Attachment F

HHSA – Public Health Policy Statement

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PUBLIC HEALTH POSITION STATEMENT

Human Health Effects of Wind Turbines

The purpose of this position statement is to summarize findings of evidence documented in the current literature on the issue of wind turbines and potential impacts on human health. In particular, this statement seeks to ascertain if the evidence supports the view that there are no direct human pathological effects from wind farms and that any potential impact on humans can be minimized by following existing planning guidelines.

BACKGROUND

With the development of electric power, wind power found new applications in lighting buildings remote from centrally-generated power. Throughout the 20th century, parallel paths developed distributed small wind plants suitable for farms or residences, and larger utility-scale wind generators that could be connected to electricity grids for remote use of power. Since the early 1970's the United States has worked with private industry to advance the technology and enable large commercial wind turbines. This research and development program pioneered many of the multi-megawatt turbine technologies in use today, including steel tube towers, variable-speed generators, composite blade materials, and partial-span pitch control, as well as aerodynamic, structural, and acoustic engineering design capabilities. With today's emphasis on "green" energy technology and the willingness to pay a premium for a renewable energy source, wind turbines have continued to gain prominence as a viable sustainable alternative to more traditional forms of energy production. However, as with any shift in technology, the emergence of the wind farms is not without controversy.

WIND TURBINE FEATURES ASSOCIATED WITH HEALTH CONCERNS

Concerns regarding the adverse health impact of wind turbines focus on the effects of noise, infrasound, electromagnetic interference, shadow flicker, blade glint, and land surface temperature produced by a wind turbine. This document will comment on the evidence for adverse side effects related to each of these wind turbine features.

Sounds and Noise

The health and well-being effects of noise on people have been classified into three categories:

- Subjective effects including annoyance, nuisance and dissatisfaction.
- Interference with activities such as speech, sleep and learning.
- Physiological effects such as anxiety, tinnitus or hearing loss.(1)

There is some evidence that noise is an underestimated cause of stress, which in turn may lead to a number of short- and long-term health problems. Examples of these conditions include sleep disturbance, hypertension and other cardiovascular effects, poorer work and school performance, and hearing impairment.(2) However, there is no evidence that wind turbines pose a unique noise threat compared to other sources of noise. One study of wind turbine and noise found that no adverse health effects other than annoyance could be directly correlated with noise from wind turbines. The authors concluded that reported sleep difficulties and feelings of uneasiness noted by individuals could either be an effect of noise exposure or could be due to respondents with sleeping difficulties more easily appraising noise as annoying. The study also found that being able to see wind turbines from one's residence increased not just the odds of perceiving the sound, but also the odds of being annoyed, suggesting a multimodal effect of the audible and visual exposure from the same source leading to an enhancement of the negative appraisal of the noise by the visual stimuli.(3)

Another issue of concern that has been raised is about infrasound from wind farms. It has been noted that the effects of low frequency infrasound (less than 20Hz) on humans are not well understood. However several authors have suggested that low level frequency noise emitted by wind turbines is minimal and of no consequence; and have concluded that there is no evidence of health effects arising from infrasound generated by wind turbines.(4-7)

An opposing view in regards to noise is put forth by a pediatrician, Dr. Pierpont who states that noise from wind turbines produces a cluster of symptoms which she terms Wind Turbine Syndrome (WTS). She has released a book entitled *Wind Turbine Syndrome: A Report on a Natural Experiment*, presenting case studies explaining WTS symptoms in relation to infrasound and low frequency noise.(8) However, Dr. Pierpont's assertions are yet to be published in a peer-review journal.

Electromagnetic Radiation (EMR) and Interference

Electromagnetic radiation (EMR) is a wavelike pattern of electric and magnetic energy moving together. Types of EMR include X-rays, ultraviolet, visible light, infrared, and radio waves. Electromagnetic interference from wind turbines may affect electromagnetic or radiocommunication signals including broadcasting radio and television, cell phones and radar.

The emanations of electromagnetic fields (EMF) are due to generation and export of electricity from the wind farms. EMFs routinely emanate from wires that carry electricity and individuals are constantly exposed to these fields in their everyday lives. The closeness of the electrical cables between wind turbine generators to each other, and shielding with metal armor effectively eliminate any EMF and therefore, wind farms do not pose a threat to public health.(9)

Shadow Flicker and Blade Glint

Shadow flicker occurs when the sun is located behind a wind turbine casting a shadow that appears to flicker on and off as the wind turbine blades rotate. Shadow flickers that interrupts sunlight at flash frequencies greater than 3Hz has the potential to provoke photosensitive seizures.(10) Therefore, it is recommended that wind turbines should only be installed if flicker frequency remains below 2.5Hz under all conditions.

According to numerous research papers there is negligible risk of seizures being caused by modern wind turbines for the following reasons:

- Less than 0.5% of the populations are subject to epilepsy at any one time, and of these, approximately 5% are susceptible to strobing light.
- Most commonly (~96% of the time), those that are susceptible to strobe lighting are affected by frequencies in excess of 8Hz and the remainder are affected by frequencies in excess of 2.5Hz.
- Alignment of three or more conventional horizontal axis wind turbines could cause shadow flicker frequencies in excess of 2.5Hz; however, this would require a particularly unlikely turbine configuration.

In summary, the evidence from shadow flicker does not support a health concern as the chance of conventional horizontal axis wind turbines causing an epileptic seizure for an individual experiencing shadow flicker is less than 1 in 10 million.(5)

In regards to blade glint, the information is promising. Manufacturers of all major wind turbine blades coat their blades with a low reflective treatment which prevents reflective glint from the surface of the blade.

Land Surface Temperatures

A recent study by researchers using NASA satellites that analyzed the surface temperature of wind farms located in Texas found that temperatures rose an average of 0.72 Celsius between 2003 and 2011. This temperature effect was most prominent at night and the research team speculated that this localized trend could be an effect of the turbines pulling down warm air from higher altitudes at night, when the air above the land would otherwise be cooler.(11)

The researchers stated that the estimated warming trends only apply to the study area region and to the study period, and thus should not be interpolated linearly into other regions or over longer periods. They warned that further science is needed to determine any possible link between the spinning of turbine blades and the increase in ground temperature.

Summary of Evidence Regarding Health Impacts

Based on the findings provided above the evidence related adverse health concerns associated with wind turbines is summarized as follows:

- While the sound and noise associated with a wind turbine may cause annoyance, low frequency infrasound (less than 20Hz) on humans is not well understood and researchers have concluded that there is no evidence of health effects arising from infrasound generated by wind turbines.
- The closeness of the electrical cables between wind turbine generators to each other, and shielding with metal armor effectively eliminate any EMF and therefore, wind farms do not pose a threat to public health.
- There is negligible risk of seizures being caused by modern wind turbines.
- Lastly, further science is needed to determine any possible link between the spinning of turbine blades and the increase in ground temperature.

CONCLUSION

The health effects of many forms of renewable energy generation, such as wind turbines, have not been assessed to the same extent as those from traditional energy sources (e.g., fossil fuel, radiation, etc.). The pathological effects on humans due to wind farms have only recently begun to be studied. This review of the available evidence, including journal articles, surveys, literature review and government reports, supports the statement: *There are no direct pathological effects from wind turbines and that any potential impact on humans can be minimized by following existing planning guidelines.*

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