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 JERRY L. PUNCH

ON BEHALF OF INTERVENORS

EXHIBIT
Int. I-2

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

A: My name is Jerry L. Punch, and I am a Professor Emeritus in the Department of Communicative Sciences and Disorders (CSD) at Michigan State University (MSU) in East Lansing, Michigan. As a retired faculty member, I maintain an office in the Department, which is located in the Oyer Speech and Hearing Building, 126 Red Cedar Road, East Lansing, MI 48824. My home address is 4469 Satinwood Drive, Okemos, MI 48864.

Q: What is the purpose of your testimony?

A: I have been asked to provide testimony as an audiologist on behalf of Intervenors in the matter of the Prevailing Wind Park wind project ("Project"). My testimony as an expert witness will address the potential health risks posed by noise from the Project, if approved according to the application and regulations described in Article 17 of Bon Homme County zoning ordinances and the affidavit of Peter Pawlowski, dated August 9, 2018.

Q: What is audiology?

A: Audiology is the study of hearing and hearing disorders. It is a health-related discipline that focuses on sound, the anatomy and physiology of the ear, hearing disorders, and the clinical aspects involved in diagnosing and treating hearing disorders. As an audiologist, I am knowledgeable of the anatomy and physiology of the ear; sound generation, propagation, and perception; and the ear and how it processes sound. I also have knowledge of research design and interpretation of research findings, and I have had a long-standing interest in community noise issues. This background has led me to understand the relationships between noise and the impacts it can have on human health.

Q: What is your educational and professional background?

A: My full CV is appended as Exhibit 1. I hold a PhD degree in Audiology from Northwestern University and have held a number of professional positions in audiology over the past 50 years. I have had an extensive and eclectic career as a clinical audiologist; clinical supervisor; researcher; teacher; and administrator in academic, professional association, hospital, and industrial settings. My academic coursework included the study of the biological sciences through enrollment in MA and PhD-level courses in anatomy and physiology of hearing and

enrollment in a PhD-level course in physiological psychology. My work experiences include internships and paid employment as an audiologist in multiple otolaryngology clinics as a graduate student; instruction of ENT residents at Indiana University School of Medicine on the clinical aspects of audiology; and instruction of undergraduate-level courses in the anatomy and physiology of hearing. Over the years, I have taught a large variety of undergraduate- and graduate-level courses in clinical audiology. Those courses include a graduate-level course on Research Methods, which I taught at MSU for approximately five years prior to my retirement in 2011. I have also taught a graduate-level seminar on ethics in research and clinical practice. For seven years in the recent past, I served as a representative of the five departments of the College of Communication Arts and Sciences on MSU's Institutional Review Board (IRB). The IRB is charged with reviewing and approving research applications of MSU researchers, with the aim of protecting human subjects who participate in research studies conducted in various disciplines.

Q: What are your current professional credentials and affiliations?

A: I am a member of the American Speech-Language-Hearing Association (ASHA), the American Academy of Audiology, the American Auditory Society, and the Acoustical Society of America (ASA). I hold the Certificate of Clinical Competence in Audiology from ASHA, which I have maintained since 1968 through various formal programs of continuing education. I am also an ASHA Fellow. Fellowship is one of the highest honors the Association bestows. To be awarded Fellowship, nominees must have made outstanding contributions to the discipline of communication sciences and disorders. ASHA Fellows make up less than one percent of the membership of that national organization. Although I am officially retired from MSU, I maintain an office in my academic department and continue to conduct audiological research and to consult on wind turbine projects as a health expert.

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

A: I have had a considerable number of such experiences. Since about 2009, I have coauthored a review article on wind turbine noise in *Audiology Today*, served as Chairperson of the Wind and Health Technical Work Group, at the invitation of the Michigan Department of Energy, and

