STATE OF SOUTH DAKOTA) : SS COUNTY OF BON HOMME)	IN CIRCUIT COURT FIRST JUDICIAL CIRCUIT
GREGG AND MARSHA HUBNER, Appellants, vs. SOUTH DAKOTA PUBLIC UTILITIES COMMISSION; PREVAILING WIND PARK, LLC; SOUTH DAKOTA PUBLIC UTILITIES COMMISSION STAFF; PAUL AND LISA SCHOENFELDER; SHERMAN FUERNISS; KELLI PAZOUR; KAREN JENKINS; AND CHARLES MIX COUNTY, SOUTH DAKOTA; Appellees.	04CIV18-000084 **APPENDIX TO APPELLANTS' OPENING BRIEF**

1. Final Decision and Order Granting Permit to Construct Facilities and Notice of Entry dated November 28, 2018.

2. Notice of Application; Order for and Notice of Public Input Hearing; Notice of Opportunity to Apply for Party Status. (AR 001212-13.)

3. Order Granting Party Status and Establishing Procedural Schedule. (AR 001928-32.)

4. Relevant Portions of Transcript of October 9-12, 2018 Evidentiary Hearing:
   October 9 (Day One)[1] Evid. HT 226-227;
   October 10 (Day Two)[2] Evid. HT 614-625;
   October 11 (Day Three)[3] Evid. HT 669-689; 792-921; 954; 959;
   October 12 (Day Four)[4] Evid. HT 1045-1084.

[1] The entire transcript of October 9 (Day One) is found at AR 011148-011528.
[2] The entire transcript of October 10 (Day Two) is found at AR 011640-012002.
[3] The entire transcript of October 11 (Day Three) is found at AR 012013-012413.
[4] The entire transcript of October 12 (Day Four) is found at AR 012448-012678.

5. Transcript of November 20, 2018 Ad Hoc Commission Meeting (Commission Deliberations). (AR 018447-018546.)

6. Intervenors' Post-Hearing Brief. (AR 018266-018286.)

7. Evidentiary Hearing Exhibit I-1, Pre-filed Testimony of Richard James; highlighted portions were stricken by Hearing Examiner. (AR 018018-018030.)

8. Evidentiary Hearing Exhibit I-1(a), Bio Materials for Richard James. (AR 017220-017225.)

9. Evidentiary Hearing Exhibit I-2, Pre-filed Testimony of Jerry Punch; highlighted portions were stricken by Hearing Examiner. (AR 018031-018045.)

10. Evidentiary Hearing Exhibit I-2(a), Curriculum Vitae for Jerry Punch, Ph.D. (AR 017284-017313.)

11. Evidentiary Hearing Exhibit I-2(b), Wind Turbine Noise and Human Health: A Four-Decade History of Evidence that Wind Turbines Pose Risks. (AR 017314-017385.)

12. Live testimony of Richard James and Jerry Punch; highlighted portions were stricken by Hearing Examiner. (AR 018078-018110.)

13. Transcript from December 5, 2013 Daubert Hearing before the Honorable William Fagerman, State of Michigan, Circuit Court for the County of Missaukee.

14. Evidentiary Hearing Exhibit I-24 (refused), Email sent by Roland Jurgens. (AR 010038.)

15. "New Wind Farm Ready for Next Step in Three Area Counties," Yankton Daily Newspaper Article dated January 16, 2019, available at https://www.yankton.net/community/article_de578c94-1a0d-11e9-8e6e-ef7719e7a046.html.

16. Research Article – Analysis of throw distances of detached objects from horizontal-axis wind turbines. (AR 015944-015959.)

