Renewable Energy Research Laboratory

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To Whom It May Concern:

We have been made aware of a letter presented at a public meeting held November 1st, 2007, regarding the installation of a wind turbine at Technology Park in Falmouth, MA. The issues raised in this letter have to do with supposed noise emitted from wind turbines, and, by extension, wind turbine setback regulations.

Noise effects:

This letter cited testimony from a Dr. Nina Pierpont, MD stating that: "A setback of 1.5 miles from homes, schools, hospitals, and similar institutions will probably be adequate…to protect people from the adverse health effects of wind turbines." The letter also cites other sources stating similar recommendations. We have been unable to find any information from a reliable (peer reviewed technical publication) that lends any credence to these claims.

In general, potential environmental effects from wind turbines fall into several categories including: noise, visual flicker, safety, and aesthetic or visual impact. In many cases aesthetic or visual impact objections often masquerade as health concerns. This appears to be the case in the work of Dr. Pierpoint who, in many of her publications, shows an inherent dislike of wind turbines, and at the same time, demonstrates a great misunderstanding of wind turbine state-or-the-art technology.

It appears that the main adverse effects that concern objectors are the noise impacts from wind turbine installations. At the University of Massachusetts, we presented a white paper on the subject: (http://www.ceere.org/rerl/publications/whitepapers/Wind_Turbine_Acoustic_Noise_Rev2006.pdf) with its latest revision in 2006. Similar conclusions have been presented by a well-respected consulting firm in New York State- AWS Truewind (see Appendix A). In no case do these reports support the conclusions of Dr. Pierpont or others holding similar views. We also note that this subject is a topic most used by wind turbine opponents, and that not all the information found on the Internet is reliable.

Wind Turbine Setback

As an emerging issue many locales in the U.S. have had no zoning bylaws in place addressing wind turbines. That is changing rapidly. There are a variety of setback distances currently on the books- and most do not specify a setback of 1.5 miles or more.

For example, a quick search of the literature revealed the following:

1) Section 4.2 of a Model Amendment to a Zoning Ordinance or By-law: Allowing Wind Facilities by Special Permit, Prepared by the Massachusetts Division of Energy Resources, Massachusetts Executive Office of Environmental Affairs, includes the following language re: Setbacks:

> **4.2 Setbacks** Wind turbines shall be set back a distance equal to 1.5 times the overall blade tip height of the wind turbine from the nearest existing residential or commercial structure and 100 feet from the nearest property line and private or public way.

2) Many states have setbacks that are similar. For example,

New York, with many wind energy facilities, recommends as one option 1500 feet from residences and 1.1 times turbine height from property lines; Pennsylvania, also home to many large wind plants, specifies distances from residences equal to 5 times the hub height and 1.1 times height from property lines. In Wisconsin, a model draft ordinance requires 1000 feet from residences and 1.1 times height from property lines. In the Oregon Community Wind Guidelines the recommendation is for turbines to be at least 1.5 times height from property lines. The suggested setback from non-participating landowner houses is greater than 1000 feet.

3) Many California counties in which wind turbines are sited require a distance from residences equal to three times the blade tip height (1,200 feet).

4) In Europe, the noise regulations that have arisen to protect against noise impact, almost universally require turbines to be located farther than 1,200 feet from homes.

5) In Denmark, home to over 6000 turbines, the minimum setback is four times blade tip height (1,600 feet)

Again we note that searching on the Internet has become an excellent way to access information that is not always credible.

In general, we think that the proposed set back for Falmouth can be justified and that much of the opposition to such setback lengths is related to a dislike of the visual impact of wind turbines.

Sincerely,

Jon G. McGowan

Jon G. McGowan, Professor

APPENDIX A- AWS TRUEWIND MEMO

AWS TRUEWIND

255 Fuller Road, Suite 274
Albany, NY 12203

TRANSMITTAL

Date: March 6, 2006
To: Vicki Colello, NYSERDA
Re: Wind Energy and Low Frequency Noise

AWS Truewind is pleased to provide you with the following information regarding low frequency noise and wind energy.