presented invited comments in public hearings and hearings of zoning boards and commissions in several states, including Michigan, Illinois, Indiana, and New York. I coauthored a three-part, invited blog on the *HearingHealthMatters.org* website (Punch & James, 2014). I have been qualified as a health expert in MI by meeting the legal challenge in a Daubert hearing, and served as a health-expert witness in legal cases at local, state, and federal levels in Ohio, Wisconsin, Michigan, Iowa, Illinois, Oregon, Indiana, and New York. This information is detailed in the Forensic Activities section of my CV. I have interviewed multiple individuals and families who have reported adverse health effects, including some who have abandoned homes or are considering abandonment because of health complaints due to wind turbine noise. I have conducted ongoing reviews of the scientific literature on the health effects of wind turbine noise, and in 2016 I coauthored an extensive peer-reviewed article on the HearingHealthMatters.org website with Richard James. The title of that article is *Wind turbine noise and human health: a four-decade history of evidence that wind turbines pose risks*, which I append as Exhibit 2. That paper contains all of the literature references in my testimony. The purpose of the 2016 article was to review the scientific literature that disputes 12 positions commonly taken by the wind industry. Among those positions are statements suggesting that acoustic energy below audible threshold cannot harm people ("What you can't hear can't hurt you"), the complaints are based on psychological expectations, and that there is not sufficient scientific evidence to establish a cause-effect relationship between wind turbine noise and adverse health effects.

Q: What materials have you reviewed in this matter?

A: I have reviewed Bon Homme County's Article 17, drafted on July 27, 2015 to regulate wind energy systems (WES); the sound study conducted by Burns & McDonnell Engineering Company, dated May 18, 2018; the 45-dBA Contour maps of the Project; the direct testimony of Chris Howell, summarizing his noise assessment in the matter of Prevailing Wind Park; the direct testimony of David M. Hessler, dated May 4, 2018, regarding the Dakota Range Wind Project; the pre-filed supplemental testimony of Dr. Mark Roberts regarding Prevailing Wind Park; the direct testimony of David M. Hessler, dated March 28, 2018, regarding the Crocker Wind Farm; and the affidavit of Peter Pawlowski, signed August 9, 2018.

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

A: In my opinion, those materials paint an overly optimistic picture by indicating or suggesting that limiting wind turbine noise to an average level of 45 dBA will avoid significant adverse health impacts and significant community annoyance. Based on my professional background and experience with people living near existing wind projects, numerous anecdotal reports, the scientific literature, papers presented at scientific and professional meetings, and governmental and agency reports, I believe that a substantial proportion of people living in the vicinity of the proposed Project can be expected to experience not only annoyance, but also a variety of adverse health effects. Those effects, which vary widely among affected individuals, are commonly observed worldwide. They include sleep disturbance, annoyance, headaches, dizziness, vertigo, nausea, motion sickness, ear and bodily sensations, fatigue, stress, depression, memory deficits, inability to concentrate, and reduced quality of life. In a given individual, these effects can occur alone or in combination with other effects. In short, a design goal of a 45 dB average level will not adequately protect the health of residents who live in the boundaries of the proposed Project.

Q: You seem to imply that not all residents will be affected adversely. In what percentage of residents would you expect these adverse reactions to occur?

A: Certainly, not everyone will experience or report negative consequences. Landowners who lease their farmland to host wind turbines ("participants") are less likely than others to complain, partially because they earn an income from their leasing agreements with the wind company, but also because they are often constrained by lease agreements that restrict them from complaining or speaking negatively about their experiences. Likewise, not all non-participants will experience negative impacts, or they may not overtly complain if they do. Some of these individuals have signed waiver agreements with the wind company, occasionally accompanied by a financial payment, which virtually ensures that they will be less likely to complain. One factor that makes the noise tolerable for many people is that the noise is intermittent because the wind is often not sufficiently strong to run the turbines. For almost all exposed residents, though, the turbines inevitably generate relatively a loud thumping, or whooshing, noise, and some residents experience ill effects from the low-

frequency noise and infrasound. The result, for what I would estimate at being around 15%-25% of exposed residents, is extreme annoyance and sleep disturbance. In the longer term, some of the other symptoms I've mentioned begin to emerge. In some cases, a few residents may suffer serious cardiovascular problems such as high blood pressure.

Q: Some of the symptoms you describe seem naturally to occur with aging. How can wind turbine noise be distinguished from aging and pre-existing conditions as the cause of such complaints?