17. Email from South Dakota Public Utilities Commission Executive Director dated April 26, 2018.

18. Evidentiary Hearing Exhibit I-23, Draft Model Ordinance for Siting of Wind Energy Systems. (AR 017497-017505.)

19. Transcript of Commissioner Hanson's January 15, 2019 testimony to the South Dakota Legislature.

ATTACHMENT 1

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	)))))))	**FINAL DECISION AND ORDER GRANTING PERMIT TO CONSTRUCT FACILITIES AND NOTICE OF ENTRY** **EL18-026**

APPEARANCES

Commissioners Kristie Fiegen, Gary Hanson, and Chris Nelson.

Mollie Smith and Lisa Agrimonti, Fredrikson & Byron, P.A., 200 South Sixth Street, Minneapolis, Minnesota 55402, appeared on behalf of the Applicant, Prevailing Wind Park, LLC (Prevailing Wind Park or Applicant).

Kristen Edwards and Amanda Reiss, 500 E. Capitol Ave., Pierre, South Dakota 57501, appeared on behalf of the South Dakota Public Utilities Commission Staff (Staff).

Reece Almond, Davenport, Evans, Hurwitz & Smith, LLP, 206 West 14th Street, Sioux Falls, South Dakota, 57101, appeared on behalf of Intervenors Gregg Hubner, Marsha Hubner, Lisa Schoenfelder, and Paul Schoenfelder (Intervenors).

Sherman Fuerniss appeared pro se.

Kelli Pazour appeared pro se.

Karen Jenkins appeared pro se.

PROCEDURAL HISTORY

On May 30, 2018, Prevailing Wind Park filed an Application for an Energy Facility Permit for an up to 219.6 megawatt (MW) nameplate capacity wind energy facility to be located in Hutchinson County, Bon Homme County, and Charles Mix County, South Dakota, known as the Prevailing Wind Park Project (Project) with the South Dakota Public Utilities Commission (Commission).[1] Also on May 30, 2018, Prevailing Wind Park filed the pre-filed direct testimony of James Damon, Bridget Canty, Keith Thorstad, Aaron Anderson, and Chris Howell.

[1] *See* Ex. A1 (Application).

On June 1, 2018, the Commission issued a Notice of Application; Order for and Notice of Public Input Hearing; Notice of Opportunity to Apply for Party Status.

On June 21, 2018, Prevailing Wind Park filed a certificate of service confirming it had sent copies of the Application and Prevailing Wind Park's pre-filed direct testimony to the Bon Homme, Charles Mix, and Hutchinson county auditors.

On June 21, 2018, Prevailing Wind Park filed a Proof of Mailing to affected landowners demonstrating compliance with the requirements of South Dakota Codified Law 49-41B-5.2.

On June 29, 2018, the Commission issued an Order assessing Prevailing Wind Park a filing fee in an amount not to exceed $348,500, with a minimum filing fee of $8,000. In the same Order, the Commission further voted unanimously to authorize the executive director to enter into necessary consulting contracts.

On July 12, 2018, a public input hearing was held as scheduled.

On July 19, 2018, an Affidavit of Publication was filed confirming that the Notice of Public Hearing was published in the *Tripp Star Ledger* on June 6, 2018 and June 13, 2018.

On July 19, 2018, an Affidavit of Publication was filed confirming that the Notice of Public Hearing was published in the *Yankton Daily Press and Dakotan* on June 6, 2018 and June 13, 2018.

On July 19, 2018, an Affidavit of Publication was filed confirming that the Notice of Public Hearing was published in the *Scotland Journal* on June 6, 2018 and June 13, 2018.

On July 19, 2018, an Affidavit of Publication was filed confirming that the Notice of Public Hearing was published in the *Avon Clarion* on June 6, 2018 and June 13, 2018.

On July 19, 2018, an Affidavit of Publication was filed confirming that the Notice of Public Hearing was published in *The Wagner Post* on June 6, 2018 and June 13, 2018.

On July 20, 2018, Staff submitted a Motion for Adoption of Procedural Schedule.

The Commission received seven (7) applications for party status by the July 30, 2018 deadline.

On August 2, 2018, Prevailing Wind Park filed a Response to Staff's Motion for Adoption of Procedural Schedule.

