BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Wisconsin Electric Power Company for a Certificate of Public Convenience and Necessity to Construct a Wind Electric Generation Facility and Associated Electric Facilities to be known as the Glacier Hills Wind Park, Located in the Towns of Randolph and Scott, Columbia County, Wisconsin	Docket No.6630-CE-302

SURREBUTTAL TESTIMONY OF RICHARD R. JAMES ON BEHALF OF THE COALITION FOR WISCONSIN ENVIRONMENTAL STEWARDSHIP

Q. Please state your name and address.

A. Richard R. James.

Q. Are you the same Richard R. James who offered direct testimony in this case?

A. Yes.

Q. What is the purpose of your surrebuttal testimony?

A. I am testifying in response to the rebuttal testimony of George Hessler, Mark Roberts, and Geoff Leventhal, filed on behalf of Wisconsin Electric Power Company.

Q. Do you agree with Mr. Hessler's critique of your direct testimony?

A. No, I do not.

Q. How have you organized your responses to Mr. Hessler's rebuttal testimony?

A. I have organized my responses into three sections: Ambient Sound Measurements, Validity of Noise Modeling, and Sleep Interference.

Ambient Sound Measurements.

Mr. Hessler takes issue with criticisms raised in Mr. Kamperman's study (as summarized in my direct testimony) with respect to location of test sites and with other aspects of his 2009 testing for Glacier Hills. These criticisms were not rebutted by Mr. Hessler and remain as questions about whether the tests appropriately characterize the ambient conditions at residences in the project footprint.

In addition, Mr. Hessler takes umbrage at the question raised in my testimony that: "It may be that Mr. Hessler selects his test sites with the intention of biasing the test results." This question was prefatory to the discussion of the Cape Vincent Study by Paul Schomer, Ph.D. of work by Hessler and Associates, which stated:

> Hessler's BP study for the Cape Vincent Wind Power Facility appears to have selected the noisiest sites, the noisiest time of year, and the noisiest positions at each measurement site. Collectively, these choices resulted in a substantial overestimate of the a-weighted ambient sound level, 45-50 dB according to Hessler.

Given that Mr. Kamperman raised similar concerns about the test sites selected for Glacier Hills, it is not unreasonable to ask whether there is a similar explanation for findings at Glacier Hills.

Mr. Hessler confuses the questions that were raised by observations made at Glacier Hills and the Schomer Report. Kamperman and I made no assertion about motives. Any issue Mr. Hessler has on that aspect is between his firm and Dr. Schomer.

Mr. Hessler refers to a paper[1] he presented at the 2009 Inter-Noise Conference in Ottawa, Canada. This paper is included in my previously filed exhibit 809. In this paper, Mr. Hessler acknowledges the concerns about contamination of the background sound level tests by wind, insects, short duration events that are not part of the background soundscape, etc. He also acknowledges that background sound levels in rural communities would be expected to be 30 dBA and below. He states:

> The very quiet rural description range of 26 to 30 dBA is based on a survey of acoustical consultants representing some 180 plus years of experience. Levels in very remote wilderness areas may be lower than the ranges shown during calm and still measurement conditions but the ranges apply to occupied residential receptors."

Mr. Hessler concludes: "It is shown that L_{Aeq} is not a good metric for quantifying levels in quiet environments, at least if the data is to be used for noise impact studies. L_{A50} and L_{A90} are better metrics."

Table 1 – Glacier Hills Background Sound Levels from 2009 Tests

	Site 1		Site 2		Site 3		Site 4	
2009 Study By:	**L_{A90}**	**L_{A50}**	**L_{A90}**	**L_{A50}**	**L_{A90}**	**L_{A50}**	**L_{A90}**	**L_{A50}**
Hessler	27.6	30.6	20.4	24.4	21.0	23.2	20.6	25.2
Kamperman	20.8	22.6	26.0	29.6	21.8	23.1	30.9	35.0

Table 1 shows the data for these two metrics from the two 2009 studies at Glacier Hills by Mr. Hessler and Mr. Kamperman. This table supports the

[1] Hessler, G., "Measuring ambient sound levels in quiet environments," Inter-Noise 2009, Ottawa, Canada, August 23-26.

statements in Mr. Hessler's Ottawa presentation regarding typical sound levels in quiet rural communities quoted above. However, Mr. Hessler is unwilling to call these values the background sound for the community, arguing:

> Nevertheless, experience indicates the worst case for potential noise annoyance occurs when winds are light at ground level but sufficiently high to operate the wind turbines. It is unduly conservative to estimate the increase in level due to turbine operation based on minimum ambient levels when the turbines will not operate.