A: One line of evidence comes from the World Health Organization (WHO, 2009), which focuses primarily on low-frequency community noise. That organization states that, based on multiple research studies, such noises can lead to stress, and subsequently to health problems. The pathways from noise to adverse health effects may be direct or indirect. It indicates that several studies have established a closer relationship between subjective responses to community noise and cardiovascular outcomes when the annoyance is sleep-related than when it is non-sleep-related (p. 78). In addition, there are many anecdotal and scientific reports of residents who have experienced sleep disturbance, as well as headaches, dizziness, ear pain or pressure, and inability to concentrate, when near the turbines. When they leave the project area temporarily or for a few days or more, their symptoms subside, and when they return, those symptoms, including sleep disturbance, reappear. Similar observations can be made regarding pre-existing conditions, which are sometimes reported to worsen after turbines become operational. If it can be determined that the additional stresses experienced when near the turbines can be relieved by leaving the area, and that they reoccur when the individual returns to the area, that is a good indication that the turbines are responsible for their deteriorating state of health. The scenario in which symptoms subside and recur with changes in location with respect to the turbines, which many have experienced repeatedly, is similar to the research design known the case-crossover design. Case-crossover studies are described in the 2016 Punch and James paper (Exhibit 2). The types of evidence I've described indicate that there is a strong association between exposure to wind turbines and the health complaints, and they strongly suggest that the link is causative. The main point is that all possible precautionary steps need to be taken to ensure the Project will not substantially impair the health of those living in and around the Project.

Q: How do you view your role in this matter, as it relates to an ability to establish a causative link between wind turbine noise and adverse health impacts?

A: I distinguish between general causation and specific causation, as they differ based on the targets of interest: the general population versus targeted individuals, respectively. Physicians, including those with epidemiological backgrounds, have the medical expertise to diagnose and treat the health symptoms of their individual patients who have been exposed to wind turbine noise. The chief recommendation of physicians who have become involved with patients who suffer adverse health effects from wind turbine noise is to move away from the source of the problem. On the other hand, acousticians, audiologists, occupational health and safety experts, and environmental experts have the expertise to analyze the available research and other evidence needed to conclude that wind turbine noise causes adverse health impacts in the general population. These individuals are often called upon as experts in legal proceedings such as this one. That is the role in which I see myself in this matter.

Q: Dr. Mark Roberts, in his supplemental direct testimony, has testified on the role of epidemiological research in establishing a causative link between wind turbine noise and AHEs. What is your reaction to that testimony?

A: My reaction is essentially the same as that already described in Exhibit 2. Dr. Roberts' testimony rests primarily on his credentials in epidemiology and apparently not on his first-hand experience with people who have been exposed to wind turbine noise over long periods of time. Also, he appears to be acquainted with only that body of literature on the subject that is favorable to the wind industry, and to his testimony in its behalf. He points to peer-reviewed epidemiological research as the only basis for proof of cause-effect relationships. Although he espouses the Bradford Hill criteria as relevant, he essentially dismisses most of the nine criteria by naming them, without discussing their implications. Those criteria, with descriptions from Punch & James, 2016, were: (1) strength (strength of observed relationships), (2) consistency (consistency, or repeatability, of relationships, based on observations by different persons, in different places, under different circumstances, and at different times), (3) specificity (causation is indicated if the association is limited to specific individuals and to particular sites

and types of disease and there are no associations with other factors), (4) temporality (there is a clear temporal relationship between outcomes and periods of exposure and non-exposure), (5) biological gradient (a dose-response relationship exists), (6) plausibility (causation is more likely when certain outcomes are biologically plausible, or possible, a caveat being that plausibility depends on the biologic knowledge of the day; this element is best expressed in the statement: "When you have eliminated the impossible, whatever remains, however improbable, must be the truth" (p. 10), (7) coherence (the cause-and-effect interpretation of data should not seriously conflict with generally known facts of the natural history and biology of the disease), (8) experiment (experimentation or semi-experimental evidence, even if only occasional, can reveal the strongest kind of evidence for causation), and (9) analogy (the recognition that similar cause-effect relationships have occurred under similar conditions). Hill states:

> What I do not believe (is) ...that we can usefully lay down some hard-and-fast rules of evidence that must be obeyed before we can accept cause and effect. None of my nine viewpoints can bring indisputable evidence for or against the cause-and-effect hypothesis and none can be required as a sine qua non. What they can do, with greater or less strength, is to help us to make up our minds on the fundamental question – is there any other way of explaining the set of facts before us, is there any other answer equally, or more, likely than cause and effect?... No formal tests of significance can answer those questions. Such tests can, and should, remind us of the effects that the play of chance can create, and they will instruct us in the likely magnitude of those effects. Beyond that they contribute nothing to the 'proof' of our hypothesis (p. 299).