On August 8, 2018, Affidavits of Publication were filed confirming that the Notice of Public Hearing was published in the *Tripp Star Ledger* on June 20, 2018 and July 11, 2018.

On August 8, 2018, an Affidavit of Publication was filed confirming that the Notice of Public Hearing was published in the *Yankton Daily Press and Dakotan* on June 20, 2018 and July 11, 2018.

On August 8, 2018, Affidavits of Publication were filed confirming that the Notice of Public Hearing was published in the *Avon Clarion* on June 20, 2018 and July 11, 2018.

On August 8, 2018, an Affidavit of Publication was filed confirming that the Notice of Public Hearing was published in *The Wagner Post* on June 20, 2018 and July 11, 2018.

On August 9, 2018, the Commission issued an Order Granting Party Status and Establishing Procedural Schedule. The Commission granted party status to: Marsha Hubner, Gregg Hubner, Lisa Schoenfelder, Paul Schoenfelder, Charles Mix County, Sherman Fuerniss, and Karen Jenkins.

On August 10, 2018, Prevailing Wind Park filed the pre-filed supplemental testimony of Bridget Canty, Dr. Mark Roberts, Michael MaRous, Daniel Pardo, and Peter Pawlowski.

On August 28, 2018, Kelli Pazour filed an application for party status.

On September 10, 2018, Staff filed the pre-filed testimony of David Hessler, David Lawrence, and Darren Kearney.

On September 10, 2018, Intervenors filed Intervenors' Disclosure of Lay Witnesses and the pre-filed testimony of Richard R. James,[2] Jerry L. Punch,[3] and Mariana Alves-Pereira.[4]

On September 11, 2018, Intervenor Karen Jenkins filed a letter stating that she intends to testify only if called as a witness, but reserves the right to submit testimony.

On September 11, 2018, the Commission issued an Order For and Notice of Evidentiary Hearing.

On September 13, 2018, Intervenors filed a Motion to Have Witnesses Appear Telephonically.

On September 14, 2018, Prevailing Wind Park filed an Answer to the Application for Party Status of Kelli Pazour. On the same day, Staff filed a Response to Late Intervention.

[2] At the evidentiary hearing, Mr. James was ruled unqualified to testify regarding health-related impacts. Portions of his pre-filed testimony were stricken accordingly and refiled on October 29, 2018 as Ex. I-1.
[3] At the evidentiary hearing, Dr. Punch was ruled unqualified to testify regarding health-related impacts. Portions of his pre-filed testimony were stricken accordingly and refiled on October 29, 2018 as Ex. I-2.
[4] Intervenors did not offer Dr. Alves-Pereira for live testimony at the evidentiary hearing and withdrew her pre-filed testimony. As such, that testimony is not part of this record.

On September 14, 2018, Prevailing Wind Park filed a Motion to Exclude Lay Witness Testimony, to Quash Subpoenas and to Require Further Disclosures.

On September 14, 2018, the Commission issued an Order For and Notice of Ad Hoc Motions Hearing.

On September 19, 2018, Staff filed a Response to Applicant's Motion to Exclude Lay Testimony, to Quash Subpoenas and to Require Further Disclosures.

On September 19, 2018, Prevailing Wind Park filed Applicant's Response to Intervenors' Motion to Have Witnesses Appear Telephonically.

On September 19, 2018, Intervenors filed Intervenors' Response to Applicant's Motion to Exclude Lay Testimony, to Quash Subpoenas and to Require Further Lay Disclosures. Included in this filing was Intervenors' First Amended Disclosure of Lay Witnesses.

On September 20, 2018, Intervenor Karen Jenkins filed a Response to Applicant's Motion to Exclude Lay Testimony, to Quash Subpoenas, and to Require Further Lay Disclosures.

On September 21, 2018, the Commission issued an Order Granting Late Party Status (Kelli Pazour).

