Ex. A19

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY DEUEL HARVEST WIND ENERGY LLC FOR ENERGY FACILITY PERMITS OF A WIND ENERGY FACILITY AND A 345-KV TRANSMISSION LINE IN DEUEL COUNTY, SOUTH DAKOTA FOR THE DEUEL HARVEST NORTH WIND FARM

SD PUC DOCKET EL18-053

PRE-FILED REBUTTAL TESTIMONY OF DR. JEFFREY ELLENBOGEN
ON BEHALF OF DEUEL HARVEST WIND ENERGY LLC

April 1, 2019

I. INTRODUCTION

Q. Please state your name.

A. My name is Jeffrey Ellenbogen.

Q. Have you previously provided testimony in this docket?

A. Yes. I provided Supplemental Testimony on February 14, 2019.

II. PURPOSE OF TESTIMONY

Q. What is the purpose of your Rebuttal Testimony?

A. The purpose of my Rebuttal Testimony is to respond to the testimony of Jon Thurber on behalf of the South Dakota Public Utilities Commission Staff ("Commission Staff") and intervenor Christina Kilby concerning wind turbines and health.

Q. What exhibits are attached to your Rebuttal Testimony?

A. The following exhibits are attached to my Rebuttal Testimony:

- Exhibit 1: Moller M, Pedersen CS. Hearing at Low and Infrasonic Frequencies. Noise and Health. 2004
- Exhibit 2: Figure 9 of Moller M, Pedersen CS. Hearing at Low and Infrasonic Frequencies. Noise and Health. 2004
- Exhibit 3: Figure 15 of Moller M, Pedersen CS. Hearing at Low and Infrasonic Frequencies. Noise and Health. 2004

This article (Exhibit 1), and the accompanying figures (Exhibits 2 and 3), demonstrate the levels of energy needed for the human sensory system to detect infrasound, and how this is many times higher than anything a person would experience at home with respect to Deuel Harvest North Wind Farm (the "Project"). This information is relevant to my response to Ms. Kilby, below.

III. RESPONSE TO THURBER

Q. Mr. Thurber attaches an October 13, 2017 letter from the South Dakota Department of Health ("SDDH") to his testimony. What is your response to this letter?

A. The letter is written by the Secretary of Health of South Dakota in 2017 and is addressed to Commission Staff. The purpose of this letter from the Secretary was "…to comment on the potential health impacts associated with wind facilities," which I take to mean that its content is broadly applicable (i.e., not unique to Crocker Wind Farm).

Specifically, the letter goes on to acknowledge that SDDH "…has not taken a formal position on the issue of wind turbines and human health," a statement based on "…studies reviewed to date…." The letter goes on to cite the wind-specific studies commissioned by two public health agencies, Massachusetts and Minnesota. The letter states: "[t]hese studies generally conclude that there is insufficient evidence to establish a significant risk to human health."

As one of the authors of the Massachusetts study, I am very familiar with that document. The Secretary accurately characterized the position of that study. I would add further that, since the time of the writing of the Secretary's letter, there is not only "insufficient evidence to establish a significant risk to human health," but also, there is now evidence to establish that there is not a significant risk to human health.

Q. Mr. Thurber states that, since its October 13, 2017 letter, SDDH "has not become aware of any additional studies that would cause [SDDH] to re-evaluate their position." Do you have a response?

A. Health Canada has now completed and published the work of its major study that formally investigated the potential for wind turbine noise to impact human health. This research examined multiple dimensions, including stress, sleep, and cardiovascular disease. Please refer to my pre-filed Supplemental Testimony and accompanying Exhibits 3, 4, and 5. The overall conclusion of that work is that there

were no positive associations between wind turbine noise and health outcomes. In my opinion, these study results would support SDDH changing its position to be even more affirmative in their position that wind turbine noise does not pose a risk to human health.

IV. RESPONSE TO KILBY

Q. Have you reviewed the testimony filed by Christina Kilby?

A. Yes, and I will respond to some of her assertions in more detail below. As a general matter, it does not appear that Ms. Kilby acknowledges the Supplemental Testimony I submitted on February 14, 2019. My Supplemental Testimony already provides responsive and more updated information regarding the issues raised by Ms. Kilby. Overall, as I will discuss in more detail below, the current state of the science on wind turbines and human health does, in fact, shows that wind turbines are not associated with adverse health effects.

Q. On page 3 of her testimony, Ms. Kilby states, "[t]here has been no evidence presented proving wind turbines do not cause harm to animals and people. According to the Massachusetts Study, 'Evidence regarding wind turbine noise and human health is limited.'" Do you agree with this characterization?

A. No. As discussed above and in my Supplemental Testimony, there has been substantial study work completed since the Massachusetts Study, and this work demonstrates no negative health outcomes associated with wind turbines.

Q. On page 3 of her testimony, Ms. Kilby states, "I believe in addition to any physical affects from the unique sound of wind turbines, or physical effects or symptoms from infrasound, continued annoyance will result in negative health effects, possibly from stress or sleep problems." What is your response?

A. At the levels produced by wind turbines, it is my professional opinion that there are no "physical effects or symptoms from infrasound." Please see Exhibits 1, 2, and 3. Further, regarding the concern of annoyance resulting in negative health effects, the

Health Canada study addressed these elements directly. The Health Canada study did show an increase in annoyance that correlated with wind turbine noise, but there was not a correlation between wind turbine noise and any measure of health effects, including stress or sleep difficulty. Thus, in that instance, annoyance did not result in negative health effects.