Hill makes this final observation in his essay:

> All scientific work is incomplete – whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time (p. 300).

In summary, my reaction to that portion of Dr. Roberts' testimony is that, like many of his epidemiological colleagues who testify on behalf of wind energy projects, he chooses to disregard Hill's intent to emphasize that experimentation (Hill's eighth of nine criteria) is only one of many criteria that are useful is establishing causation between external agents and disease processes.

Q: Can you give specific examples of how the Bradford Hill criteria apply to wind turbine noise and adverse effects on health?

A: Yes, I believe that the available evidence, which includes both research and common-sense observations, meets all nine of the Bradford Hill criteria, and that, in their totality, that evidence supports a causative relationship between wind turbine noise and adverse health effects. This evidence includes, respectively: (1) widespread reports of complaints, (2) consistency of reported symptoms, (3) and (4) concurrence of symptoms with wind turbine operation, (5) an observable dose-response relationship between exposure levels (or distance) and symptoms, (6) the role of disturbances of the hearing and balance mechanisms of the inner ear in causing identified symptoms, (7) coherence with WHO (2009) and other relevant guidelines, (8) in addition to cross-sectional studies, experimentation is established by the fact that symptoms decline or disappear when receptors leave the area and recur when they return to the area, and (9) Sick Building Syndrome as the analogy. Based on these observations, Dr. Roberts' efforts to raise epidemiology as the only cause-and-effect threshold sets the standard so high that we may never expect to reach resolution on this and many similar matters. Dr. Carl Phillips, also an epidemiologist, states in a paper prepared for the Wisconsin Public Service Commission (dated July 3, 2010):

> Some recent commentators (Colby et al. 2009; Roberts and Roberts 2009) have attempted to dismiss this evidence because none of it is based on the epidemiologic study types that they understand. It is true that other study designs would have told us more, and still could. But dismissing the evidence we have makes little sense given that a huge portion of all knowledge, including formal scientific inference, is based on data that is not from studies designed according to certain preferred approaches. It should be obvious that "does not tell us everything we want to know" does not mean "has no information content". Those making this argument either do not understand scientific inference or are pretending they do not. Claiming that there is no evidence even though there are reports of individuals suffering is akin to claiming that there is no evidence that people get injured as a result of text-messaging while engaged in other activities because, even though the pathway is obvious and there are numerous accidents occurring from some activities, there is often not a "real study" that allows us to make various quantitative estimates. (p. 7).

Q: Do you have additional reactions to Dr. Roberts's supplemental direct testimony in this case?

A: Yes, I would like to make one other point. Dr. Roberts raises the nocebo argument. He is arguing that the complaints people make regarding adverse effects of wind turbine noise are psychologically motivated by expectations resulting from negative messages surrounding

turbines. That argument continues to persist as one of the wind industry's primary explanations for adverse health impacts. In our 2016 paper, James and I, after evaluating these claims, concluded that none of these explanations is as plausible as the notion that a variety of adverse reactions are *physiological* effects caused directly or indirectly from exposure to low-frequency noise and infrasound from wind turbines. While psychological expectations and the power of suggestion can influence perceptions of the effects of wind turbine noise on health status, no scientifically valid studies have yet convincingly shown that psychological forces are the major driver of such perceptions. We describe in some detail in our article the scientific shortcomings of the several studies that have been done, all of which conclude that the nocebo effect is the culprit. I encourage interested individuals to read those details.

Q: How does your background qualify you to testify on the general causal mechanism that explains these adverse health effects?

