

# SCHOMER AND ASSOCIATES, INC.

Consultants in Acoustics and Noise Control

Paul D. Schomer, Ph.D., P.E.  
Member; Board Certified  
Institute of Noise Control Engineering

2117 ROBERT DRIVE  
CHAMPAIGN, ILLINOIS 61820  
PHONE: (217) 359-6602  
FAX: (217) 359-3303

Public Service Commission of Wisconsin  
RECEIVED: 02/08/13, 12:01:14 PM

February 8, 2013

Kathleen J. Zuelsdorff  
Environmental Analysis and Review Coordinator  
Public Service Commission of Wisconsin  
610 North Whitney Way  
P.O. Box 7854  
Madison, W 53707-7854

Re: Application of Highland Wind Farm, LLC, for a Certificate of Public Convenience and Necessity to Construct a 102.5 Megawatt Wind Electric Generation Facility and Associated Electric Facilities, to be Located in the Towns of Forest and Cylon, St. Croix County, Wisconsin.  
Docket No. 2535-CE-100; Supplemental Environmental Assessment

Dear Ms. Zuelsdorff:

The Town of Forest requested that we respond to the Supplemental Environmental Assessment's conclusion of "no significant impact" to the environment based upon the recent Shirley Wind Farm study. It is my opinion that the Shirley Wind Study does show the need for an Environmental Impact Statement for the reasons outlined below:

The January, 23, 2013, Supplemental Environmental Assessment for the Highland Wind Farm Project," makes the following statements:

1. "The team of acousticians who conducted the measurements at Shirley appear to agree that the results clearly show infrasound at frequencies corresponding to the wind turbine blade pass frequency and associated harmonic frequencies, both inside and outside one of the three residences where measurements were taken. *While the members of the team do not dispute that infrasound at these frequencies exists, the absence of turbine on/off measurements limits the conclusions that can be drawn regarding the magnitude of the infrasound component of the wind turbine noise relative to the ambient sound level.* The study did not include a health impact component other than reporting observations of how several area residents and study team members felt."
2. "The Shirley Report contained recommendations for further measurement and testing of ILFN from wind turbines, in particular during controlled turbine-on/turbine-off conditions.

3. The project EA included the consideration of potential health effects from wind turbine noise. Commission staff is preparing this Supplemental EA to acknowledge the Shirley Report and determine whether the report would lead to conclusions or recommendations different than those in the EA.

4. EA Considerations. The consideration of wind turbine noise and potential health effects is found on pages 18-23 and page 30 of the EA. *Overall, the evaluation noted that research studies done to date suggest that there is a wide variability in how people react to wind turbine noise and that many people do not appear to be affected. The studies do, however, support the concern that some people react negatively to wind turbine noise, primarily through annoyance and sleep disturbance.* There is no known way to anticipate who may react negatively to a new wind turbine project.

5. The EA's noise evaluation made substantial use of two comprehensive reviews of wind turbine noise and health. The two reviews were conducted by the Minnesota Department of Health in 2009 and the Massachusetts Department of Health and Department of Environmental Protection in 2012.

6. The Massachusetts report included an extensive discussion of potential health effects of infrasound and low frequency noise. When summarizing that discussion the report stated:

*'Both the infrasonic and low frequency noise ranges were considered. Assertions that infrasound and low frequency noise from turbines affect the vestibular system either through airborne coupling to humans are not empirically supported. In the multitude of citations given in the popular media as to methods in which the vestibular system is influenced, all refer to situations in which there is direct vibration coupling to the body or when the wave amplitudes are orders of magnitudes greater than those produced by wind turbines. Recent research has found one potential path in the auditory system, the OHC4, in which infrasound might be sensed. [referring to Salt and Hullar 20105] There is no evidence, however, that when the OHC sense infrasound, it then leads to any of the symptoms reported by complainants. That the infrasound and low frequency noise couple to humans through the forcing of structural vibration is plausible but has not been demonstrated for modern wind turbines.'*

The Commission staff then observes that the Falmouth study and the Shirley study are essentially the same and yield very much the same results. They state:

7. Shirley and Falmouth Reports.

*"The Falmouth project report included a graphic representation of the inside/outside sound measurements at the home. The graphic shows patterns and levels of infrasound and low frequency noise that are similar in many ways to those presented for the R2 residence in the Shirley Report. The similarities present in both studies' infrasound range sound level peaks, are described as being harmonic frequencies of the turbine's blade*

*passage rate. The blade pass rate for turbines at both sites was 0.7 Hz. The harmonic sound level peaks appear to be present at the same frequencies (1.4, 2.1, 2.8, 3.5, 4.2, and 4.7 Hz). The graphic representations from both studies also show reduced indoor noise attenuation compared to outdoor sound levels in the low frequency range of about 10 – 30 Hz.*

"The Falmouth sound characterization did show and describe two other sound level spikes, present both inside and outside the house. These were at 22.9 and 129 Hz. These two peaks do not appear to be present in the Shirley test results."

