May 19, 2009

Dr. Charles Danielson
Chair, Public Health Committee
Maine Medical Association
P.O. Box 190
Manchester, Maine 04351

Dear Dr. Danielson:

The Independent Energy Producers of Maine (IEPM) is a not-for-profit association of renewable power producers, suppliers of goods and services to those producers, and other supporters of the industry. IEPM members generate electricity in a sustainable manner from hydropower, biomass, wind, tidal, and waste to energy. On behalf of the members of the IEPM with interests in wind power, I am writing regarding the ongoing discussion within the Maine Medical Association's (MMA) Public Health Committee on sound and other purported health issues related to the operation of wind turbine facilities in Maine. We understand that the MMA has been asked to consider the medical and scientific facts related to this matter and that the committee will likely be making recommendations in the near future.

The purpose of this letter is to share information relevant to this discussion that may be helpful to the members of the Public Health Committee as they consider this matter.

The information provided herein comes from credible sources that have performed measurements and prepared reports that are consistent with the scientifically objective standards of medical professionals and organizations like MMA. Many of the listed sources/organizations are recognized for their primary research of various aspects of sound produced by utility grade wind turbines (e.g., DELTA) and are principal organizers of internationally recognized specialty conferences (e.g., INCE Europe - 2005, 2007 & 2009) related to causes, effects and mitigation of wind turbine noise (e.g. Leventhal, Pederson, Sondergaard and van den Berg). Several of the listed authors can be found published in a variety of technically peer-reviewed, scientific journals. Caution should be exercised when referring to publications that rely on the author's selection of secondary or tertiary sources of information or when authors have no direct experience with measuring wind turbine sound in accordance with appropriate national and international standards (such as the American National Standards Institute (ANSI) and the International Standards Organization (ISO).

This material also reflects IEPM's strong belief that a science-based approach is essential to considering these matters. Accordingly, we rely on direct measurements and scientifically objective materials, as MMA members and other credible organizations and individuals would. It is imperative that decisions on these matters be based on fact and science to avoid blurring of any legitimate issues with issues created or overstated for the sole purpose of fomenting opposition to wind energy projects. Clearly, any concern that wind turbines may impact someone negatively must be explored. However, we are not aware of scientifically peer-reviewed information demonstrating a link between wind turbines and negative health effects of infrasound and low frequency noise (ILFN). ILFN is produced by all heavy rotating machinery, combustion sources, including domestic furnaces and HVAC equipment commonly found in hospitals. IEPM also urges the MMA to place wind turbine sound levels into the context of other common energy, industrial, commercial, medical, residential, traffic, aircraft and natural sources. These other common sources produce sounds – including ILFN – that equals or substantially exceeds that produced by utility grade wind turbines.

IEPM and its members have gathered a significant amount of information on infrasound, low-frequency sound, and shadow flicker – the most frequently cited concerns related to health effects. We urge committee members to review these materials prior to making any recommendations. Following is a synopsis of relevant studies and sources, with citations linking to each of the studies that have been provided as attachments to this letter.

Infrasound. Low frequency pressure vibrations are typically categorized as *low frequency sound* when they can be heard near the bottom of human perception (<1-200 Hz), and *infrasound* when they are below the common limit of human perception. According to a review by Rogers et al. (2006) of the University of Massachusetts at Amherst, infrasound is always present in the environment and stems from many sources including ambient air turbulence (i.e., wind), ventilation units, waves on the seashore, distant explosions, traffic, aircraft, and other machinery. Although infrasound may not be "heard" based on the normal meaning of the word, under certain circumstances it can be perceived by humans; there is some degree of auditory perception below frequencies of 20 Hz and there are non-auditory mechanisms such as the vestibular balance system and the resonant excitation of body cavities by which humans can sense infrasound (Howe et al.2006).

In the peer-reviewed journal Canadian Acoustics, Dr. Geoff Leventhall, an acoustical expert specializing in wind turbine sound, concludes, "*…it is clear that modern, utility-scale wind turbines do not generate infrasound at levels of concern*."