A: First, I would note that two of the seven panelists commissioned by the American Wind Energy Association to conduct the 2009 review of literature by Colby and colleagues on the noise and health effects of wind turbines were audiologists. Audiologists have the educational background to understand the functioning of the inner ear, and it is that knowledge that led me to become interested, over the last decade, in the relationship between ear physiology and the health impacts of infrasound and low-frequency noise from wind turbines on people. Like many others who have studied this relationship, I believe that most of these adverse reactions are mediated by disturbances of the hearing and balance mechanisms of the inner ear resulting from the low-frequency noise emitted by industrial wind turbines. The inner-ear components affected include the cochlea, which is the organ of hearing, and the vestibular system, which includes the semicircular canals, utricle, and saccule. These organs are responsible for balance, or equilibrium. While the cochlea is responsible for the perception of audible sounds, the vestibular system is sensitive to movement and changes in head position, and can be stimulated by infrasound to induce perceptions of unsteadiness, dizziness, vertigo, and motion sickness in some people.

Q: Earlier, you emphasized sleep as being critical to health. How does wind turbine noise lead to sleep disturbance, in your opinion?

A: Wind turbine noise is a significant disruptor of sleep because our ears, unlike our eyes, are always open, especially to unusual or novel stimuli, including "bumps in the night" that might threaten our safety. During operation, the turbines produce audible noise, mostly in the infrasonic and low-to-mid-frequency range. That audible noise results in the perception of both a relatively constant whirling sound and a periodic whooshing sound, caused by a combination of the blade movement against the air and the blades passing in front of the tower. When the three blades are rotating at a typical 20 revolutions per minute, that sound occurs once per second. Those audible sounds can annoy people and disrupt their sleep patterns. The turbines also generate a pulsating sound at infrasonic rates that are based on blade rotational speed, meaning that the sound spikes, or peaks intermittently. These noises, and the unpredictability of the prevailing winds, are responsible for sleep disturbance in a substantial number of people. The peakiness of the noise is especially annoying and disturbing, and is the reason sleep disruption is not adequately predicted from, or correlated with, long-term average decibel levels, designated as LAeq.

Q: If dB LAeq is not used to quantify noise levels of wind turbines, what metric might better predict sleep disturbance?

A: LAmax, or the maximum noise level produced during a given nighttime period, appears to be the optimal measurement metric to protect sleep. The WHO (2009) Night Guidelines suggest that a 40 dB LAmax level should be the maximum allowable level during nighttime hours. That document uses the term "LAmax" a total of 93 times, which is an indication that the WHO considers the concept highly important as a metric for quantifying nighttime noise. If used, any compliance-monitoring procedures should allow some degree of repetition to occur, and to eliminate other noise sources as the origin of the emissions, before noncompliance is declared. Because there are sufficient audible differences among wind turbine noise and other sources of noise—including traffic noise, thunder, wind, and wildlife—the various sources are easily distinguishable.

Q: Are there other noise measurement metrics that could effectively protect sleep?

A: Yes, possibly. Dr. Paul Schomer currently recommends that wind turbine noise should be limited to an average level of 36-38 dBA, based on a 24-hour measurement period. Although he

offers that recommendation for the purpose of avoiding substantial annoyance at all hours of the day and night, it is a potential alternative to 40 dB LAmax in an effort to minimize or avoid sleep disturbance. Dr. Schomer's credentials as the former Director of the Standards Division of the Acoustical Society of America, and his use of four independent sources in deriving his recommendation, give considerable weight to his recommendation. The major concern I have with that approach is that verification is required to show that a 24-hour metric can sufficiently protect sleep during nighttime hours. Wind companies typically prefer to use the Leq metric because it is more easily compared to available data, and generally resist accepting levels lower than 45 or 40 dBA as a design goal for its wind projects.

Q: The Charles Mix County zoning commission seemingly has joined Bon Homme County in establishing minimum setback distances. Rather than establishing the highest permissible noise level to protect the health of residents, would it not be simpler to establish the minimum permissible distance?

