

BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION

DOCKET EL18-003

IN THE MATTER OF THE APPLICATION BY DAKOTA RANGE I, LLC AND DAKOTA RANGE II, LLC FOR A PERMIT OF A WIND ENERGY FACILITY IN GRANT COUNTY AND CODINGTON COUNTY, SOUTH DAKOTA, FOR THE DAKOTA RANGE WIND PROJECT

**Direct Testimony of David M Hessler
On Behalf of the Staff of the South Dakota Public Utilities Commission
May 4, 2018**

1 **Q. Please state your name and business address.**

2 A. My name is David M. Hessler. The address of my company's administrative
3 offices is 38329 Old Mill Way, Ocean View, DE 19970, and my personal office is
4 located at 1012 W Las Colinas Dr., St. George, UT 84790.

5
6 **Q. Mr. Hessler, by whom are you employed and in what capacity?**

7 A. I have been employed for over 27 years by Hessler Associates, Inc., as Vice
8 President and a Principal Consultant. Hessler Associates, Inc. is an engineering
9 consulting firm that specializes in the acoustical design and analysis of power
10 generation and industrial facilities of all kinds, including wind energy projects.

11

12 **Q. Please describe your educational background and your professional
13 experience?**

14 A. I received my Bachelor of Science in Mechanical Engineering (B.S.), 1997,
15 *Summa cum Laude*, at the A. James Clark School of Engineering, University of
16 Maryland, College Park, MD, and a Bachelor of Arts (B.A.), 1982, at the
17 University of Hartford, Hartford, Connecticut. I am a registered Professional
18 Engineer (P.E.) in the Commonwealth of Virginia and I am a member of the
19 Institute of Noise Control Engineering (INCE). My professional specialization is
20 the measurement, analysis, control and prediction of noise from both fossil fueled
21 and renewable power generation facilities. I have been the principal acoustical
22 designer and/or test engineer on hundreds of power station projects all over the

1 world and on roughly 70 industrial scale wind energy projects. My resume is also
2 attached for reference as Exhibit_DMH-1.

3
4 **Q. Have you ever testified as an expert witness before any court or
5 administrative body? If so, what was the nature of your testimony?**

6 A. Yes, on a number of occasions. For example, I have provided both written and
7 extensive oral testimony before the Ohio Energy Facility Siting Board on behalf of
8 the Applicant in support of the Buckeye Wind Farm project in Champaign County,
9 OH. I prepared the noise impact assessment study for that project and testified
10 with regard to that study. On another occasion I testified before the Wisconsin
11 Public Service Commission on behalf of Clean Wisconsin, Inc., a non-profit
12 environmental advocacy organization, with regard to the proposed Highland
13 Wind Farm project in St. Croix County, WI where I was tasked with reviewing and
14 evaluating the validity of the Applicant's noise assessment study for that project.
15 A further listing of all cases where I have testified is included in Exhibit_DMH-1.

16
17 **Q. What is the purpose of your testimony in this case?**

18 A. I have been asked by the Staff of the South Dakota Public Utilities Commission
19 to review and evaluate the adequacy of the noise assessment study carried out
20 by Epsilon Associates, Inc. in support of the Dakota Range Wind Project, to
21 consider any public comments on the project regarding noise, and to review and
22 comment on, as appropriate, any testimony relevant to noise issues filed by or on
23 behalf of the Applicant.

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Q. What materials have you reviewed in this matter?

A. I have reviewed the “Sound Level Modeling Report” prepared by Epsilon Associates, Inc. and included in the permit Application submitted by Dakota Range Wind and the testimony of Mr. Robert O’Neal the author of this study. I have also read the written comments of Mr. George L. Holborn submitted during a public input hearing on March 21, 2018.

Q. Can you please summarize your overall opinion of the sound level modeling report submitted on behalf of the project?

A. In general, the quality of the work and noise modeling is perfectly satisfactory and consistent with good industry practice. I agree with the modeling methodology and would use the same software and make all the same assumptions myself. However, the study is entirely focused on simply determining whether the project will comply with the noise provisions relating to wind energy facilities contained in the Grant and Codington County Zoning Ordinances, both of which essentially limit the sound emissions from wind energy projects to no more than 50 dBA at “off-site residences”, rather than assessing or addressing in any way the potential for an adverse community reaction to project noise.