On September 26, 2018, Intervenors filed a Subpoena for Testimony at Evidentiary Hearing to Michael Soukup.

On September 26, 2018, Intervenors filed a Subpoena for Testimony at Evidentiary Hearing to Keith Mushitz.

On September 26, 2018, Intervenor Mr. Fuerniss filed the Response of Sherman Fuerniss to Direct Testimonies.

On September 26, 2018, Prevailing Wind Park filed Applicant's Disclosure of Lay Witnesses and the pre-filed rebuttal testimony of Bridget Canty, Dr. Jeffrey Ellenbogen, Aaron Anderson, Dr. Mark Roberts, Peter Pawlowski, Michael MaRous, and Scott Creech.

On October 1, 2018, the Commission issued an Order Granting Motion for Telephonic Testimony and Order Denying Motion to Exclude Lay Testimonies and Quashing Subpoenas.

On October 1, 2018, Intervenors filed a Subpoena for Testimony at Evidentiary Hearing to Jack Soulek.

On October 1, 2018, Prevailing Wind Park filed Applicant's Witness List and Exhibit List and exhibits for hearing.

On October 1, 2018, Staff filed its Witness List and Exhibit List and exhibits for hearing.

On October 1, 2018, Intervenor Mr. Fuerniss filed his exhibits for hearing.

On October 1 and 2, 2018, Intervenors filed their Witness List and Exhibit List and exhibits for hearing.

On October 2, 2018, Intervenor Ms. Jenkins filed her exhibits for hearing.

On October 4, 2018, Prevailing Wind Park filed Applicant's Corrected Exhibit A5.

On October 4, 2018, Intervenors filed the Subpoena for Testimony at Evidentiary Hearing to Eric Elsberry. On the same day, Admissions of Service of Subpoenas were filed for Eric Elsberry and Michael Soukup. Charles Mix County Sheriff Office's Return of Service for Keith Mushitz was also filed.

On October 4, 2018, Intervenor Ms. Jenkins filed Additional Exhibits.

On October 5, 2018, Intervenors filed Intervenors' Corrected Exhibit I-16 and Exhibit I-17.

On October 5, 2018, Intervenor Mr. Fuerniss filed Additional Exhibits.

On October 9, 2018, Intervenors filed Intervenors' Opposition to Having Exhibits I-16 and I-17 be Confidential.

On October 9, 2018, Intervenors filed Exhibits I-16, I-17, I-28, I-29, and I-30.

Also on October 9, 2018, Prevailing Wind Park filed Applicant's Exhibits A3-2, A10-2, A16-R, A20-1, A20-2, A22-3, A24, A27, A28, A29, A30, A31, A32, and A33. Staff filed Exhibit S5.

On October 10 and 12, 2018, Prevailing Wind Park filed Exhibits A34, A35, A36, A37, A38, A39, A40, and A41. Prevailing Wind Park also filed an updated map, designated Attachment 4-2, to Intervenors' Exhibit I-29. Intervenors also filed Exhibits I-31, I-32, I-33, I-34, I-35, I-36, and I-37.

The evidentiary hearing was held before the Commission on October 9-12, 2018 in Pierre, South Dakota.

On October 29, 2018, Prevailing Wind Park filed Exhibit A42, which was pre-admitted at the evidentiary hearing on October 12, 2018.

Also on October 29, 2018, in accordance with the Commission's decision regarding the striking of portions of Intervenors' Exhibits I-1 and I-2 and of the transcript from the evidentiary hearing on October 12, 2018, the hearing examiner filed the redacted

versions of Intervenors' Exhibits I-1 and I-2 and the redacted transcript of the evidentiary hearing on October 12, 2018.

Having considered the evidence of record, applicable law, and the briefs and arguments of the parties, the Commission makes the following Findings of Fact, Conclusions of Law, and Order:

FINDINGS OF FACT

I. PROCEDURAL FINDINGS.

1. The Procedural History set forth above is hereby incorporated by reference in its entirety in these Procedural Findings. The procedural findings set forth in the Procedural History are a substantially complete and accurate description of the material documents filed in this docket and the proceedings conducted and decisions rendered by the Commission in this matter.