He then proceeds to reintroduce his regression analysis, which presumably shows that: "The LA90 baseline level is seen to be 33 dBA when wind turbine operation begins." This statement is based upon an assumption that wind turbines only produce noise when the wind speeds at the ground level are high enough to result in noise from vegetation and turbulence around ground structures and obstacles. Acoustical consultants for wind utility developers frequently make this assumption, but it is without basis in fact.

Numerous studies have shown that wind turbines can be operating at nominal or higher power production during conditions when the ground level winds are calm and there is no noise from vegetation and turbulence around ground structures to mask the wind turbines. I have conducted almost all of my studies of operating wind turbines under the condition of wind speeds at the ground level (not 10m measurement, but ground level measurements) where winds are less than 2.2 m/s (5 mph). I have also confirmed that many of the complaints made about excessive wind turbine

noise by residents living in the footprint of operating wind generators are made when wind speeds at the ground level are calm.

The appropriate background sound levels against which the Glacier Hills project should be judged are those reported in Table 1 above, not the L_{A90} sound levels Mr. Hessler proposes to substitute under his assumption that ground level winds are required for operation of the turbines. This is explained in more detail in the reference paper submitted with my direct testimony by Mr. Clif Schneider[2] stating:

> Stable conditions occurred in 67% of nights and in 30% of those nights, wind velocities represented worst-case conditions where ground level winds were less than 2 m/s and hub-height winds were greater than wind turbine cut-in speed, 4 m/s.

There is no reason to believe that the stable weather conditions referred to for New York are any different in Wisconsin.

Validity of Noise Modeling

Mr. Hessler's faith in the estimates of wind turbine noise propagation models based on ISO 9613-2 as implemented in Cadna/A, demonstrates a lack of understanding of the limitations that the ISO 9613-2 document includes in the body of the Standard. However, I stand by the statements made in my direct testimony explaining how experience shows they are not accurate.

Contrary to Mr. Hessler's protestations, sound propagation models are not precise instruments, and are not any better than the input data used

[2] Schneider, C. "Measuring background noise with an attended, mobile survey during nights with stable atmospheric conditions" Inter-Noise 2009 Ottawa

to represent the noise source and accuracy of the algorithms used to represent how sound decays with increasing distance from the location of each source. Errors in models of wind turbine noise propagation located on flat terrain have been shown to have errors of 5 to 10 dB or more when studied by independent acoustical engineers (See studies by Kaliski in exhibit 809)

In his paper, Mr. Kaliski notes that he produced four (4) different models of a simple wind turbine layout using the various options and settings provided in Cadna/A. He then goes on to state that his “real world data” matched only one of the four models' predicted sound levels. This does not prove that the model is accurate. It only proves that Mr. Kaliski found one of his four models produced sound levels that were close to the real world measurements.

Cadna/A has so many tweaks and options that there is no way its use can be calibrated unless numerous independent studies are done. For the example in Mr. Kaliski’s paper and in Mr. Hessler’s claim that these studies confirm the model’s accuracy, it is my opinion that any such "matching" of model to real world results are more likely a case of seeking the set of Cadna/A variables that support the conclusion than it is any sign that models are accurate.

It should be expected that errors of 5 dBA or higher would be found in models of more complex terrain such as is found in the community near Glacier Hills' footprint even if the follow up study was

done by independent experts and the models' assumptions for the state of turbine power generation, wind speed and direction are carefully matched. The fact that Mr. Hessler finds no such errors when he checks his own models proves nothing about model accuracy. This is not independent validation.

There are independently validated models that are accepted as being accurate enough for planning purposes used by the Federal Highway Administration and the Federal Aviation Administration. Those models have undergone much development for specific noise sources and have been independently validated by experts not involved in creating the models.

