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STATE OF MINNESOTA

OFFICE OF ADMINISTRATIVE HEARINGS

FOR THE MINNESOTA PUBLIC UTILITIES COMMISSION

IN THE MATTER OF THE APPLICATION BY AWA GOODHUE WIND, LLC

FOR A SITE PERMIT FOR A LARGE WIND ENERGY CONVERSIONS SYSTEM FOR A 78 MW

WIND PROJECT IN GOODHUE COUNTY

DIRECT TESTIMONY

OF

SCOTT ZILKA

ENVIRONMENTAL SCIENTIST

HDR, INC.

ON BEHALF OF

AWA GOODHUE, LLC

JANUARY 28, 2011

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BEFORE THE MINNESOTA PUBLIC UTILITIES COMMISSION

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I. INTRODUCTION AND QUALIFICATIONS

Q: Please state your name and business address.

A: My name is Scott Zilka. My business address is 701 Xenia Avenue South Suite 600, Minneapolis, Minnesota 55416.

Q: By whom are you employed and what is your position?

A: I am employed by HDR Engineering, Inc. (HDR). HDR is a consulting and engineering firm that was founded almost 100 years ago. The company has more than 7,800 professionals at nearly 200 offices worldwide. My position at HDR is Environmental Scientist.

Q: Please describe your educational background.

A: I received a Bachelor of Science degree in Meteorology from St. Cloud State University in 1994.

Q: What has been your employment history?

A: My entire career has been at HDR as a scientist working primarily in environmental permitting and compliance for proposed and existing private and public projects. I have more than 17 years experience in the processing and quality assessment of meteorological data, in preparation of input data for source receptor, emissions and other dispersion modeling, in conducting dispersion modeling of air pollutant emissions, and in performing shadow flicker analyses. I have participated in numerous dispersion modeling analyses for both stationary and mobile emissions sources and in shadow flicker modeling analyses for wind turbine energy projects. I have extensive experience in computer programming, and I am proficient in several computer software packages used for database and spreadsheet manipulation, graphics

preparation, and model input generation. Additionally, I have authored numerous air quality and climate sections of environmental impact statements for a wide variety of projects, as well as shadow flicker assessments for wind energy projects.

Q: For whom are you testifying?

A: I am testifying on behalf of AWA Goodhue, LLC.

Q: What is the purpose of your testimony today?

A: The purpose of my testimony is to explain the shadow flicker phenomenon and to describe the results of a modeling analysis HDR completed to estimate the number of hours of shadow flicker per year that nearby residences may experience once the turbines are installed and in operation.

Q: Please summarize your testimony.

A: Shadow flicker caused by wind turbine generators is defined as alternating changes in light intensity caused by moving rotor blades upon a given stationary location, or receptor, under specific conditions. HDR conducted a modeling exercise to estimate the number of hours of shadow flicker that a resident might experience under a conservative set of assumptions. Recently, HDR updated the modeling relying on the latest turbine layout proposals. The modeling results show that 278 of the 289 analyzed homes near the turbines are expected to experience less than 20 hours per year of shadow flicker.

II. SHADOW FLICKER

Q: What is shadow flicker?

A: Shadow flicker caused by WTGs is defined as alternating changes in light intensity caused by moving rotor blades at a given stationary location, or receptor, such as the window of a home. In order for shadow flicker to occur, three conditions must be met: (1) the sun must be

shining with no clouds obscuring the sun; (2) the rotor blades must be spinning and be located between the receptor and the sun; and (3) the receptor must be sufficiently close to the turbine to be able to distinguish a shadow created by the turbine. The shadow flicker intensity and frequency of occurrence at a given receptor are determined by such factors as the sun angle and sun path, turbine and receptor locations, cloud cover and degree of visibility, wind direction, wind speed, nearby obstacles, and local topography.

Q: How do you model for possible shadow flicker?

A: Shadow flicker may be analytically modeled, using geometry and site-specific data to estimate the number of hours per year that flickering shadows may be cast upon a given receptor. The movement of the sun over the year is simulated and assessed at one-minute intervals to calculate the potential frequency of shadows at receptors near the project. The model produces "actual expected shadow" results, where historical sunshine probability and wind direction data representative of the project site are incorporated in the assumptions. However, even these "actual expected shadow" scenarios may produce higher shadow flicker values than one would experience at the receptors as the scenarios do not account for the numerous factors that can influence the intensity of shadow flicker, but instead report only the potential occurrence of flicker. For example, these results do not consider the potential screening effect of nearby vegetation or buildings.

