In Lincoln Township, WI, after two years with the turbines, 73% of people said they would not consider buying or building a house within a mile of the turbines, and 23% wished to be at least 2 miles away (212 people sampled).

It is significant that each of these setbacks (the first for hazard of falling objects, the second for noise) is supported by two unrelated pieces of data yielding the same result. For noise, the data from two wind installations of different ages in different countries, one by resident survey and the other an engineer's measurements, yield the same distance at which noise stops being bothersome: at something greater than 1-1.2 miles. Thus the age or specific type of equipment is not relevant to the noise issue, and specific measurements, properly done, support what neighbors of wind installations are saying.

In conclusion, based on these data, wind turbines should not be built within 1.5 miles of people's homes. Let it be understood, however, that there will still be health and life quality problems caused by wind turbines beyond this radius. People living 1.5 to 3 miles from a proposed turbine site should be notified of potential health and life quality effects, and for this they should be appropriately compensated.

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[1] See photos at **http://www.pbase.com/wp/wind_turbine_photos**.

[2] Personal communication, Prof. Terry Matilsky, Dept. of Physics and Astronomy, Rutgers Univ., Piscataway, NJ. See **http://xray.rutgers.edu/~matilsky/windmills/throw.html**

[3] Bittner-Mackin, E. Excerpts from the Final Report of the Township of Lincoln [Wisconsin] Wind Turbine Moratorium Committee, 12/4/03.

[4] van den Berg, GP, 2004. Effects of the wind profile at night on wind turbine sound. Journal of Sound and Vibration 277:955-970. Contact **g.p.van.den.berg@phys.rug.nl** . For a pre-publication copy of this article, go to **http:/www.nowap.co.uk/docs/windnoise.pdf**

[5] Berglund, B, et al, 2000. Guidelines for Community Noise, World Health Organization. Quoted in Leventhall, G, 2003, A Review of Published Research on Low Frequency Noise and its Effects; see **http://www.defra.gov.uk/environment/noise/lowfrequency/pdf/lowfreqnoise.pdf**

[6] Milner, C. 2004. Wind farms "make people sick who live up to a mile away." Telegraph.co.uk, 1/25/04; see **www.telegraph.co.uk**

[7] Balaban, CD, and Thayer, JF. 2001. Neurological bases for balance-anxiety links. Journal of Anxiety Disorders 15:53-79.

[8] Sataloff, J, et al. 1987. Tinnitus and vertigo in healthy senior citizens without a history of noise exposure. American Journal of Otolaryngology 8:87-89.