In November 2006, HGC Engineering was asked to address the issue of infrasound related to wind farms and concluded that *"there is no evidence of adverse health effects due to infrasound from wind turbines."* According to HGC Engineering, while infrasound can and does occur around wind turbines (primarily at very close distances) it is generally below background levels caused by natural sources such as wind (Howe et al. 2006).

In October, 2008, the Canadian Wind Energy Association compiled a list of articles and publications from reputable sources on issues associated with infrasound from wind turbines. CANWEA noted that these publications *"…clearly show that there is no peer-reviewed scientific evidence turbines have an adverse impact on human health."*

Finally, according to a review by Danish Electronics Light & Acoustics (DELTA 2008), *"There seem to be solid evidence and general agreement among researchers and technicians that wind turbines do not emit audible infrasound. The levels are far below the hearing threshold."*

Low-Frequency Sound. The overall sound signature of most wind turbines is broadband. *Low frequency sound* (LF) is the audible sound at the low end of the sound spectrum. It is not a new or mysterious phenomenon. As a general rule, lower frequency sound does carry farther than higher frequencies, and is less likely to be attenuated by structures. *(RISO National Laboratory: " Low frequency noise from MW wind turbines - - mechanisms of generation and its modeling"; April 2008).* This is well known to acousticians and is accounted for in the assessment of environmental sound impacts. According to a review by Danish Electronics Light & Acoustics (DELTA 2008), *"…at distances at 6 hub heights (600m)[1,969 ft] or more, the wind turbine is among the sound sources with the least contribution to LF-noise indoor and outdoor"*.

The terms *infrasound* and *low-frequency sound* are sometimes used erroneously in reference to *amplitude modulation* (AM). Wind turbines make a fluctuating "whoosh-whoosh" sound that results from the rotating blades passing at 1-2 second intervals (i.e., at a low frequency of 1-2 Hz). It is this sound that most experts agree can be objectionable to neighbors (e.g., see Howe et al. 2006, Leventhall 2006, Moorhouse et al. 2007). This sound is within the audible range (typically 500 to 1000 Hz, according to Leventhall 2006), measureable, and here in Maine there are specific regulatory standards that address sounds of this type (see below).

Maine Noise Regulations. Predicting, measuring and regulating environmental sound is a complex and technical undertaking. Here in Maine, wind energy facilities are required to meet the standards set forth in the noise regulations administered by Maine DEP. DEP's current noise regulations were developed with a variety of industrial installations in mind, such as paper mills and power plants; they have been applied to literally hundreds of projects around the state over the last 20 years and have stood the test of time. Though sophisticated, Maine's standards provide relatively clear, consistently applied, measurable standards for all projects. Importantly, Maine DEP regulations stipulate that measurements to demonstrate compliance be made when sound from the operating facility is *most clearly noticeable*. Measurements conducted at Mars Hill are consistent with published studies indicating that the sound from an operating wind facility is most noticeable at downwind locations, at night when there is a mild to strong atmospheric inversion resulting in little or no wind and ground level and moderate to strong winds aloft.

Amplitude Modulation (AM) is addressed under the *short duration repetitive sound* (SDRS) provisions of the DEP noise regulations. If sufficient in magnitude, a SDRS source is subject to a penalty of 5 dB under the regulations. Wind energy facilities are required to consider SDRS for assessing impacts and determining compliance. For example, standards for demonstrating compliance with the SDRS provisions are explicitly set forth in the recently issued DEP Order for the Rollins project in Lincoln, which reads, in part, "*…In consideration of … the potential for SDR sounds to occur, and to ensure that the 45 dBA hourly sound level limit is met during all conditions, the applicant must implement an operational compliance assessment methodology for use during very selective, meteorological and background sound conditions. The compliance assessment method will enable compliance measurements to be determined under the most favorable conditions for sound propagation and maximum amplitude modulation*".

Maine DEP also regulates tonal sound, and a similar 5 dB penalty is applied to sources that meet the criteria for tones. Wind projects in Maine are required to consider tonality for assessing impacts and determining compliance.