1 **Q. Does the noise limit of 50 dBA contained in the Grant and Codington**
2 **County Zoning Ordinances automatically protect the community from**
3 **disturbance or annoyance due to noise from wind turbines?**

4 A. No. My experience testing and observing the community reaction to completed
5 wind turbine projects in rural settings like this indicates that, although very
6 commonly seen in many local noise ordinances, a limit of 50 dBA is too high to
7 ensure that a wind project will have only a minimal or acceptable impact. When
8 such a sound level actually occurs at a residence, whether participating or not,
9 there is a distinct possibility of complaints and dissatisfaction.

10

11 **Q. According to the Dakota Range noise study, is a sound level of 50 dBA**
12 **predicted at any residences?**

13 A. No, which I am pleased to see.

14

15 **Q. Since you believe a sound level of 50 dBA is too high, would you**
16 **recommend a lower noise limit for this project?**

17 A. Yes, I believe the community would be better served and protected with a 45
18 dBA noise limit as a definite maximum at non-participating residences and as an
19 earnest design goal at participating residences. I would add that even this noise
20 limit would not guarantee that no one would be bothered by project noise. In
21 fact, I generally recommend limiting the average sound level from a wind project
22 to 40 dBA at non-participating residences as an ideal design goal, because at
23 that point the sound level is so low in absolute terms that complaints or issues

1 with noise become quite rare. It is important to clarify that both of these
2 suggested limits are considered to be long-term averages measured over a
3 period of a week or more and not instantaneous or short-lived maxima.

4
5 **Q. Is your suggested long-term average sound level of 45 dBA at residences**
6 **currently being met?**

7 A. According to the modeling results presented in the report, my recommended
8 long-term average limit of 45 dBA would be met at all residences whether
9 participating or not. Moreover, the model predictions include a unilaterally
10 applied 2 dB uncertainty factor that has been added to the maximum turbine
11 sound power level, meaning that the predictions are somewhat conservative. At
12 the same time, it must be understood that wind turbine sound levels commonly
13 fluctuate within a range of about +/- 5 dBA and sometimes vary up to roughly +/-
14 10 dBA depending on wind and atmospheric conditions, so a 2 dB design margin
15 is not as significant as it might seem.

16
17 **Q. Is your suggested ideal design goal of 40 dBA at non-participating**
18 **residences currently being met?**

19 A. No, but that is not unusual. 40 dBA is a very low sound level that requires very
20 large set back distances that are only usually practical at remote or very sparsely
21 populated sites. In this case, the model results indicate that 13 non-participating
22 residences would be in the 41 to 44 dBA range. However, if the 2 dB explicit

1 design margin were subtracted, it would leave only 2 non-participants above 40
2 dBA - and then only by 1 and 2 dBA.

3
4 **Q. What would you surmise from these predicted sound levels?**

5 A. In general, I would consider the very limited number of non-participants over 40
6 dBA and the fact that a level of 45 dBA or less is conservatively predicted at all
7 residences a favorable situation in the sense that I would anticipate very few
8 complaints about noise from this project based on the community reactions to
9 operating projects that I have personally observed during compliance tests.

10
11 **Q. Have you reviewed the comments about possible adverse health effects
12 due to low frequency noise submitted by George Holborn?**

13 A. Yes. Mr. Holborn brings up the important issue of possible disturbance and
14 discomfort from inaudible low frequency noise and references the work of the
15 Australian acoustician Steven Cooper. The A-weighted sound level limits
16 discussed above relate to audible "swishing" noise but Cooper, in his paper
17 "Subjective perception of wind turbine noise – The stereo approach" presented at
18 the Acoustical Society of America meeting this past December, presents fairly
19 compelling evidence that completely inaudible pressure pulsations are
20 perceptible to certain individuals as disturbing sensations. In a controlled double
21 blind laboratory experiment people with known sensitivity to low frequency wind
22 turbine noise were able to accurately perceive when a recording of inaudible

1 wind turbine sound measured inside a home at an existing project was randomly
2 played, while others in a control group essentially noticed or felt nothing.

3
4 **Q. Have you ever done any field work yourself investigating complaints about**
5 **low frequency wind turbine noise?**

6 A. Yes. As a part of a team of researchers, I participated in an investigative survey
7 at a site in Wisconsin where a number of families had abandoned their homes
8 due to disturbance from what was described as low frequency noise. We spoke
9 with the residents and measured sound levels in the rooms and specific locations
10 where they said the noise was the worst in the middle of night with the project
11 operating. I heard nothing but complete silence, I felt nothing and I could not
12 understand what these people were complaining about. This experience directly
13 parallels Cooper's where, in the Master Resource interview (2/1/18) cited by Mr.
14 Holborn, Cooper states "on my first experience the noise was extremely low,
15 could not be detected inside the dwelling and I didn't understand why the
16 residents would be so vocal and genuinely distressed from the turbines."