Q: Please describe the work HDR did to model shadow flicker for the AWA Goodhue wind project.

A: In January of 2011, HDR was provided the most recent wind turbine layout and receptor data for 289 homes within 2000 meters (6,562 feet) of a proposed wind turbine. HDR used that data to run a shadow flicker model to predict hours of shadow flicker that are expected to be

experienced at each receptor when the project is constructed. This effort is similar in scope and result to previous work done by HDR in July 2010.

Q: Has HDR put the results of its latest modeling effort into a written report?

A: Yes, HDR prepared a report entitled "Shadow Flicker Assessment of the Goodhue Wind Project" dated January 2011. A copy of this report is attached to my testimony as AWA Ex. 7-A.

Q: What major assumptions did you make in conducting your modeling?

A: The shadow flicker model includes real data, such as actual coordinates of receptors (homes) and turbines, digital elevation data to account for local changes in topography, and actual physical characteristics (that is, hub height and rotor diameter) of the project-specific wind turbines. The model also includes realistic features, such as long-term average sunshine probability data by month from a nearby National Weather Service station to approximate average cloud cover and actual wind direction data from a local meteorological tower to account for the percentage of time the wind blows from each direction. Finally, the model assumes a number of conservative factors, such as assumptions that the turbines will operate 100 percent of the time, that receptors can be impacted from all directions, and no shading or screening from buildings or vegetative cover is accounted for. Given that many homes will have individual windows that are partially or wholly screened from shadow flicker due to garages or other structures, trees, or the home itself, it is likely that these screening effects will allow many individuals in houses to experience less shadow flicker than the model predicted values. These assumptions are intended to result in a conservative prediction of "actual expected" hours per year of shadow flicker. While variations in actual sunshine probability or wind direction in a given year could be somewhat different than the long-term average data used in the model, these meteorological differences are unlikely to create significant differences in the actual expected

hours per year as reported. However, the conservative assumption of 100 percent turbine operation is highly likely to create "actual expected" results that will be significantly higher than experienced impacts, since wind turbines operate less than 100 percent of the time and shadow flicker only occurs while wind turbines operate. Additionally, no mitigation such as shades, trees, or operational restrictions has been considered in these results.

Q: What are the main conclusions of your work?

A: One main conclusion is, of the 289 homes within 2000 meters (6,562 feet) of a proposed AWA Goodhue wind project turbine, 278 (96.2 percent) are expected to experience less than 20 hours of shadow flicker per year. A majority of homes (248, or 85.8 percent) are expected to experience less than 10 hours per year. Five of the 11 homes that are expected to experience more than 20 hours of shadow flicker per year are participants of the project, including the three homes with the greatest expected amount of shadow flicker. The greatest amount of expected shadow flicker at a participating receptor is 39 hours, 21 minutes per year while the greatest amount at a non-participating receptor is 33 hours, 11 minutes, both of which are less than one percent of the approximately 4,462 annual daylight hours in Goodhue County, Minnesota.

Q: What accounts for the small number of anticipated hours of shadow flicker that a homeowner may be subject to over the course of a year?

A: In addition to the change of shadow location with daily and annual changes in the sun's path, the fact that the turbines do not operate 100 percent of the time over the course of a year, the spacing and siting of wind turbines, typical setback requirements, and the fact that shadow flicker decreases with increasing distance between wind turbine and receptor accounts for the relatively small number of hours that a homeowner will actually encounter shadow flicker. While each wind project is unique and it is difficult to make comparison between projects, it is

typical for wind energy projects to impact a large number of "nearby" receptors but with a small number of hours of shadow flicker.

Q: Does the State of Minnesota have any shadow flicker restrictions?

A: No, there is no Minnesota state agency that has promulgated a limit on the hours of shadow flicker that are permissible. The Minnesota Public Utilities Commission has not promulgated any standards on shadow flicker.

Q: Does Goodhue County have any shadow flicker restrictions?

A: No, it does not.

III. CONCLUSION

Q: Does this conclude your testimony?

A: Yes it does.