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August 6, 2010

Eric Lipman via e-mail: eric.lipman@state.mn.us
Office of Administrative Hearings
P.O. Box 64620
St. Paul,
MN 55164-0620

Re: AWA Goodhue Wind –Certificate of Need and Siting Docket PUC Certificate of Need Docket:IP-6701/CN-09-1186 PUC Siting Docket: IP-6701/WS-08-1233

Subject: Comments on July 16th, 2010 Wind Noise Assessment submitted by HDR on behalf of Goodhue Wind, LLC

Dear Judge Lipman:

I am submitting these comments on behalf of Goodhue Wind Truth in the above-entitled dockets. Please consider these to be in addition to the comments I provided in oral testimony on July 21 and 22, 2010.

First, during the course of the testimony I offered to provide information regarding my findings from a study of background sound levels conducted during the week of July 20-22. The first section of these comments provides a summary of my findings generalized to address properties of different types found in the community.

Next, I will provide comments on the findings of the background noise study conducted by HDR on behalf of Goodhue, Wind LLC.

Finally, I will provide comments on the findings and methodology used by HDR to conduct a sound modeling study of the proposed project.

E-COUSTIC SOLUTIONS BACKGROUND NOISE STUDY

During the period beginning the evening of July 20, 2010 and the evening of July 21, 2010 a selection of representative test sites were monitored to establish daytime and nighttime background sound levels (dBA L_{A90}). Background sound levels represent the contribution from noise sources at a distance to the test location. Short term sounds, such as a vehicle pass-by or a dog barking near-by are not included. However, the sound of the vehicle and other vehicles in the distance or a dog barking in the distance would be included. Sounds from nature that are not always present are also excluded. This excludes wind noise rustling vegetation and leaves, birds, bugs, frogs, etc. that are not present during all seasons. Procedures used included short term observed measurements lasting from 30 minutes to about an hour combined with longer tests of one or more hours including overnight tests. All procedures followed the guidelines set by the American National Standard Institute's ANSI-ASA S12.18-1994 (R2009) *Procedures for Outdoor Measurement of SPL* and ANSI-ASA S12.9 Part 3 (1993 R 2008) *Short Term Measurements with Observer Present*. These are standardized procedures for outdoor sound measurements including determination of the long term background sound levels. The long term background sound level is an estimate of the sounds that are present on a property from activities that are not near-by and that would be occurring during any season of the year. It is this type of measurement that is used in land-use planning to set the floor for a new project. Studies have shown that human reaction to a new noise source is related to the differential between the long term background sound level and the sound level that is introduced at that location by the new noise source. Since wind turbines operate 24 hours a day, and we know that

nighttime is the time when human activities that produce community noise are at a minimum and that quiet is needed for proper healthful sleep. WHO 2009 states that 30 dBA or lower outside a home is the known to be safe for healthful sleep and that levels of 40 dBA or higher cause adverse health effects.
Table A below, provides a summary of background sound levels from the findings of my study sorted by day and night for several common land-use categories in Goodhue Twp. representing different noise exposure situations.

TABLE A-Summary of E-CS Background Noise Study Findings

	Background Sound Level dBA (LA90)		
Type of Receiving location	Daytime	Nighttime	Notes
Isolated Residential	30 and under	20 to 25	Residential properties located at least 2000 feet from public roads. No adjacent neighbors within 1500 feet.
Semi-isolated Residential	30 to 35	20 to 25	Residential properties located within 2000 feet of a public road that has moderate daytime traffic and light night time traffic. No adjacent neighbors.
Residential near major roads	35 to 40	25 to 30	Residential properties located on major traffic arteries that have frequent daytime traffic and light to moderate nighttime traffic.
Residential or Farm Home adjacent Farming operations	30 to 40	25 to 35	This category represents homes located near farm fields with active farming activities, such as haying, or dairy farming

Installation and operation of wind turbines will establish a new background sound level for these locations since they operate 24/7/365. If a residential property is currently experiencing nighttime background sound levels of 25 dBA and the Goodhue Wind Project's sound propagation model shows that this property will receive 43 dBA the result will be to raise the background sound level from 25 to 43 dBA. What this means in principle is that the sounds of nature that currently comprise the nighttime soundscape will be replaced by the sound of wind turbines. Instead of hearing the sounds of nature and activities at great distances, the roar of the wind turbines and the blade swish associated with blade rotation during many nighttime weather conditions will be the dominant sound in the community.