When errors in models are identified by projects that do follow the models' predictions, the models are revised or cautions for the circumstances that lead to those errors are available. This is not true for wind turbine project models. Each wind project model is unique and validation attempts to date have been flawed by poor protocols and documentation.

Sleep Interference

Mr. Hessler asserts that the World Health Organization's most recent documents and criteria on nighttime noise and health support his position that sound levels above 40 dBA ($L_{night\text{-}outside}$) are acceptable. He states: "The final document from WHO[3] states in a crystal clear manner in

[3] World Health Organization 2009, Night Noise Guidelines For Europe, ISBN 978 92 890 4173 7

the Abstract and the report body that an "outside level of 40 dBA should be the target of the Night Noise Guidelines for Europe (NNG) to protect the public …" This is an incomplete representation of the 2007 and 2009 WHO statements. The 2007 document states:

> "Lnight,outside 30 dB is the ultimate target of Night Noise Guideline (NNGL) to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise."

The 2009 document states:

> The LOAEL of night noise, 40 dB $L_{night,outside}$, can be considered a health-based limit value of the night noise guidelines (NNG) necessary to protect the public, including most of the vulnerable groups such as children, the chronically ill and the elderly, from the adverse health effects of night noise.

There is no conflict between the 2007 and 2009 documents; just a different goal. On the one hand, the 2007 WHO guidelines set 30 dBA as the target to protect the public, while on the other hand,, the 2009 WHO guidelines state that 40 dBA should be considered as the health-based limit value. Limit values are "limits," not "targets." A value of 40 dBA is a not-to-exceed-without-risk-of-harm limit.

The two documents confirm that WHO's post-2000 research shows that if the $L_{night\text{-}outside}$ is 30 dBA or lower, the environment can be considered as safe and healthful for sleep. When the $L_{night\text{-}outside}$ is 40 dBA or higher, the data is sufficient to establish that adverse health effects will be experienced by the vulnerable groups. Mr. Hessler's confusion over what these values represent is apparent when he draws his conclusion (above) that WHO's 2009 document sets 40 dBA as the target one should

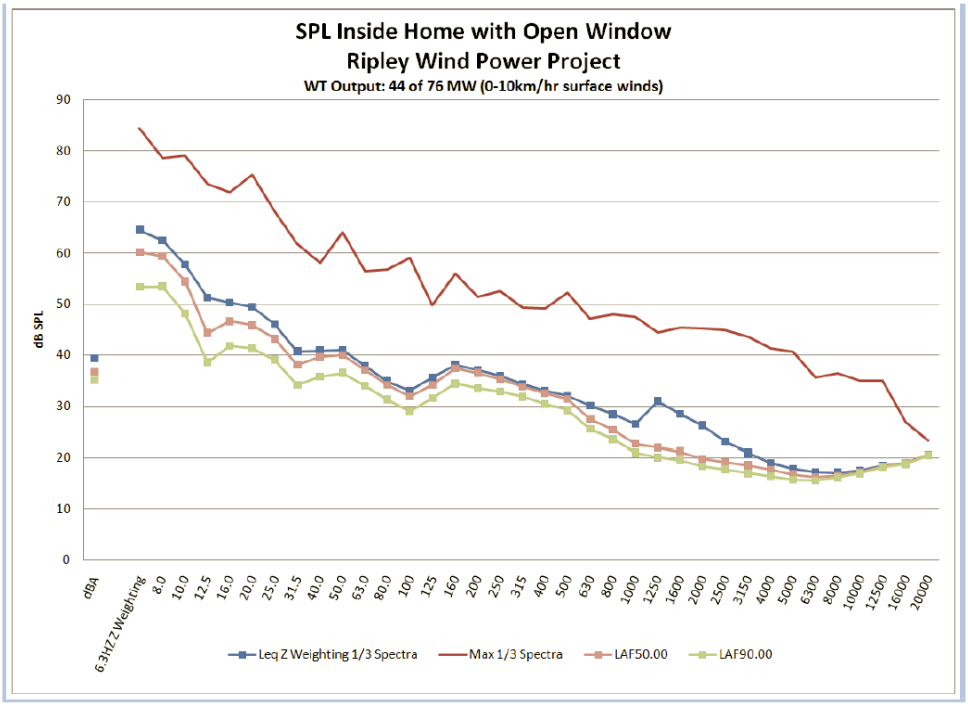
try for. A level of 30 dBA is reasonable in light of the current nighttime background sound levels of less than 30 dBA (L_{A90}). A level of 40 dBA or higher would clearly put the public's health and well being at risk.

