BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY PREVAILING WIND PARK, LLC FOR A PERMIT OF A WIND ENERGY FACILITY IN BON HOMME COUNTY, CHARLES MIX COUNTY, AND HUTCHINSON COUNTY, SOUTH DAKOTA, FOR THE

PREVAILING WIND PARK PROJECT

EL18-026

PREFILED TESTIMONY OF RICHARD R. JAMES

ON BEHALF OF INTERVENORS

EXHIBIT
Int. I-1

Q: Please state your name, title, affiliation, and address.

A: My name is Richard R. James. I am the Principal Acoustician for E-Coustics Solutions, LLC, in Okemos, Michigan.

Q: What is the purpose of your testimony?

A: I am testifying to the acoustic issues of appropriate thresholds for audible and in-audible wind turbine sound at non-participating properties in the footprint of the proposed Prevailing Wind Park Project (PWPP) and to the computer modeling used by the applicant to assess impact of noise.

Q: What is your educational and professional background?

A: I have a degree in Mechanical Engineering with emphasis on noise control and acoustics. I have attached a set of documents that provide the details of my professional work. (See Exhibit 1.) The first page of that packet summarizes my work with focus on wind turbines since 2006 when I formed my current company, E-Coustic Solutions, LLC, (E-CS). It summarizes my published papers and qualifications to speak to wind turbine noise measurement, modeling and the impact of wind turbine noise on people in various jurisdictions. The next page is an excerpt from a Business Week article on my work with my clients using a computer model I developed with my first company based on the work I did for my undergraduate thesis. This model was accepted in government hearings in 1976. It was capable of modeling both in-facility worker noise and community noise. I was one of the first acousticians to use computer models for new facility design long before there were established national standards for such work. Other parts of the package cover my professional credentials and affiliations, list my publications and list hearings that I have participated in over the past 10 years.

Q: What experiences have you had that qualify you as a health expert in cases involving wind turbine noise?

A: I began looking at wind turbine noise as a special case of noise source shortly after closing my last company in 2006. Several early projects resulted in media exposure and I began to get requests from many places, some international, to advise local agencies or intervenors on proper siting methods. Because of that early work I have been involved in many major lawsuits about wind turbine noises where I have had access to not only my research work but also that of the opposing acousticians through discovery. I was also involved with the early studies that found that modern utility scale wind turbines emitted a pressure pulsation caused by the blade when it passes in front of the tower back in 2009.

This experience led to my work for the intervenors in the Wisconsin Brown County Shirley Wind case which Mr. Hessler referred to in his written testimony submitted in prior proceedings before the PUC. Subsequent to that I have been associated with other acousticians around the world, such as Steven Cooper of Australia's Acoustics Group who have reproduced my work and expanded upon it.

This experience gives me a unique set of experiences that I have used to advise my clients for projects currently under development or for lawsuits related to existing projects.

Q: What materials have you reviewed in this matter?

A: I have reviewed:

1. The sound study conducted by Burns & McDonnell Engineering Company, dated May 18, 2018;
2. The contour maps of the Project depicting the 45 dBA Leq boundaries from the sound study model;
3. The pre-filed testimony of Chris Howell, summarizing his and the Burns and McDonnell Engineering report assessing noise from the Prevailing Wind Park Project (PWPP);
4. The pre-filed testimony of Dr. Mark Roberts regarding Prevailing Wind Park;
5. The testimony of David M. Hessler, dated May 4, 2018, regarding his review of the Dakota Range Wind Project and recommendations for noise thresholds;
6. The testimony of David M. Hessler, dated March 28, 2018, regarding the Crocker Wind Farm; and
7. Bon Homme County's Article 17, regulation of wind energy systems (WES).

Q: After reviewing those materials, what is your overall impression regarding any potential health risks posed by the proposed Project?