Overview of Issue

Low frequency noise, also referred to as infrasound, is the term used to describe sound energy in the region below about 200Hz. The rumble of thunder and the throb of a diesel engine are both examples of sounds with most of their energy in this low frequency range. Wind energy opponents have raised concerns that sound emissions from wind turbines contain sufficiently high levels of low frequency energy to pose a threat to human health. It's been suggested that symptoms included nausea, headaches and anxiety.

To date, there have been no documented direct health effects associated with the level of low frequency noise generated by modern wind turbines. Over the past decade, noise studies conducted at wind farms in the UK, Denmark, Germany and the US have repeatedly shown that the levels of low frequency noise radiated from modern, upwind wind turbines are at a very low level, typically below the threshold of perception. These studies have been peer reviewed and are generally accepted by noise professionals.

Most recently, Vision Quest, a wind power developer based in Canada, presented the results of a study on low frequency noise at the Canadian Wind Energy Conference. This study, conducted by Hepburn Exploration Inc., investigated the presence of low frequency noise at Vision Quest's operating 44 MW Castle River wind farm in Alberta, Canada. The results of their work suggest that wind turbines may reduce ambient infrasound levels at high wind speeds by converting the energy in the wind into electricity. The following list summarizes the key results of the study:

• Evidence shows that low frequency sound pressure levels are often lower when turbines are on, than when off
• Where turbines contribute to sound pressure levels, the magnitude of the contribution is small and in all cases below levels of concern to human health
• Ambient sound pressure levels of low frequency noise are much higher than contributions from wind turbines
• The wind itself generates infrasound
• Wind turbines generate low levels of infrasound, detectable very close to the facilities and detectable at low to medium wind speeds

Dr. Geoff Leventhall, Consultant in Noise Vibration and Acoustics, also authored a recent report on Low Frequency Noise and its Effects. This report measured low frequency noise levels at a proposed wind farm using a calibrated tape recording of noise from a 1.3-megawatt (MW) wind turbine. Leventhall's analysis confirmed the presence of tonal peaks in the low frequency region. However, the levels were found to be below the hearing threshold of most people. The research concluded that noise from the proposed wind farm installation in the low frequency (10Hz to 200Hz) range was unlikely to be a problem. Upon completion of this study, Dr. Leventhall stated:

I can state quite categorically that there is no significant infrasound from current designs of wind turbines. To say that there is an infrasound problem is one of the hares which objectors to wind farms like to run. There will not be any effects from infrasound from the turbines. The turbines produce a modulated higher frequency - the swish, swish – which people may not like, but this is not infrasound. There is no low frequency in it. There is negligible infrasound and very little low frequency noise from wind turbines - a few low level tones from the gearbox. Whatever might be making people ill it is not low frequency noise - there just isn't enough of it from modern wind turbines.

Another study often referred to regarding low frequency noise and wind turbines is a 1987 report examining the 2 megawatt MOD-1 downwind type wind turbine, which had a stiff tower design and was known to have problems with sub-audible vibration. The research showed that if the noise had an impulsive characteristic, then under the right set of circumstances, people could "hear" it within homes in nearby communities. According to the research, downwind wind turbines can produce impulsive noise due to wakes arising from tower structural elements, as was the case with the MOD-1 turbine and its pipe truss design with four cylindrical legs connected by cross-members. Subsequent US research reported in 1991 compared low frequency noise from downwind and upwind machines. This work confirmed the fact that low frequency noise is indeed a function of the downwind turbine configuration. Because the majority, if not all, wind turbines installed in the US and Europe in recent years are upwind machines, low-frequency noise is not an issue.

Web sites

BWEA Summary Page - http://www.bwea.org/ref/lowfrequencynoise.html
BWEA Technical Brief - http://www.bwea.org/pdf/lfn-annex.pdf
AWEA Summary - http://www.awea.org/faq/noise-lf.html

Publications

InfraSound from Wind Turbines – Observations from Castle River Wind Farm. Edworthy, Jason. Vision Quest Inc. Canadian Wind Energy Association Conference, Toronto, October 2005

Defra (2003), A Review of Published Research on Low Frequency Noise and its Effects, Report for Defra by Dr Geoff Leventhall Assisted by Dr Peter Pelmear and Dr Stephen Benton.