*"The magnitudes of the sound levels measured at both sites were also similar in the infrasound and low frequency ranges."*

*"However, the absence of turbine on/off testing at the Shirley site limits the confidence that can be given to the measured magnitude of the ILFN component of the wind turbine noise relative to the ambient sound level."*

"Both the Falmouth report and Mr. Rand's appendix in the Shirley Report describe how the researchers felt during their data collection efforts."

## 8. Evaluation.

"Commission staff placed considerable weight on the evaluations and findings in the Massachusetts report when preparing the Highland project EA, including the report's discussion and conclusions regarding ILFN. This supplemental EA looks at the Shirley Report in light of whether it contains '[N]ew information about the proposed action's potential to affect the quality of the human environment in a significant manner or to a significant extent not already considered in the EA."

"Specifically regarding the Falmouth report, the Massachusetts review noted that:"

'...the measurements shown in the report are atypical within the wind turbine measurement literature and the data analysis is not fully described. Also, the report offers no plausible coupling mechanism of the sound waves to the body beyond that proposed by Salt and Hullar (2011 [sic]). Because of this, the results are suggestive but require corroboration of the measurements and scientifically based mechanisms for human health impact'

Essentially, the Commission staff makes three major points:

1. The Shirley study measured very low-frequency noise from the wind turbines but the measurements are not reliable because Duke would not cooperate.
2. The only, potential *proven* health effects from wind turbines are primarily annoyance and sleep disturbance.

3. There is absolutely nothing new in the Shirley study; it is almost an exact repeat of Falmouth, except for a couple of extraneous sonic tones found at Falmouth and not found at Shirley.

**Reliability of Shirley Data.** Above about 8 Hz, it was not possible to say what was wind noise and what was from the turbines. This is what all the researchers said and what is correct. But below about 5 to 8 Hz where all of the blade passage frequency harmonic tones are evident at R-2, the measurements are accurate and relate to the turbines; the effect of extraneous noise, wind or other, is not significant. These measurements at R-2 below about 5 to 8 Hz are to be relied on. This frequency range, below about 5 to 8 Hz, is the range where the important data reside. These are the acoustic energies that appear to be making people ill. The Shirley report concluded:

"This cooperative effort has made a good start in quantifying low frequency and infrasound from wind turbines."

"Unequivocal measurements at the closest residence R2 are detailed herein showing that wind turbine noise is present outside and inside the residence."

We made this statement because all the acousticians believed that we had good data that was not corrupted by noise.

**Health Effects as Annoyance.** There is no question that there is blurred line between health effects and annoyance. An Environmental Impact Statement would help to clarify the differences. One thing was very clear to me in working with the residents at Shirley. None of these people left their homes because they were "annoyed". They left because they were sick. They felt they had no choice. Any one who has ever been on a boat in rough weather in contact with someone suffering from motion sickness or who has experienced it first hand will understand the difference. The first impulse a sea sick person has is to get off the boat as quickly as possible. Nothing else matters as it is impossible to function normally in a state of abject misery. Sleep is impossible which adds to the severe malaise. In the wind turbine scenario the home becomes the boat as the exposure to frequencies causing nausea are present as they were at R-2. The major difference is that instead of getting off the boat, these people have left their homes which is a common reaction to ultra low frequency sound which we found to be produced at Shirley

**The Shirley Study Added no Additional Knowledge.** It appears the staff has missed the important findings of the Shirley study:

A. *Falmouth.* I agree that what was accomplished at Shirley is virtually identical in every significant way to what was done at Falmouth. But we must look at what the MA study is saying in the paragraph of the MA study that the Commission staff quotes that is repeated here in just above the 3 numbered assertions. The MA study says ".....the measurements shown in the report [Falmouth] are atypical within the wind turbine measurement literature..." George Hessler obviously agreed that measurements at these very low frequencies are atypical when he wrote in the report:

"The four investigating firms are of the opinion that enough evidence and hypotheses have been given herein to classify LFN and infrasound as a serious issue, possibly affecting the future of the industry. It should be addressed beyond the present practice of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies."

This statement applies to Highland. The effects of the very low frequency infra-sound should be addressed in an EIS in this case and it should go beyond the present practice of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies.

But this very important paragraph from the MA study quoted by the Commission staff and repeated above says more. It says that the Falmouth measurements "require corroboration" and there needs to be a scientifically based "*plausible*" coupling mechanism of the sound waves to the body. It is highly significant that Shirley does corroborate both the effects on people and the physical acoustic emissions found at Falmouth. No result could be more important to establish an important scientific principle of the presence of ultra low frequency sound from wind turbines than an exact duplication of the Falmouth study.