A: The project, as proposed, has a significant potential to cause adverse health effects related to sleep disturbance and annoyance to audible sounds from the wind turbines, especially at night. The recommended thresholds by Howell and Hessler of 45 dBA Leq, are not appropriate for rural communities. This is especially true for communities that have no prior experience with utility scale noise sources operating 24/7/365 that produce fluctuating, pulsatile, tonal infra and low frequency sound. Wind turbine noise emissions have specific characteristics that make them more likely to cause these adverse effects than other common rural noise sources. Thus, criteria intended for urban/suburban communities where traffic noise is the typical nighttime noise source (urban hum) are not suitable for communities were people have an expectation of quiet. People in rural communities have lifestyles that are based on the quiet nature of most rural communities at night. This is reflected in ANSI-ASA S12.9 Part 4 "Noise Assessment and Prediction of Long-term Community Response" Appendix F, which cautions:

> **"F.3.4.1** In newly created situations, especially when the community is not familiar with the sound source in question, higher community annoyance can be expected. This difference may be equivalent to up to 5 dB.
>
> **"F.3.4.2** Research has shown that there is a greater expectation for and value placed on "peace and quiet" in quiet rural settings. In quiet rural areas, this greater expectation for "peace and quiet" may be equivalent to up to 10 dB.
>
> **"F.3.4.3** The above two factors are additive. A new, unfamiliar sound source sited in a quiet rural area can engender much greater annoyance levels than are normally estimated by relations like equation F.1. **This increase in annoyance may be equivalent to adding up to 15 dB to the measured or predicted levels." (Emphasis added)**

The community's response to the wind turbine noise will be as if the wind turbines were 15 dB louder than what is being predicted. This caution was in the EPA's 1974 Levels Document and also is present in current ISO standards followed in the EU and other countries. It is accepted acoustical practice that is overlooked by wind energy developers and their consultants.

Q: Are there sound level limits that you find more appropriate for rural communities?

A: In 2008 I worked with George Kamperman, one of the senior acousticians who led in the development of community noise limits for urban and suburban communities in the 1960s and 70s, to determine what the proper sound limits should be for wind turbines in quiet rural communities. Wind turbines were never considered when the community noise limits were set and especially it was not anticipated that they would be located in quiet rural areas near homes. So we decided to apply the same type of analysis to wind turbine noise as had been done for other common community noise sources in the past. We looked at when the turbines would operate, what the nighttime background sound levels would be in the receptor's location, and how much sound they emit in each frequency band. Then applying methods for calculating sound propagation that reflect how low frequency sound differs from higher frequency sound, we estimated the distances needed to prevent the noise of ten (10) wind turbines of the 1.5 MW class common in the late 2000s from causing nighttime annoyance inside a home with windows open.

We determined that the maximum sound level for audible sounds should be 35 dBA

(Leq) and 50 dBC, especially for nighttime wind turbine noise. We also limited the new noise source to be no more than 5 dBA louder than the pre-operational background sound level at night. Typical nighttime background sound levels are under 30 dBA (L90) in these communities so the 35 dBA acts as an upper limit.

The Kamperman/James document was subsequently reviewed in a paper titled: "Noise: Wind Farms," by three experts (Shepherd (Psychoacoustics), Hanning (Sleep Medicine Specialist) and Thorne (low frequency acoustician)) and published in the 2012 edition of the Encyclopedia of Environmental Management. They review the special character of wind turbine noise and in the Appendix update the criteria that Mr. Kamperman and I prepared in 2008 to address the fluctuating character of wind turbine noise. I have attached a copy as Exhibit 2 of their paper for the details behind these criteria.

Q: Are there other acousticians who have made similar recommendations for noise thresholds in rural communities?

A: Yes, there are many who have made similar recommendations. In 2017, Dr. Paul Schomer, the Emeritus Director of the Acoustical Society of America's Standards Committee published a paper titled: "A possible criterion for wind farms" at the 173rd meeting of the Acoustical Society of America. (*See* Exhibit 3.) Dr. Schomer, in his capacity as Director of the ASA Standards Committee has directed the work of the American National Standards Institute (ANSI) groups that produce the S12 consensus standards on how to measure noise and how noise affects people for over 30 years.

In his 2017 paper, he reviews how proper application of the ANSI standards for assessing the impact of a new noise source on a community to avoid adverse impacts results in a criterion of 36 to 38 dBA Leq. Dr. Schomer explains how the character of wind turbine noise requires lower limits than other common community noise sources.

He also bases his recommendation on the findings of a major study conducted by Health Canada (the Canadian equivalent to the US Centers for Disease Control (CDC). That study looked at a sample of just under 2000 people living within 3-5 km of six wind projects in Ontario. It found that the percent of people who report they are highly annoyed by wind turbine noise jumps dramatically from less than 2% when the modeled sound levels are 35 dBA Leq or less to over 10% for levels between 35 and 40 Leq. Health Canada defines High Annoyance to noise as an adverse health effect in accordance with the World Health Organization (WHO) and other bodies. The limits for new wind projects in Canada are set at 40 dBA Leq (worst case one hour). Thus, if PWPP is permitted to produce higher sound levels, it should be expected that annoyance will also be higher for those closest to the turbines.