Numerous studies have shown that when there is a 5 dBA increase in background sound levels it is noticeable to people, but not likely to cause complaints. An increase of 10 dBA sets the stage for

complaints. Table B provides a summary of how people react to increases in sound levels. For the example of 25 dBA raised to 43 dBA the expected reaction is Objectionable. Given that the predicted value of 43 dBA is an optimistic estimate of the operating sound levels of turbines near homes in Goodhue Twp (see discussion later in this letter) and that sound levels of 50 dBA and higher are routinely measured at homes located at distances of 1500 to 2500 feet from the nearest turbine it is likely that on those days when the turbine noise is maximum the reaction will be Very Objectionable to Intolerable. This will result in complaints, threats of legal action, and people trying to sell their homes.

This is borne out in studies of communities where wind turbines have been operating for a year or more. People living at distances of 2500 feet or less from one or more turbines, or even 3000 to 3500 feet if surrounded on three or more sides by turbines, find the noise intolerable. As a result, they have abandoned their homes. This abandonment often takes the form of a farmer and family renting or purchasing a second home in a nearby town for purposes of sleeping and other quiet activities. The farmer then tends to the farm during the day. It also takes the form of demands for the wind utility operator to purchase the home. This is now a frequency occurrence in Ontario where the siting criteria are 40 dBA at the nearest home. Given that Minnesota, at least unofficially, supports 45 to 50 dBA at non-participating properties; the reaction of the people in Goodhue to the wind utility is expected to be more severe.

TABLE B-HUMAN REACTION TO INCREASES IN SOUND PRESSURE LEVEL

Increase in Sound Pressure (dBA)	Human Reaction
Under 5	Unnoticed to tolerable
5 - 10	Intrusive
10 - 15	Very noticeable
15 - 20	Objectionable
Over 20	Very objectionable to intolerable

(Down and Stocks - 1978)

What the above discussion shows is that noise criteria for the Goodhue Wind LLC project must be more stringent than those provided by the Minnesota PUC or even the Minnesota Department of Health to avoid the adverse consequences that have been observed in other wind turbine projects located in communities with mixed residential and agricultural land uses. The sound level limits need to recognize the current guidelines for nighttime noise set by WHO in 2009 and the experiences of other similar communities where lenient noise criteria permitting noise levels of 40 dBA and higher have led to complaints and litigation. The limits should reflect the needs of the non-participating residents for peaceful enjoyment of their properties and not be set based on the desire to expedite the construction of wind turbine projects at the expense of the non-participating residents. Public policy must first protect the residents and then consider the need for wind turbines; not the other way around.

HDR Wind Noise Assessment Review and Comments

The following comments are related to the July 16, 2010 report by HDR to Goodhue Wind LLC regarding Wind Noise Assessment. These comments are in addition to those presented in oral testimony.

HDR Section Titled: Existing Environment

Review of the tables provided as attachments to the study report for each of the six (6) HDR test locations raises several questions. It should also be noted that there is no table provided for Location 3 nor is it discussed in the narrative. No reason for not including it was provided.

The HDR tests refer to 5 locations as summarized below in a table excerpted from the report.

Table 4. Site Description of Measurement Locations

	Start Time	Brief Qualitative Description
Location 1	June 24, 2010 4:00 AM	Removed from traffic noise; near to residence and farm buildings. This location represents residences where agricultural activities occur daily.
Location 2	June 18, 2010 4:00 AM	Far removed from any manmade noise, except for potential mobile farm equipment. This location represents residences which are set far back from any road. There are few places in the project area where potential mobile farm equipment noise is avoidable.
Location 4	June 15, 2010 11:00 PM	Near to low traffic volume unpaved road; near to residence and farm buildings. This location represents residences near unpaved roads and where agricultural activities occur daily.
Location 5	June 24, 2010 3:00 AM	Near to paved county road with moderate traffic volume; set back from road comparable distance to a residence. This location represents residences along County Road 7, County Road 6 and County Road 1
Location 6	June 18, 2010 4:00 AM	Near to paved county road with frequent traffic; set back from road comparable distance to a residence. This location represents residences along County Road 9, which was subjectively judged to be the heaviest-traveled road in the project area.