Mr. Hessler's contention that the criteria should be even higher than 40 dBA is based on his incorrect assumption that wind turbines do not produce significant low frequency sound, and thus will not be an indoor noise problem. Given the information showing that low frequency sounds are the dominant form of sound emitted by wind turbines (as stated in my direct testimony), it seems unusual that Mr. Hessler would reintroduce his opinion that the walls of a home would be effective in reducing the low frequency rumble that is experienced inside homes, especially evident at night when the bedroom is quiet.

The subject of low frequency noise is addressed on pages 9-12 of the Kamperman-James "How to… Guide," which is included in exhibit 809. Low frequency noise was also highlighted in the 1990 NASA study[4] by Hubbard and Shepherd (See: Noise Exposure Inside Buildings, page 35-39) to the effect that low frequency turbine sounds can resonate inside a home leading to even higher levels of low frequency sound inside the home than outside. Mr. Hessler's focus on only dBA values, which do not include the low frequency sounds, discredits Mr. Hessler's contrary argument.

[4] Hubbard, H. H., Shepherd, K. P. "Wind Turbine Acoustics," NASA Technical Paper 3057 DOE/NASA/20320-77 (1990)

Mr. Hessler also comments on the need to limit low frequency sound to levels of 60 to 65 dBC is a valid upper limit. The criteria proposed in the Kamperman-James paper uses Mr. Hessler's paper on that topic as a source for its not-to-exceed limits. However, the reports of adverse health effects, especially those of the type described for Wind Turbine Syndrome also occur during the daytime when sleep disturbance is not an issue. Tests I have taken inside the homes of people reporting such effects found low frequency sound pressure levels exceeding 60 dB in the 6.3 Hz 1/3 Octave Band. The graph below illustrates this situation.



The slope of the spectrum increases as frequency decreases. Thus, the sound pressure levels in the infrasound region below 10 Hz may be higher yet. These measured levels are consistent with the sound emission

spectrum of wind turbines. Although wind may play some role in raising the sound pressure level in the lower frequency, the wind turbines are by themselves significant contributors that should not be ignored by continued use of A-weighting to measure and display wind turbine sound data.

Adverse health effects are being reported that may be linked to vestibular and balance functions. Whether these are a result of the simple average sound pressure level or whether some other characteristic of the acoustic energy such as the dynamic modulation of the sound in these lower frequencies is responsible is not known. Following the precautionary principle, the K-J criteria proposed that in communities without significant man-made sources of low frequency sound to mask the ILFN sounds from the turbines that there also be limits to any increases in over-all ILFN. Thus, the recommendation for applying a second limitation for ILFN using the criteria of $L_{Ceq} = L_{C90} + 5$ for additional sound from wind turbines.

Q. Does this complete your response to the rebuttal testimony of George Hessler?

A. Yes.

Q. What is your response to the rebuttal testimony of Mark Roberts?

A. Dr. Roberts describes what he believes to be deficiencies in the work of Dr. Nina Pierpont. This position may be more understandable when one considers that epidemiological studies rely on exposed populations with

adverse health effects. In this case the focus should be on preventing adverse health effects in the exposed population, not permitting it.

What is lost in Dr. Roberts's arguments is that Dr. Pierpont's work is the first step in bringing attention to the adverse health effects reported by people living near wind turbines. Today, there is no base of exposed population that would permit a study of the type Dr. Roberts would like to have conducted. Dr. Roberts claims an extensive knowledge of how such studies should be done in his field, but fails to acknowledge that studies of the type conducted by Dr. Pierpont are common and accepted in the medical community.