In 2008 DEP was asked to review their regulations with respect to wind energy development as part of the *Governor's Wind Power Task Force*. Upon review of their regulations, DEP concluded that,

"*…the existing statute and rules are sufficient to allow the Department to regulate the noise effects of wind power turbines*".

In addition, DEP notes that their noise rules conform to the best practices of the National Research Council's 2007 report on the "Environmental Impacts of Wind-Energy Projects." Maine DEP's noise regulations were written to be protective of human health. The preamble to Maine DEP's noise regulations reads:

The Board recognizes that the construction, operation and maintenance of developments may cause excessive noise that could degrade the ***health and welfare*** *of nearby neighbors. It is the intent of the Board to require adequate provision for the control of excessive environmental noise from developments proposed after the effective date of this regulation.* [emphasis added]

In reviewing the concerns expressed about wind energy projects it is also critical to look at the distances where health concerns are being claimed. A significant number of health effects claims are within 1,500 feet of turbines. The Maine DEP noise regulation requires a "de-facto" setback from nearby protected locations in order to meet specified limits. Maine's quiet area (45 dBA) noise regulations for a neighboring dwelling in most rural residential areas typically requires setbacks from neighboring dwellings in excess of 2,000 feet. Despite this, there can be instances where very low ambient background sounds occur at the ground level when wind turbines are operating in accordance with quiet limits that result in clearly audible wind turbine sounds at distances of 2,000 feet and beyond.

Mars Hill. The Mars Hill facility is a unique case. Most importantly, the project was granted a variance from certain of the noise standards, so it is not subject to all of the same standards as new projects that are coming under review. Further, neighbors expected to hear no sound from the project, and so hearing any sound is contrary to what they expected. Wind turbines do make sound that can be audible to, and under certain circumstances, irritating to neighbors. (DELTA 2007; van den Berg 2006)

Shadow Flicker. Shadow flicker occurs when the blades of a turbine pass in front of the sun to create a recurring shadow on an object. Models in wind development software can determine – down to the hour - the days and times during the year that specific buildings in close proximity to turbines may experience shadow flicker (National Research Council 2007. The effects of shadow flicker are most noticeable within about 1,200 feet and drop off with distance, and are negligible beyond about 10 rotor diameters (i.e., about 2,500-3,000 feet), according to the Northern Ireland Planning Service. The allegation is sometimes made that shadow flicker from wind turbines can cause epileptic seizures, however shadow flicker from wind turbines occurs much more slowly than the light "strobing" associated with seizures (Epilepsy Foundation undated). The strobe rates necessary to cause seizures in people with photosensitive epilepsy are 3 to 30 flashes per second and large wind turbine blades cannot rotate this quickly.

Health Benefits. Not to be overlooked is the very real potential for a shift toward emission-free electricity generation to have substantial human health benefits. Particulate matter in the air, often as a result of power plant emissions, has been shown to affect cardiovascular and respiratory health. The generation of electricity from the wind does not result in any air emissions. Wind energy can offset more polluting forms of energy generation and actually

improve air quality. In 2007, wind energy generation prevented the emission of nearly 28 million tons of carbon dioxide – a greenhouse gas that contributes to climate change (AWEA 2007). Even when the manufacturing process of wind turbines is accounted for, wind energy results in less than two percent of the emissions from coal combustion per megawatt-hour; giving it one of the lowest greenhouse gas lifecycle emissions of any power technology (Kempton and Levy 2007).

In conclusion, we urge committee members to review the enclosed information before making a decision on this matter. We believe the MMA is on stable ground in asserting that existing wind power regulations more than adequately protect the health of the people of Maine. Furthermore, the clean, renewable power these projects generate bring significant environmental and economic benefits to the State, region, and country at large. Thank you for the opportunity to share this material.

Sincerely,

Jeremy N. Payne
Executive Director

cc: Gordon Smith, Executive Vice President
Andrew MacLean, Deputy Executive Vice President & General Counsel
Kellie Miller, Director of Public Health Policy

Enclosures:

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