Based on the description for Location 2, it is expected that this location would have the lowest background sound levels, particularly at night, unless some unusual activity was occurring during the test. No such unusual activity is noted unless the reference to mobile farm equipment infers that this site was not a quiet remote site, but instead near active farm equipment.

Review of the Appendix Table for Location 2 shows that daytime background sound levels (L_{A90}) 35 to 48 dBA range, which is surprising since Location 1 ranges from 33 to 35 dBA, Location 4 ranges from 33 to 36 dBA, Location 5 ranges from 35 to 39 dBA and Location 6, which is near a busy road ranges from 34 to 41 dBA. These results are unusual enough that they warrant comments and

explanations from HDR. None were provided. Why is the quietest location, the one with the highest background readings? What does this imply about the other test data?

Nighttime test results reported in the Appendix charts for Locations 1, 2, 4, 5, and 6 are equally unusual. Almost all of the nighttime readings fall into the range of 32 to 38 dBA. One would expect that the background sounds would follow the diurnal pattern of human activity in the community and thus show the lowest readings for the periods of 11PM through 4PM, but this is not the case. There is sometimes little difference between day and night readings for some locations. The noise study conducted by E-CS showed that at all similar locations the nighttime readings were in the low to mid 20 dBA range. Why do the HDR results not show these similar patterns?

HDR's study included evaluation of the 50 percentile sound level (L_{50}) while the computer model used to estimate the sound at receiving locations provides the energy average sound level (L_{eq}). HDR attempts to establish an equivalence between the L50 and the L_{eq} data with the following statement:

"Even with a fluctuating noise source, the L_{eq} is a close approximation or even a conservative overestimate of the L_{50}. For purposes of this analysis, the predicted L_{eq} can be considered a reasonable and appropriate estimate of the L_{50}." (page 4 of July 16, 2010 report)

These statements are not true except in very special cases which are not likely to be present for wind projects using guidelines of L_{50} sound levels. The L_{50} levels represent the median of the monitoring data which is a statistical value. It is the point at the top of the bell curve representing the distribution of sound levels over a measurement period. The L_{eq} values from the CADNA model represent the energy average sound level which is entirely different. One problem with the energy averaged sound level (L_{eq}) is that it is extremely sensitive to short duration, high noise events. A single pass-by of a vehicle that raises the sound level from 25 dBA to 70 dBA for one minute during a one hour measurement in a very quiet area would yield an L_{eq} of over 50 dB for the hour. This does not tell us much about the degree of quiet for the other 59 minutes. It would not be reflected in the L_{50} value for the hour which would be close to 25 dBA for the example given.

It is not possible to say that the predicted L_{eq} can be considered a reasonable and appropriate estimate of the L^{50} as is claimed by HDR. If the two values are close, it means that the only sounds that will be present in the community when the turbines are running are those from the turbines.

The bulk of their report relies on having the reader believe that the L_{eq} and L_{50} values are interchangeable. Given that the L_{eq} associated with the residential properties closest to the wind turbines is predicted to be 43 L_{Aeq} and the Minnesota PUC and Public Health guidelines establish a limit of 45 L_{A50} there is only a 2 dB margin for error if the L_{Aeq} and L_{A50} are not exactly the same. Claiming that 43 L_{Aeq} meets the LA50 limits of the PUC and Health Guidelines is making an assertion that is not supportable unless one knows the distribution of sound levels over time from the wind turbine project. We do not know that information since the model only provides the energy average sound level, $L_{Aeq.}$

HDR Section Titled: Noise Assessment

During my oral testimony I listed a number of errors of omission or commission I found in my review of the HDR model of Goodhue Wind. I will only briefly summarize them again.