Other countries, such as the U.K., Australia, and New Zealand, also use 40 dBA Leq as the upper limit for wind turbine projects. Some, like Germany and other European countries have limits of 35 dBA Leq for rural communities. Limits like these have not prevented wind energy development in those countries. The developers have to select locations where there is sufficient distance to prevent noise from exceeding the limits or work out private easement contracts with neighbors.

Q: Has the use of a limit of 40 dBA Leq been found adequate to prevent adverse effects?

A: No. This might be anticipated from the Health Canada finding that 10% of people find sound levels in the range of 35 to 40 dBA Leq are highly annoyed, increasing to about 14% for higher sound levels. Jurisdictions that set the threshold at 40 dBA Leq must deal with ongoing complaints, threats of legal action and other indicators that 40 dBA Leq is not sufficiently protective. Proper siting criteria can prevent this.

Q: How can, what appears to be a small change in sound level from 40 Leq to my 35 dBA Leq or Dr. Schomer's 36-38 dBA Leq, make such a difference in acceptability?

A: While it may appear that the difference is only a few decibels, it is important to remember that a 3 dB change in sound levels represents a doubling or halving of the acoustic energy. Thus, a change from 40 dBA to 37 dBA Leq is equivalent to turning off half of the wind turbines in a project designed to meet the 40 dBA Leq limit. This implies that the 3 dB change increases the setback distances by a substantial amount.

Based on my experience reviewing Ontario projects designed for 40 dBA Leq the closest homes to wind turbines have setbacks of about 1800 feet. To meet a 37 dBA Leq limit these setbacks would be increased to about 2500 feet. To meet the 35 dBA Leq limit the setback distance would be on the order of 3600 feet. To prevent annoyance during nighttime periods from multi-turbine projects Mr. Kamperman and I calculated the setback would need to be 1.25 miles (2km).

This is primarily because the rural areas are so quiet at night that even at these distances wind turbines can be audible inside homes where people are sleeping, especially those that sleep with windows open. To avoid this disturbance, the people would need to change their behavior to how suburban people cope with noise by having windows closed much of the time and using air conditioning for summer cooling.

In parts of Germany and Poland noise limits have been replaced with arbitrary setback distances based on the diameter of the wind turbine's rotors. The setbacks are equivalent to ten (10) times the rotor diameter. Thus, for a wind turbine with a 110 meter diameter blade the setback would be about 3600 feet. This is equivalent to the setbacks derived for 35 dBA Leq limits discussed above but avoids the complexity of sound modeling.

Q: Should these limits be applied to the property lines or to the homes?

A: I am a strong supporter of property rights and believe that noise that exceeds known safe levels should not be imposed on people just because they live near a neighbor who wishes to host wind turbines. This position influences my response to this question.

If a person owns property that is primarily agricultural with a residential home, they should still have the entire property protected to prevent future restriction on how the land can be used. For example, in the future they decide to subdivide their property for residential purposes. If the limit was set to the home, it is possible that the future development would be in a location where the noise is excessive for residential land use. If the limits are set for the homes, not the property lines, then wind project's noise emissions physically trespass on the neighbor's property without any compensation for the non-participating neighbor. The phrase "Noise Trespass" has been used in states like Michigan and Ohio were the debate over setting limits for the property line vs home are debated.

The question may be easier to answer if we look at other forms of pollution than noise. Take water pollution for example. If a farmer raises livestock and that livestock causes pollution of a stream passing through the property, the adjacent property owner is deprived from using the stream for normal purposes. In most states that I am aware of, the pollution is controlled at the emitter's property line. The same should be true for noise pollution. The landowner hosting the wind turbine may have a right to have a wind turbine on his/her property but does not have any rights to allow that sound energy to trespass onto the properties of neighbors. The obligation to prevent that trespass is on the property owner hosting the wind turbine(s) and the utility operator.

There is nothing that prevents the utility developer from working out an agreement with non-participating property owners to compensate them for allowing higher sound levels on parts of their property that are between the home and property line that they know will not be used for residential developments. Thus, the property line should be the default for protecting neighbors. If the utility developer/operator is willing to provide compensation for the "Noise Trespass" they can work out arrangements to protect that part of the property that is residential or may become residential in the future.