A: Undoubtedly, distance is the most effective means of avoiding negative health impacts from wind turbine noise. The short distances from the property line, such as the 500 feet or 1.1 times the system height, whichever is greater, and from residences, such as the 2,000 feet or 3.5 times the system height, whichever is greater, that have been agreed to in this Project are entirely inadequate. Such short distances are intended to reduce risks from physical failures such as blade throw, ice throw, or falling towers. They do almost nothing to protect residents from exposure to low-frequency noise and infrasound. Researchers who have offered distance as an index to obviate health effects have typically recommended 2 kilometers, or 1.25 miles, as a minimally safe distance from the nearest turbine. Although that distance will not prevent annoyance and health effects for everyone, I think it is a reasonable compromise aimed at protecting health and well-being. We have to recognize, though, that studies have shown that some residents within several miles of an industrial wind project complain that the noise is disturbing, presumably because infrasound travels great distances and is not easily attenuated. The problem with distance as a predictor is that different residences at the same distance from the turbines will experience different noise emissions, depending on the turbine array, topography, variable wind speeds, and other factors. In the end, the actual level of noise

emissions is the critical variable that needs to be controlled, as distance in itself cannot assure that the noise will not be invasive for residents in the footprint of the wind project.

Q: In your opinion, is there any important information omitted from, neglected, or erroneously stated in the documents you reviewed for the Prevailing Wind Park project?

A: Yes. Similar to Mr. Hessler's observation in his Dakota Range report, I noticed that an important component missing from the Burns & McDonnell Engineering Company's sound study for this Project is a discussion of the annoyance and adverse health impacts of the Project. Like almost all reports commissioned by wind companies, it does not discuss the fact that annoyance can lead to adverse health effects, as established by Berglund et al. (1999); the WHO (2009); Shepherd, Hanning, and Thorne (2012); and Fast et al. (2016). The WHO (2009) has described annoyance as a critical health effect, in that in some people it is associated with stress, sleep disturbance, and interference with daily living. In fact, the Burns & McDonnell report ignores much of the information in the WHO 2009 guidelines, which were revised downward from the 1999 guidelines as a result of new medical research into adverse health symptoms due to noise. Burns & McDonnell describe wind noise as a masker that can "drown out" the sounds created by the turbines. Although this may be true in rare cases, it is typically not true at night when wind speeds are high at the turbine heights and low at ground level. Also, the design goal of 45 dBA (Bon Homme County ordinance), or 43 dBA (Charles Mix County— Pawlowski affavidit) is higher than what most independent researchers consider protective of health.

Q: Did you find any shortcomings in Mr. Howell's study of background sounds?

A: Yes, in several respects. To me, the most surprising point Mr. Howell made is that he reports measured L90 background sound levels as high as 45 dBA, which is unusually high for a rural area. A table showing all measured levels would have revealed the frequency of such occurrences. Instead, he reports only a range of 21.5-45 dBA. He also understates the sound impact of wind turbine noise by comparing it to levels of normal conversational speech. Comparing the noise from wind turbines to speech using an A-weighted scale is misleading because the levels of low-frequency noise and infrasound from turbines is substantially greater than for speech, as speech energy begins to drop off precipitously at about 150 Hz and below, and the levels of turbine noise continue to rise below that frequency. Using A-weighting

attenuates low frequencies below 1000 Hz, and effectively filters out infrasound, leading to a gross underestimate of infrasonic energy. Also, related to the fact that Bon Homme County does not specify how sound measurements should be performed, Mr. Howell does not indicate whether the design goal is met by measurements over a specified time period. They could be taken over hours, minutes, or days, and could cover the daytime hours, nighttime hours, or a full 24-hour day. Again, it is essential to limit sound levels to those that fully protect residents' sleep, as sleep is a major determinant of good health.

Q: Based on your professional experience and expertise, what restrictions should be placed on the Project to ensure that it will not substantially impair the health of those living around it?

A: As a general rule, no wind turbine should be located closer than 1.25 miles from the property line of any residence. This distance should preferably be applied to all residences, both participating and non-participating. If placed closer to participating residences than 1.25 miles, those residents should be adequately informed, in writing, of the potential for high annoyance and health risks. With regard to permissible noise levels, the WHO recommendation of 40 dBA Leq(night,outside) should not be exceeded at any residence, particularly at non-participating households. To provide adequate protection from sleep disturbance, nighttime noise levels should be limited to 40 dB LAmax. A metric of dB LA10(night, outside), the noise level exceeded 10% during nighttime hours and measured at the façade of the residence, may be a reasonable substitute for LAmax if considered by acoustical experts to be easier to apply for the purpose of compliance.

Q: Does this conclude your testimony?

A: Yes.

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

Dated this 6th day of September 2018.

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Jerry L. Punch