For example, the use of case studies and self-reported adverse health effects are the medical community's first line of defense against unexpected interactions between prescription drugs. There are reports in the news that this or that new drug has unanticipated side effects for a small portion of the people to whom it was prescribed. These are based on studies of the type conducted by Dr. Pierpont and others for wind turbine related health issues.

It is not clear which version of Dr. Pierpont's study Dr. Roberts reviewed. The study will not be available to the public in published form until November 6th, 2009, at the earliest. Since the second draft was released on the Internet in winter 2009, the study has changed significantly. Yet, no other complete copies have been made available. The references that I used in my direct testimony were taken from a

small excerpt of the galley draft made available to a limited audience for the purpose of addressing Dr. Pierpont's concerns about papers published by others that claimed there were no adverse health effects. Dr. Pierpont's forthcoming study has been extensively and favorably peer-reviewed by some of the top experts in the fields of otolaryngology and otology.

Q. What is your response to the rebuttal testimony of Geoff Leventhall?

A. Dr. Leventhall states that "infrasound from wind turbines is of no consequence." Dr. Leventhall incorrectly lumps infrasound and low frequency noise together. They are two distinct noise categories. This is surprising since even Dr Leventhall's own earlier work is concerned with the mitigation of low frequency noise because it has been acknowledged to be disruptive to human activities.

Dr. Leventhall testifies that "any effect from wind turbine noise, or any other low level of noise, which might be produced within the body is 'lost' in the existing background noise and vibration." Human beings have adapted to disregard normal bodily noises. It is , therefore, seriously wrong of Dr. Leventhall to compare external, imposed, and unnatural fluctuating sounds with pressure levels of 40 -70 decibels to physiologic noises within the body.

Dr. Leventhall testifies that "higher frequency noise from wind turbines, if it is audible, can cause disturbance to some residents, but this effect is no different from that of noise from another source." On the

contrary, wind turbine noise, by virtue of its constant presence (over hours or days), dynamic modulation of ILFN and audible frequencies, and frequent nocturnal exacerbation, is unlike other sources of community and industrial noise. Moreover, other sources of industrial noise are regulated in manners suitable to their nature. Given the demonstrated increased annoyance of turbine noise, and contribution of nighttime annoyance to sleep disturbance, regulations must be specially formulated to address their unique qualities and potentials for annoyance.

Q. Do you have any comments on Dr. Leventhall's discussion of the work of Dr. Inger and Dr. Mulvihill?

A. Yes. Dr. Leventhal correctly notes that Dr. Ingber's research does not establish a link between ILFN and cellular response. The conclusion that research into mechanotransduction response supports a link to ILFN was drawn by Dr. Mulvihill based on her prior experience and on the research reported in peer-reviewed studies. Dr. Leventhall dismisses these studies as not meeting his standards or his understanding of this hypothesis for the causal link between ILFN and adverse health effects.

Dr. Leventhall contacted Dr. Ingber about Dr. Mulvihill's linkage reported in the direct testimony and Dr. Ingber responded that his work was neutral on this topic. Dr. Mulvihill contacted Dr. Ingber in response to Dr. Leventhall's rebuttal. The following is Dr. Ingber's email response to Dr. Mulvihill (provided to me by Dr. Mulvihill):

From: **Ingber, Donald** <Donald.Ingber@childrens.harvard.edu>

Date: Fri, Oct 23, 2009 at 9:54 AM

Subject: Re: Wind turbine controversy

To: Eileen Mulvihill <mulvier@gmail.com>

E/ Prof. Leventhall did not indicate that he would be using this for formal testimony, but I also was not aware you or others were referring to my work without first inquiring about the details.

In any case, that quote of mine is accurate, HOWEVER, I also wrote him:

"You can quote me as long as you do not make me seem to say there is no way that low frequency vibration can influence cells directly, because there probably is an effect; I just can't tell whether that effect is negative, positive or null physiologically without controlled experiments."

Feel free to use this quote, AS LONG AS you emphasize the need for controlled experiments to explore potential health dangers.

Best,

Don

It is clear that Dr. Ingber remains open to the possibility of the causal link in spite of Dr. Leventhall's assertion that no such link exists.