*B. Health Effects from LFN.* Shirley exactly replicates not only the physical measurements, but also the health effects, the nausea, the tiredness and feeling ill. The MA study did not call for multiple replications of Falmouth. One replication is more than sufficient and adds considerable weight to the knowledge on this subject and explaining that the residents of Glenmore left their homes because of the presence of low frequency noise from wind turbines. This same paragraph from the MA study calls for *a scientifically based "plausible" coupling mechanism of the sound waves to the body.* In addition to the work of Alex Salt which was attached as Exhibit 15 to my LFN testimony some of which was published after the Massachusetts study, I presented an additional explanation for the health symptoms of nausea which research shows is caused by the presence of ultra low frequency acoustical energy of less than 1 Hz.

This explanation of what is happening at Shirley is more than just plausible. My research has confirmed the following: (1) the otoliths fundamentally sense pressure, not acceleration, (2) that there is a viable pathway for the acoustic energy to reach the otoliths, (3) that the order of magnitude of the force on the otoliths from acoustic pressures is the same as the order of magnitude of the force on the otoliths due to acceleration, and (4) that details in the description of the Shirley residents have given me of some effects fit, and only fit, with a stimulus of a scalar like acoustic pressure in a closed space (i.e., the inner ear) in contrast to a vector like acceleration. In other words, this effect that they describe can only occur if the pathway through the ear as outlined above is reacting to the wind turbine acoustic energies as I have outlined above.

**Recommendations from the Massachusetts and Minnesota Studies.** On a different note, the Commission staff says they are relying heavily on the MA and MN studies, but they fail to comment on the most important recommendations that each study makes with respect to

avoiding impact on the human environment. The concluding chapter in the MA study includes the table given below. This table from the MA study supports the same noise limit that is the average of the level suggested by George Hessler and me for residential areas in the Shirley Study to avoid health problems in Forest: 37dBA.

Promising Practices for Nighttime Sound Pressure Levels by Land Use Type

Land Use	Sound Pressure Level, dB(A) Nighttime Limits
Industrial	70
Commercial	50
Villages, mixed usage	45
Sparsely populated areas, 8 m/s wind*	44
Sparsely populated areas, 6 m/s wind*	42
Residential areas, 8 m/s wind*	39
Residential areas, 6 m/s wind*	37

*\*measured at 10 m above ground, outside of residence or location of concern*

And the MN study's total recommendations with respect to sound are:

"To assure informed decisions:

- "Wind turbine noise estimates should include cumulative impacts (40-50 dB(A) isopleths) of all wind turbines.
- "Isopleths for dB(C) - dB(A) greater than 10 dB should also be determined to evaluate the low frequency noise component."

In summary, the Shirley study added considerably to the knowledge base of why some people leave their homes when mega wind turbines are built nearby and requires an Environmental Impact Study to assess the costs and benefits of such a project. I give this opinion for the following reasons:

First, the Wind Industry has continually denied that wind turbines produce any LFN. This study showed that it does. At R-2 it was measured as clearly as if the turbine had left a fingerprint on the inside of the house.

Second, the Shirley study fully and completely corroborates Falmouth and fills the knowledge gap suggested by the MA study which was a literature review, not a hands-on field study. There is no reason to corroborate it again.

Third, the measurement of ultra low frequencies produced by mega turbines such as those at Shirley and proposed for Highland are the key to avoiding significant impacts to human health from wind turbines. As the Minnesota study concludes, the low frequencies must be studied further as part of the project planning. In the case of Forest, this study of the low frequency isopleths must be a part of an in-depth EIS, or the project must be redesigned with smaller turbines that are not likely to precipitate such severe health problems that people have no choice but to abandon their homes. These are precisely the studies that we recommended in our Shirley report and the EIS is a perfect way to obtain the information before the project is built; and

Fourth, the record as a whole in this case as well as the literature and case studies all over the world have suggested that people are leaving their homes because they are being exposed to significant levels of pulsating ultra low frequency sound produced by wind turbines. In addition there is no question that larger turbines produce more infrasound below 1 hertz which increases the likelihood that health problems will occur unless noise limits are dramatically reduced through the use of smaller turbines or lower noise limits are required at each house. To conclude that the Highland project will have no significant impact to the human environment and that no further study is needed in the face of people leaving their homes on an identical project is wishful thinking and in my opinion will be proven to be wrong if the project is built as designed.

Sincerely,

A handwritten signature in black ink that reads "Paul Schomer". The signature is written in a cursive, flowing style.

Paul Schomer, PHD, P.E.

Member; Board Certified, Institute of Noise Control