Q: What other characteristics of wind turbine sound emission affect adjacent properties?

A: The limits using dBA criteria are focused on sound that is in the speech frequency range. Sounds that are heard. The A-weighting process de-emphasizes low frequency sounds from 500 Hz and below. That includes sound that is felt. Like the bass beat from a neighbor's home when they play the stereo loud. Modern utility scale wind turbines like those proposed for PWPP have most of their acoustic energy in the range from under 1 Hz to 500 Hz that is ignored by the dBA calculations. This sound is called infrasound (0-20Hz) and low frequency sound (20-250Hz). Low frequency sounds, including infrasound, are problematic because they propagate much further than higher frequency sound with little loss of energy. That results in people hearing a rumble (very low frequency noise) or roar (low frequency sound above 100Hz) that penetrates their homes, especially at night when the house is quiet. Infra and low frequency sounds are not blocked by normal home construction methods for walls, roofs and windows.

Infra sound is a special case of low frequency sound where the energy has to be very high for the sound to be audible, but some people can "feel" the sound as body vibrations, pressure changes, migraines, tinnitus, dizziness, and other non-auditory effects. This is not limited to wind turbines. It also is a characteristic of helicopter sound emissions or large fans in high rise office buildings when they need maintenance. (In that last case the term is Noise induced Sick Building Syndrome.)

Dr. Schomer's 2015 paper titled: "A theory to explain some physiological effects of the infrasonic emissions at some wind farm sites" (attached as Exhibit 4) explains how these inaudible levels of wind turbine sound, which are presented as pressure pulsations inside of homes, can trigger these non-auditory sensations and symptoms. The phrase "Wind Turbine Syndrome" was coined by Dr. Nina Pierpont, MD. to describe them. These symptoms cannot be explained as occurring due to audible sound levels in the speech frequency range. See the attached Exhibit 5, which is a one-page summary of wind turbine blade pass frequency and effects, for an explanation of how these pulsations are produced.

Mr. Hessler refers to a study in his written testimony that he participated in for the Wisconsin Public Service Commission for the Shirley Wind Project in Brown County Wisconsin. That study was conducted in the homes of my clients who had filed complaints with the WI PSC during a hearing on a second wind project in another part of the state. The study that Mr. Hessler points to was designed by me for my clients and accepted by the PSC. I developed the test protocol, selected the homes to be tested, and picked the acousticians who would conduct it. Because the complainants were my clients, I did not participate, but was given full access to the data and did an independent analysis for the PSC which confirmed the presence of pulsating infrasound.

This study confirmed that inside the homes, wind turbine pulsations created by the loss of lift on the blades as the blade passes into the wind deficit region in front of the tower was present at levels almost the same as outside the homes. I have attached as Exhibit 6 a set of graphs showing the infrasound that I prepared for the Brown County Health Department showing the infrasound using two types of instrumentation. The graph on the first page shows the spectrograms from multi-hour micro barometer tests in the home with the highest infra sound during the test Mr. Hessler describes. (This was R1 of the study at 3600 feet from the nearest wind turbine). The infrasound pulsations are seen as horizontal bands of energy and are explained in the notes. The last page shows a simultaneous test at R1 and another home located about four (4) miles away where the occupants experience pressure related headaches when the turbines are operating even though none of the wind turbines are visible. The infrasound traces are still present at this distance although somewhat attenuated. It is this ability to propagate long distances that makes the infra sound component of wind turbine noise so problematic.

Brown County's Health Department declared the entire region within 2.5 miles of the Shirley Wind project to be a "Human Health Hazard" zone. This is an official classification under Wisconsin law.

The owners of two of the homes (R1 at 3600 feet and R3 at one mile) abandoned their homes shortly after the project started to operate due to symptoms that included nausea and dizziness. Those homes are still vacant. R2 was abandoned to the mortgage company who resold it to a different family.

Q: Has this study been duplicated?

A: Yes, several times by myself and other acousticians, most notably Steven Cooper of Australia's Acoustics Group. Cooper's Cape Bridgewater study is very detailed and lengthy but can be obtained at http://www.pacifichydro.com.au/english/our-communities/communities/cape-bridgewater-acoustic-study-report/.

He finds that the test subjects in his three test homes were able to reliably sense the starting and stopping of the wind turbines without visual cues. One test subject was functionally deaf due to childhood illness damaging the auditory nerves. This test subject was able to sense the operation of distant wind turbines without any auditory or visual cues. Mr. Hessler refers to this study as one that resulted in him rethinking his position on inaudible infrasound as a source of adverse health effects.

