E-Coustic Solutions, LLC

NOISE CONTROL ● SOUND MEASUREMENT ● CONSULTATION
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To: Mr. George Holborn

Subject: Infra and Low Frequency Noise Impact of Utility Scale Wind Turbines on Residents of Wind Projects

Dear Mr. Holburn:

I would like to address the potential for adverse impacts to people who are living in or near the footprint of 4.2 MW wind turbines.

First, it should be recognized that this size of wind turbine is new. There is no experience using land-based turbines of this size in communities with residential and rural property where people occupy or work in homes and other structures. What is known about the larger models beginning with the 2 and 2.5 MW wind turbines of the type operating in the Wisconsin Shirley Wind Project is that they produce significant infra and low frequency pulsations that result in a consistent set of complaints that related to sensations of pressure, tinnitus, dizziness, nausea, headaches, etc.. None of these effects can be explained as being an effect of audible sounds. Those are more commonly associated with annoyance and sleep disturbance. Even larger wind turbines will produce more infra and low frequency sound even if they produce the same A-weighted sound levels as did earlier models. The acoustic energy shifts into lower frequency as size increases.

While the Shirley wind project consists of only eight 2.5 MW wind turbines located in a rural area with mixed agricultural, dairy, and residential land use has resulted in 3 families abandoning their homes (distances of 3500 feet to over one mile from the nearest wind turbine) and over 50 complaints from other families. The Brown County Health Department has declared a 2.5-mile zone around that project to be a "Human Health Hazard" which is a formal status under Wisconsin Law.

This project has been heavily studied by a variety of acousticians, including myself, who have concluded that infra sound is a special problem with these larger models and that it must be considered as a source of adverse impacts on the people living near them. Dr. Paul Schomer, Emeritus Director of the Acoustical Society's Standards Committee has studied the Shirley Wind homes and published a paper describing the vestibular mechanism that is triggering the reported symptoms[1]. Recent laboratory studies[2] have shown that in blinded experiments test subjects who self-identify as being sensitive to wind turbine infra and low frequency sound can sense the pressure pulsations at sound levels far below the threshold of audibility. In other words, the test subjects could not hear any sound when the pulsations were present, but hey could feel it and determine the direction from which it was being produced. Some of the test subjects who did not sense the pulsations at wind projects were able to sense the pulsations in the laboratory study while others did not. The ability to sense the pulsations under controlled laboratory conditions supports the current understanding that the wind turbine's pressure pulses are linked to the complaints and that

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[1] Schomer, P.D., et. al, "A theory to explain some physiological effects of the infrasonic emissions at some wind farm sites," published in the peer reviewed Journal of the Acoustical Society of America, Pages 1356-1365, February 2015.

[2] Cooper, S. E., "Subjective Perception of wind Turbine Noise – The Stereo Approach" published in the Proceedings of Meetings on Acoustics, 174th Meeting, Dec. 2017, paper 4pNS5.

other theories, such as the NOCEBO effect, which rely upon people's imagining the sensations are not correct.

These studies, and the experience I have gained in working at a number of wind projects for groups of people living with wind utilities around their property, have moved the arguments about safe distances and sound levels of audible noise outwards to be more protective. In 2008 I used standard acoustical procedures to determine the proper sound level for wind turbines of the 1.5 MW size in quiet rural communities. I concluded that the limits would need to be 35 dBA (Leq) to not result in annoyance or sleep disturbance and that a setback of 1.25 miles would be protective. I can no longer say that 1.25 miles is enough. There is increasing evidence that, for those who are sensitive to the pressure pulsations, even larger setbacks are required.

Dr. Schomer has also published a paper where he applies the same acoustical procedures I used in 2008 to arrive at the limit of 35 dBA (Leq).[3] He applies three different models and arrives at the conclusion that wind turbine sounds should be limited to no more than 36 to 38 dBA (Leq). This low limit is needed to account for the pulsations and low frequency tones and other characteristics that are not addressed with a dBA standard. In other words, the sound emitted by the larger model wind turbines needs dBA limits that are very low because the real source of complaints are not adequately measured using the A-Weighting scale.

I would urge the local government to set limits that are protective. 38 dBA (Leq) should be the maximum threshold, if A-weighting is used for the criteria. If a C-weighted criterion was considered, it should be 50 dBC (Leq). It would be best for a large setback and protective threshold to be set by the local authorities. This does not preclude the developer with entering into agreements with non-participating landowners to compensate them for any noise trespass on their properties and for the resulting annoyance and other adverse impacts.

Sincerely,
E-Coustic Solutions LLC

Richard R. James

[3] Schomer, P. D., et. al., "A possible criterion for wind farms," published in the Proceedings of Meetings on Acoustics, 173rd Meeting, June 2017, paper 4aNSb3.