Q. Ms. Kilby attaches an article titled "Wind Turbine Noise and Sleep: Pilot Studies on the Influence of Noise Characteristics" to her testimony (the "Noise Characteristics Article"). Have you reviewed this article?

A. Yes. There are serious methodological flaws that undermine its relevance in this proceeding for the following reasons.

First, the authors of this study were not physicians, and none had extensive training or expertise in brain sciences including sleep.

Second, the experiments were trivial in size: including only six participants, one of whom had some or all of his/her data excluded from analysis. (By comparison, Health Canada examined over 1,200 people.) The authors of this article state that the study was "…conducted with the intention to guide the design and implementation of a larger-scale main study," and it "…was not hypothesis testing…." In other words, the authors themselves acknowledge that the findings are too small and too rudimentary to have value in an applied setting (such as this proceeding). Rather, the findings were intended only to be used to gain experience and information in how to conduct a proper study.

Third, the study examined people in synthetic laboratory environments in which "the background level [of sound] was unnaturally low (<13 dB LAEq)" and "the levels [of wind turbine noise used in the study] were selected to represent worst-case conditions…." Testing the effects of noise from turbines in this context is like testing the brakes of a car on an oil-slicked road – the lab conditions are unrealistic and distort any potential finding. Finally, all participants in the study "…were classed as

being noise sensitive…," meaning, the study participants were chosen based on their tendency toward being likely to awaken from any noise. This kind of selection is referred to by researchers, epidemiologists and statisticians as "biased," which is a major flaw in scientific validity.

To summarize, the study was performed by people who were not experts in sleep, the population studied was biased, the study conditions were distorted and exaggerated, and the sample size was too trivial to be anything other than a pilot study. The authors themselves acknowledge that "…the findings should not be taken as clear evidence of sleep disturbance due to WTN [wind turbine noise]." These facts are counter to other substantive studies, including Health Canada, that showed no relationship between wind turbine noise and sleep disturbance. In short, this pilot study in no way informs a serious discussion regarding wind turbines and sleep. Any use of it to that effect is a distortion of the authors' intent and a misrepresentation of medical science.

Q. On page 4 of her testimony, Ms. Kilby states, "just saying something has not been proven is not the same as proving it is not true. . . . Several studies that have been done conclude that more research needs to be done." What is your response?

A. More recent work has been done concerning the potential relationship between wind turbine noise and human health outcomes. These findings are reassuring in that they provide evidence that wind turbine noise at the levels studied do not cause any known health effect. These studies were already discussed in my Supplemental Testimony and accompanying exhibits.

Q. On page 4 of her testimony, Ms. Kilby states, "I believe there is some evidence supporting that people can perceive infrasound and be extremely bothered by it." Do you agree?

A. I am not aware of any reliable study demonstrating that humans can perceive infrasound from wind turbines – let alone be extremely bothered by it – at the levels

we are discussing with respect to wind turbines. The levels of infrasound produced by wind turbines are well below audible thresholds for perception. See Exhibits 1, 2, and 3, attached, which show that for infrasound to be even slightly perceived, it needs to be several times the noise levels that we are discussing here with respect to wind turbines.

Q. Ms. Kilby attaches an article titled "Altered cortical and subcortical connectivity due to infrasound administered near the hearing threshold – Evidence from fMRI" to her testimony (the "Cortical Article"). Have you reviewed this article?

A. Yes.

Q. What is your response to the Cortical Article?

A. It is an article of very limited value for the following four reasons. First, it was not a study of noise produced by wind turbines or people living near them, so it has little relevance. Second, the authors claim that they demonstrate the brain's capacity to respond to infrasound, even below the hearing threshold. But the experiment used only 2 dB below the hearing threshold, which is within the margin of error of that threshold, making their claim unsupported. Third, the levels of noise produced in all aspects of this experiment (77 to 94.5 dB at 12 Hz) were orders of magnitude higher than levels we are discussing with respect to wind turbines, so it cannot reasonably be applied to the facts at issue. Ms. Kilby introduced a document in her pre-filed testimony that readily demonstrates this point. (See her Exhibit 2, figure on page 6.) Fourth, there are a number of methodological and statistical concerns I have about the experiment itself. For instance, I find it hard to believe that any noise study could be conducted in an MRI, which itself is incredible noisy; and, a study of only 14 people usually has limited validity.

Q. On page 5 of her testimony, Ms. Kilby quotes from "Wind Turbine Health Impact Study: Report of Independent Expert Panel, January 2012." Please provide context for this quotation.

A. This statement (which I co-authored) was intended to be supportive of any ongoing efforts to further characterize potential relationships between wind turbine noise and human health. At the time of the writing of that statement (in 2012), based on the research I reviewed at that time, I did not expect any such relationships would be found, but I wanted to be supportive of ongoing research. I felt it would be a welcome addition to the public discussion regarding safety. Since that time, scientific studies have provided the key evidence I would have needed to be more definitive in our panel's statements in 2012. Please see my Supplemental Testimony.

Q. With respect to infrasound, on page 6 of her testimony, Ms. Kilby states, "[i]t appears the panel did not have enough information on infrasound and low frequency noise to make any conclusion. . . ." Have there been additional studies since that time that provide relevant information?

Yes. Health Canada studied potential health effects from noise produced by wind turbines. It presented the data in dB(A). Because infrasound and dB(A) are linked together, studying one is studying the other. As such, the Health Canada study provides the information Ms. Kilby asserts was missing, and the Health Canada study showed no association between wind turbines and human health, as I have discussed above.

V. CONCLUSION

Q. Does this conclude your Rebuttal Testimony?

A. Yes.

Dated this 1st day of April, 2019.

Dr. Jeffrey Ellenbogen