Q. Do you have any comments regarding Dr. Leventhall's discussion of VAD ?

A. Yes. There are others who support Dr. Mulvihill's conclusion about cellular level processes accounting for some of the reported adverse health effects. Dr. Leventhall not only dismisses the work of Dr. Pierpont, he also dismisses the work of the VAD Team headed by Dr. Nuno Branco, which has been investigating the linkage between ILFN and pathology for over 28 years in Portugal. The VAD Team's research has been published in peer-reviewed journals and also presented at conferences, yet Dr. Leventhall dismisses their conclusions regarding this causal hypothesis. While it may be true that many of their studies involved higher levels of ILFN than may be routinely present in homes near operating wind utilities, there is also research that shows effects at levels more typical of wind turbine noise.

There are also recent studies showing adverse health effects associated with living near airports and highways that may be an early indication that community standards which have focused on A-weighted sound levels may have failed to protect the public from adverse health effects of low frequency sound.

Q. Do you have any comments on Dr. Leventhall's discussion of mechanotransduction?

A. Yes. Dr. Leventhall pays great attention to rebutting any link between research on the mechanotransduction process and the adverse health effects reported for exposure to ILFN, claiming that sound pressure levels are not high enough to cause any such effects from wind turbines. Yet, in

the VAD team's paper entitled: "*Vibro-acoustic disease: Biological effects of infrasound and low-frequency noise explained by Mechanotransduction cellular signaling,*" --reproduced in exhibit 810, filed with my testimony-- it is just this link that is presented as the explanation for these health effects. It is clear that the sound pressure levels reported in this paper are not significantly different in the lowest frequency bands than the sound pressure levels inside homes during the operation of wind turbines documented by me.

Dr. Leventhall's fallback argument seems to be that, in his opinion, sound pressure levels of low frequency sound in people's yards and homes do not exceed the threshold of perception levels for the median population. He then asserts there can be no adverse health effect without audibility. Yet the adverse health effects, other than sleep disturbance, are being reported by a small sub-set of the people living near wind turbines. Not all people living near wind turbines are claiming any adverse health effects. The adverse health effects matching the symptoms of Wind Turbine Syndrome being reported do not affect large percentages of people living near wind turbines. The fact that it is a small portion of the exposed population that report adverse health effects may be supporting evidence that it is some more vulnerable subset of people who are responding to the wind turbine acoustic energy.

If we use the threshold of perception for the most sensitive people then the median threshold drops by approximately 12 dB. In Dr.

Leventhall's article in Noise and Health (part of exhibit 809) he discusses this issue and states that for the most sensitive people the threshold may be even lower than 12 dB. This is not far from the sound pressure levels that are being reported inside homes. It should also be remembered that the 1990 NASA study reported that in-home resonance can increase the amplitude of the lower frequency acoustic emissions above the levels found outside the home.

Q. Do you have anything else to add regarding exhibit 810.

A. Yes. A careful reading of the section of the VAD team's paper, in section "*2.2 What you can't hear, won't hurt you,*" supports my precautionary approach to the reports of adverse health effects, not the outright dismissal that is offered by Dr. Leventhall.

Q. Do you have any further comments on Dr. Leventhall's rebuttal testimony?

A. Yes. Dr. Leventhal finds flaws in my direct testimony regarding other research papers. His testimony demonstrates more about the frame of reference in which he positions his beliefs and opinions than it does about errors in using those references. It is true that reasonable people can differ in their interpretation of such research. There are many independent experts in acoustics, medicine, and other professions who support the positions taken in my direct testimony. It is the responsibility of all professionals to use their skills to protect the public health and welfare.

Some may disagree and say that we should proceed with allowing wind turbines to be located close to homes as do those who recommend distances of 1000 to 2000 feet. In my opinion, there should be at least a mile and ¼ between turbines and homes. I say this not to restrict wind energy as a source of renewable energy, but instead as a temporary condition until the questions of adverse health effects can be addressed in independent research that can be used as a future guide to either continue the large setbacks or to set new setbacks that are founded on knowledge and not speculation.

Q. Does this complete your testimony?

A. Yes.