17
18 **Q. What is your general opinion on this matter now?**

19 A. Prior to this recent work by Cooper I was puzzled by these kinds of complaints
20 and saw nothing in any measurements that I've ever taken of wind turbines that
21 could explain them. Nor did I find anything in the work other investigators that I
22 felt credibly established a cause and effect relationship. In fact, the
23 preponderance of the evidence suggests that wind turbines produce only a

1 miniscule amount of low frequency sound that is dramatically below the threshold
2 of perception. However, Cooper's experimental results now convince me that a
3 minority of people do have a sensitivity to the minute pressure pulsations
4 associated with the blade passing frequency, which is typically extremely low;
5 less than 1 Hz. The question is: how small or large is this minority? My sense is
6 that it is very small because out of the many, many wind turbine projects that
7 currently exist all over the world this kind of complaint, to my knowledge, has only
8 arisen as a serious issue at a small handful. If a large or even moderate
9 segment of the population had this sensitivity, such complaints would be
10 commonplace and every project would be overwhelmed by this problem.
11 Consequently, I think there is a small risk with any proposed project that some
12 nearby residents could be seriously disturbed by this aspect of the wind turbine's
13 sound emissions.

14
15 **Q. Do you believe that the Commission should require a sound test once the**
16 **project is operational to verify that it is actually producing the predicted**
17 **sound levels?**

18 A. No, I don't think such a survey is warranted as a firm prerequisite in this instance
19 because the expected sound levels at non-participating residences are so far
20 below the Grant and Codington County Zoning Ordinance limit of 50 dBA that a
21 violation of that limit is highly unlikely. However, it would advisable for the
22 Commission to reserve the right to require a verification/investigative survey if
23 serious and on-going complaints should arise from any party, participating or not.

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Q. Please provide your recommendation for a permit condition the Commission should consider.

A. Because the Applicant already expects that the Project will generate sound levels below 45 dBA at all residences, I think it would be reasonable to make this performance of condition of the operating permit. More formally, I would suggest the following condition: The Project, exclusive of all unrelated background noise, shall not generate a long-term average sound pressure level, as measured over a period of at least one week and/or under all integer wind speeds from cut in to full power, of more than 45 dBA at any occupied residence, irrespective of participation status. Should any serious and on-going complaints about noise arise, and there is reason to believe that the 45 dBA limit is not being met at any residence, the Commission shall require the Project Owner to engage a qualified acoustical engineering firm to carry out a verification field survey to quantify the Project-only sound level at the complaint location(s) and determine if it is in compliance with this condition. If the long-term average level exceeds 45 dBA then the Project Owner shall operate the offending turbine(s) in a low noise mode sufficient to bring the average sound level at the complaint location(s) down to 45 dBA or less or take whatever other steps are necessary to rectify the situation.

Q. Does this conclude your testimony?

A. Yes.

CURRICULUM VITAE

DAVID M. HESSLER

Title: Principal Consultant, Vice-President
Hessler Associates, Inc.

Professional Affiliations: Professional Engineer (P.E.), Commonwealth of Virginia
Member Institute of Noise Control Engineering (INCE)
National Council of Acoustical Consultants (NCAC)

Education: Bachelor of Science in Mechanical Engineering (B.S.), 1997
Summa cum Laude
A. James Clark School of Engineering
University of Maryland, College Park, MD

Bachelor of Arts (B.A.), 1982
University of Hartford, Hartford, CT

Employer: Hessler Associates, Inc.
3862 Clifton Manor Place
Haymarket, VA 20169

Years in present position: 26

Current Job Description: Acoustical engineer specializing in the prediction, assessment and mitigation of environmental noise from new and existing power generation and industrial facilities. Typical tasks include:

- Field measurement studies of existing ambient sound levels in the vicinity of proposed project sites
- Computer noise modeling of new facilities prior to construction
- Environmental impact assessments for new projects
- Noise mitigation design studies of new facilities
- Verification measurements of completed facilities
- Diagnostic studies of facilities with existing noise problems
- Design and specification of noise mitigation measures
- Educational lectures on noise issues for private corporations
- Expert witness testimony

General Experience: As an outside consultant to nearly all the major power industry EPC contractors, developers and OEM's, have been the principal acoustical designer of over 400 power plants and industrial facilities worldwide ranging from a 3900 MW power station in Saudi Arabia to numerous combustion turbine combined cycle plants to refineries and wind turbine projects. Typically, the focus of the work on these projects was to anticipate potential noise impacts at sensitive receptors near the project and recommend practical noise abatement measures to avoid them. In addition, extensive verification measurements in and around the completed power plants and wind farms have been performed to confirm that the design recommendations have been successfully executed.