Dr. Schomer references this study in his paper (referenced earlier) and also conducted a peer review of it. His peer review concludes:

> "The results are that there is a cause and effect relationship between turbine power output and subject response, and, at the same time there is no correlation between subject

response and either sound level or vibration level. These results show that there is a non-visual, non-audible pathway by which wind turbine emissions can cause some specific effects in some people. These results say nothing about the nature of these effects. Nothing internal to the body is discussed. We again reiterate to government and to wind farm operators, if you don't believe the results, replicate the study using clearly independent consultants.

"Some may ask, this is only 6 people, why is it so important? The answer is that up until now windfarm operators have said there are no known cause and effect relations between windfarm emissions and the response of people living in the vicinity of the windfarm other than those related to visual and/or audible stimuli, and these lead to some flicker which is treated, and "some annoyance with noise." This study proves that there are other pathways that affect some people, at least 6. The windfarm operator simply cannot say there are no known effects and no known people affected. One person affected is a lot more than none; the existence of just one cause-and-effect pathway is a lot more than none. It only takes one example to prove that a broad assertion is not true, and that is the case here. Windfarms will be in the position where they must say: "We may affect some people." And regulators charged with protecting the health and welfare of the citizenry will not be able to say they know of no adverse effects. Rather, if they choose to support the windfarm, they will do so knowing that they may not be protecting the health and welfare of all the citizenry."

Q: Has this been duplicated in a controlled laboratory test?

A: Yes. Mr. Hessler references such a study in his testimony. This was reported in a paper presented by Steve Cooper at the Acoustical Society of America's December 2017 conference and published in the Proceedings of Meetings on Acoustics (POMA) in a paper titled: "Subjective perception of wind turbine noise - The stereo approach."

Steve Cooper designed a laboratory where he could accurately reproduce the sounds he measured in the Cape Bridgewater homes in both frequency and time domain, down to 3 Hz. He created an audio sample from one of his Cape Bridgewater measurements that reproduced the pulsations at the infrasonic rate of the blade pass frequency. He did blind testing of people who included some who live in wind projects and by others who did not think they were sensitive to such sounds.

Cooper's controlled experiments reproduced the acoustical characteristics found inside homes where sensitive people have filed complaints of sensations and other non-auditory complaints. Inaudible sound pulsations occurring at infrasonic rates emitted by wind turbines were shown to cause perceptible sensations in test subjects who self-identified as being sensitive to wind turbine infra sound. Those who self-identified as being sensitive to wind turbine infra sound were able to reliably detect when the sample was played or not and could also detect the direction from which the sound came (blindfolded and sitting in a swivel chair). Some of the test subjects who did not identify as "sensitive" were also able to detect the presence of the infra sound pulsations.

Mr. Cooper's study shows that:

1. It is possible to reproduce in a controlled laboratory experiment the acoustic characteristics of wind turbine sound pressure pulsations occurring at infrasonic rates found in homes of people living near utility scale wind turbines who have filed complaints of adverse sensations and health effects.
2. These inaudible acoustic conditions reliably trigger in self-identified "sensitive people" sensations and adverse effects associated with the complaints by people who live in or near the footprint of utility scale wind turbines.

Wind turbine sound emissions consisting of dynamically modulated pressure pulsations at infrasonic rates synchronized to the blade pass frequency were shown to cause sensations and other adverse effects under controlled laboratory conditions.

There are other studies of this type being conducted but they do not use a real audio sample from a home where people have reported the sensations. Those studies rely on what is being called a "surrogate sample" that does not include the dynamically modulated pressure pulsations, they only reproduce the frequency and sound pressure levels measured in the homes. Thus, they do not include the most important characteristic of pulsating noise. These studies report that the test subjects do not respond to the sound. This is a strong piece of evidence that it is the pulsations and not the infra and low frequency sound levels that are important in producing sensations. It also explains why people do not report these sensations when exposed to steady infra sound from the natural environment.

Q: Do you have any comments on the Burns-McDonnell Sound Study for the Prevailing Wind Park Project?