1. The CADNA model is based on the procedures and algorithms of ISO 9613-2 Acoustics-Attenuation of sound during propagation outdoors. This standard has known limitations. First and

foremost, it only applies to sound sources located within 30 meters of the ground. A wind turbine produces most of its noise from the blades and nacelle which are 80 meters above the ground and higher. Even if the wind turbines were within the 30 meter limitation there are known errors of 3 dB that are associated with use of the algorithms. The HDR report does not disclose these limitations nor does it report the tolerances of the underlying procedures used in constructing the model as is commonly done in scientific work.

2 The test data used for the model is derived from a standardized test procedure for estimating the sound power output of a wind turbine at various wind speeds. This test procedure, IEC 61400-11 does not attempt to test the wind turbines under weather conditions that lead to excessive blade swish and other noises. Instead, it is similar to the EPA test procedures for establishing mileage ratings for automobiles. As with any automobile, the EPA rating is not what an individual driver can expect to get under real world driving conditions. They are designed to allow a buyer to compare models with the assumption that the EPA procedures have normalized the data to make the comparison useful. The IEC standard has a known tolerance of 2 dBA for its data. HDR did not indicate that it included this tolerance in its estimates of sound levels at receptors.

Appendix A of the IEC procedure lists a number of factors that can increase the wind turbine noise above what is reported. These include turbulence in the in-flow air which is common during storms or strong winds. Turbulence is also a cause of nighttime noise from blade swish when there are temperature inversions. Studies have shown that temperature inversions can occur as often as 60 % of summer evenings. These conditions result in calm or no wind at the surface and strong winds at the wind turbine's blades. During these conditions the wind turbines produce strong blade swish or thumps which occur about one every second and can raise the sound level above the normal steady sounds by as much as 10 to 15 dBA. Thus, the 43 L_{Aeq} estimate by HDR could be in error by as much as 20 dBA under some weather conditions that are not unusual.

3 HDR made the assumption that reflected sounds from the ground would be 70% absorbed by the soil and surface vegetation. This assumption reduces the sound levels at distant sites by 2-3 dBA or more. Yet, studies by others (Kaliski, et. al., Hubbard and Shepherd (NASA 1990)) have shown that ground absorption should be considered to be 0% because much of the year the soil is dry and hard packed, frozen, or covered with snow, with little or no vegetation. It is not correct to create a model representing conditions that are not present for much of the year. Further, since the assumption results in lower predicted levels the conclusion of HDR that the project meets the Minnesota guidelines by only 2 dB (45 -43=2) this could be construed as a method to bias the results in favor of the developer at the expense of the residents.

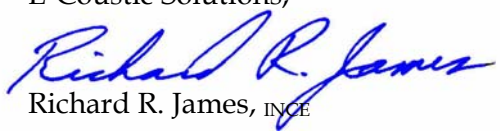
4. If we add the tolerances outlined above to the 43 L_{Aeq} estimate we have 43 +3+2+2=50 dBA for the turbine's noise potential. If we add in the amplitude modulation (which occurs frequently enough to affect the L50 sound level) from blade swish this could be 50 + 10 or 50 + 15. That is the real sound levels experienced at the non-participating properties could be as high as 60 to 65 dBA under adverse conditions and routinely 50 dBA under normal conditions. This shows that the project cannot comply with the 45 dBA limits which HDR sets as the threshold for compliance with current Minnesota practice.

5. HDR claims that they followed the same procedures used by other wind developer's in Minnesota. This is likely a true statement but it does not make the procedure correct. Every year at noise conferences dealing with wind turbines there are papers presented on how to model wind turbines. There are different methods used all around the world. In addition to the Cadna software methods, there are models that take different approaches used in Scandinavian countries and also models developed especially for wind turbines such as the WindFarmPerception Model from Van

den Berg, et. al. at the University of Groningen. If there was any one model that was really accurate all acoustical consultants would be using it. The facts show the contrary. What we know is that models routinely underestimate the sounds that will occur on receiving properties. To not disclose this in a modeling study shows that there is a lack of understanding of the issue by HDR or if they are aware of these issues that they chose not to disclose them to the developer or the public.
In closing I want to offer a quote by Mahatma Gandhi that summarizes the situation.

"An error does not become truth by reason of multiplied propagation, nor does truth become error because nobody sees it."

Sincerely,
E-Coustic Solutions,



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