Wind Turbine Experience: Over the past 14 years have performed noise impact evaluations and siting optimization studies for roughly 70 large wind turbine projects in

the United States and Canada, involving nearly all current makes and models of wind turbines. Have developed test protocols and conducted long-term field measurement surveys of numerous newly completed wind projects to evaluate compliance with applicable permit conditions, to investigate complaints and/or to verify the accuracy of pre-construction noise modeling. Have carried out field tests of wind turbine sound power level in strict accordance with the IEC 61400-11 test methodology. Have carried out field measurement studies of operating wind turbines to evaluate their low frequency sound emissions, nacelle noise sources and radial directivity characteristics. Have testified as an expert witness at permitting hearings for proposed wind projects. Attended six bi-annual Wind Turbine Noise conferences.

Recent Papers and
Publications:

“Wind Turbine Noise”, Chapter 7 *Measuring and Analyzing Wind Turbine Sound Levels*, Multi-Science Publishing Co., Brentwood, Essex, UK, Jan. 2012. Comprehensive book on all aspects of wind turbine noise. Each chapter written by a recognized expert in that subject.

Teleseminar “Wind Turbine Siting and Best Practices”, National Regulatory Research Institute (NRRI), Invited speaker, Jan. 2012.

“Best Practices Guidelines for Assessing Sound Emissions from Proposed Wind Farms and Measuring the Performance of Completed Projects”, Prepared for the Minnesota Public Utilities Commission under the auspices of the National Association of Regulatory Utility Commissioners (NARUC), Oct. 2011.

“Accounting for Background Noise when Measuring Operational Noise from Wind Turbines”, Fourth International Meeting on Wind Turbine Noise, Rome, Italy, Apr. 2011.

“Recommended noise level design goals and limits at residential receptors for wind turbine developments in the United States”, *Noise Control Engineering Journal*, J.59 (1), January-February 2011.

“Wind tunnel testing of microphone windscreen performance applied to field measurements of wind turbines”, Third International Meeting on Wind Turbine Noise, Aalborg, Denmark, June 2009.

“Experimental study to determine wind-induced noise and windscreen attenuation effects on microphone response for environmental wind turbine and other applications”, *Noise Control Engineering Journal*, J.56, July-August 2008.

Expert Witness Cases:

Before the Washington State Energy Facilities Siting Board (EFSEC) on behalf of Bechtel and the Cherry Point Cogeneration Project, Bellingham, WA, 2003. Permitting support for a proposed combined cycle power plant facility.

Before the Public Service Commission of West Virginia on behalf of the Longview Power Project near Morgantown, WV, 2006. Permitting support for a proposed coal-fired power plant facility.

Before the Pennsylvania Department of Environmental Protection on behalf of Waste Management and the Alliance Sanitary Landfill in Taylor, PA, 2006. Support in defending against a Class Action Lawsuit brought by neighbors of the landfill.

Before the Office of the Attorney General of New York on behalf of the Hudson Valley Community College Cogeneration (Diesel) Plant. Support in defending against a Class Action Lawsuit brought by neighbors.

Before the Hanover County (VA) Board of Supervisors on behalf of Martin Marietta Materials and the Doswell Quarry, 2008. Permitting support for a proposed quarry expansion.

Before the New Hampshire Site Evaluation Committee on behalf of Granite Reliable Power, LLC, 2008. Docket No. 2008, July 2008. Permitting support for a proposed wind turbine project in Northern New Hampshire.

Before the Public Utilities Commission of Ohio, Ohio Power Siting Board on behalf of EverPower Renewables and the Buckeye Wind Project, 2008. Permitting support for a proposed wind turbine project in Ohio.

Before the Wisconsin Public Service Commission on behalf of Clean Wisconsin with regard to the proposed Highland Wind Farm in Forest, WI. Docket No. 2535-CE-100. Engaged as an independent expert to evaluate the Applicant's sound studies and the testimony of opposition groups.

Before the Public Utilities Commission of Ohio, Ohio Power Siting Board on behalf of EverPower Renewables and the Buckeye II Wind Project, 2012. Permitting support for a proposed wind turbine project in Ohio.

Before the Maine State Government Energy, Utilities and Technology Committee on behalf of Patriot Renewables and the Beaver Ridge Wind Project, 2014. Peer review of operational sound testing by others.