A: Yes. First as indicated by my testimony above I disagree with the idea that a threshold of 45 dBA Leq is protective for people living near the wind project. Second, I reviewed the information on the computer model prepared for the report. I find the model is deficient in many ways. One significant way is that it fails to include two important sets of tolerances. The sound power data used as input to the model is derived using a method that has about a ± 2 dB tolerance for measurement repeatability. This tolerance should have been added to the sound power levels used as input to the model to account for known variability in measurement data. Also, the model uses the formulas and protocols from ISO 9613-2 which states it is not applicable for noise sources that are more than 30 meters above the ground or receiver elevation. Even if the model was appropriate for wind turbine noise the model has known tolerances of ± 3 dBA. This should have also been applied as an adjustment to the Burns-McDonnell sound model. Given these two tolerances the predicted sound levels are as much as 5 dBA low.

Further, the values used for ground attenuation are not disclosed. The proper value for ground attenuation is "0" to turn off any calculations of ground effect. This is because the height of the wind turbines means that the sound emitted by them radiates directly from the blades to the homes without interaction with the ground. The ISO ground attenuation calculations are intended for ground-based noise sources where the sound radiates along a line from source to receiver just above the ground.

Dr. Schomer has in the past, identified additional problems with wind turbine noise prediction using the ISO model methods. He was a member of the committee that developed the ISO 9613-2 standard and its ANSI equivalent (ANSI/ASA S12.62). He has repeatedly stated in hearings and conferences that the model does not properly predict the propagation of low frequency noise. The ISO model range for accuracy is focused on sound in the frequencies that are most important for other types of ground-based community noise sources. In testimony he gave for the White Pines project in Ontario he stated that the model is likely to underestimate the sound propagation from wind turbines by as much as 11 dBA. This is in addition to the issue of tolerances for the calculations. As I have stated above I have also measured wind turbines operating at levels 10 dBA Leq or more above the predicted sound levels.

Q: What does this mean for the Prevailing Wind Park project?

A: It means that the predicted sound levels at receptors in and near the PWPP are <u>at least 5 dBA less</u> than what should be expected if the project was operating and the sounds measured and compared to the model's predictions. I have conducted such studies and routinely find that the wind turbines exceed the modeled sound levels by 5 dBA and in some cases, especially when the operating mode includes high blade angles or wind turbulence, the model under predicts by 10 or more dBA.

The flaws in the model make it likely that if the project is approved as designed there will be many complaints of annoyance and some of adverse health effects along the lines of what occurred at Shirley Wind and Cape Bridgewater.

Before any decisions are made on permitting this project the applicant should be required to submit a new model that applies the known tolerances to the input data. It should also show the contour lines for 30, 35, and 40 dBA. These new sound levels should then be viewed as indicators of what the community will experience on a day when the wind turbines are operating under optimum conditions for the lowest noise emissions. They are not precision predictions. Review of the model should be done keeping in mind that the operating values can be as much as 10 dB higher than what is predicted, under operating conditions that would be considered normal.

The likely complaint times will be at night when winds at the blades are strong with high wind shears at the hub elevation, but calm or no winds at the ground (called a stable nighttime atmosphere). Studies have shown that these weather conditions occur as frequently as 2 out of 3 nights during warm seasons. Since the ground level winds are calm there is no wind induced noise or leaf rustle to mask the wind turbine noise. This condition is recognized in many jurisdictions (e.g. Ontario) as the "worst-case" condition for complaints.

Q: Do you have any comments on Dr. Roberts' testimony.

A: Yes, however I understand the Dr. Punch will be addressing that testimony in more detail. What I would add is that, in my opinion as an acoustician, Dr. Roberts is not qualified to speak to the issue of acoustics or human response to wind turbine noise. Acoustical engineers are trained in how to measure sound and relate those measurements to human and community response. I saw nothing in his background that qualifies him to speak to these issues.

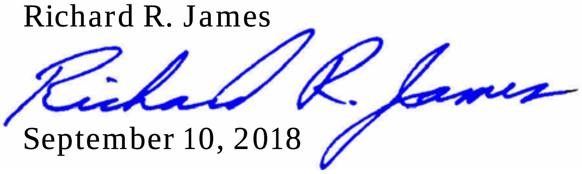
Dr. Roberts' testimony is not reliable when read by an experienced acoustician who understands the particular character of wind turbine noise that leads to it being highly annoying at sound levels well below other common community noise sources.

Q: Do you have anything further to add at this time?

A: The foregoing written testimony is to be presented to the South Dakota Public Utilities Commission for SD PUC Docket EL 18-026.

I reserve the right to revise and expand upon these written comments during the hearing.

Richard R. James



September 10, 2018