II. PARTIES.

2. Prevailing Wind Park, LLC is a South Dakota limited liability company and a wholly owned subsidiary of sPower Development Company, LLC (sPower).[5]

3. sPower is an independent renewable energy company based in Salt Lake City, Utah. sPower is the largest private owner of operating solar assets in the United States. sPower owns and operates a portfolio of solar and wind assets greater than 1.3 gigawatts (GW) and has a development pipeline of more than 10 GW.[6]

4. Intervenors Gregg and Marsha Hubner are landowners within the Project Area.

5. Intervenors Paul and Lisa Schoenfelder are landowners within the Project Area.

6. Intervenor Sherman Fuerniss is a landowner within the Project Area.

7. Intervenor Karen Jenkins is a landowner within the Project Area.

8. Intervenor Kelli Pazour resides adjacent to the Project Area.

9. Staff fully participated as a party in this matter, in accordance with SDCL 49-41B-17.

III. PROJECT DESCRIPTION.

10. The proposed Project is an up to 219.6 MW wind energy conversion facility located in Hutchinson, Bon Homme, and Charles Mix counties, South Dakota. The

[5] Ex. A1 at 1-1 (Application).
[6] Ex. A1 at 1-1 (Application).

proposed Project includes up to 61 wind turbine generators, access roads to each turbine, underground 34.5-kilovolt (kV) electrical collection system, including an occasional aboveground junction box, connecting the turbines to the Project collector substation, underground fiber-optic cable for turbine communications co-located with the collector lines, a 34.5-kV to 115-kV collector substation, up to four permanent meteorological (MET) towers, an operations and maintenance (O&M) facility, and additional temporary construction areas, including crane paths, public road improvements, a laydown yard, and a concrete batch plant(s) (as needed).[7]

11. The Project would interconnect with Western Area Power Administration's (WAPA's) existing Utica Junction Substation, located approximately 27 miles east of the Project. The Applicant is proposing to construct a new 115 kV gen-tie line in Bon Homme and Yankton counties from the Project collector substation to the Utica Junction Substation. The gen-tie line is not under the jurisdiction of the Commission and will be permitted in Bon Homme and Yankton counties.[8] A 115-/230-kV substation would be constructed near the point of interconnection to step up the voltage to match that of WAPA's 230 kV interconnection facilities.[9]

12. The Project is located on approximately 50,364 acres of land in Hutchinson, Charles Mix, and Bon Homme counties, South Dakota (Project Area).[10]

13. The current estimated capital cost of the Project is approximately $297 million based on indicative construction and wind turbine pricing cost estimates. This estimate includes lease acquisition; permitting, engineering, procurement, and construction of turbines, access roads, underground electrical collector system, Project collector substation, interconnection facilities, O&M facility, supervisory control and data acquisition (SCADA) system, and MET towers; and project financing. Capital cost estimates could fluctuate for the Project, dependent on which turbine model is ultimately used, materials and labor costs, and interconnection costs.[11]

14. Prevailing Wind Park provided evidence to support the need for turbine model flexibility.[12] The proposed turbine model that would be utilized for the Project is the GE 3.8-137, a 3.8 MW turbine with a 111.5-meter hub height and 137-meter rotor diameter (RD).[13] For up to nine turbines, Prevailing Wind Park requested the option to use a GE 2.3 MW turbine, which has an 80-meter hub height and 116 meter RD.[14] Prevailing Wind Park demonstrated that this turbine model flexibility is necessary in case use of the smaller turbine model is required to qualify for the production tax credit.[15] Further, Prevailing Wind Park has committed to the process outlined in Condition 29 of Applicant's and Staff's Revised Joint Recommended Conditions for addressing the

[7] Ex. A1 at 1-1 (Application); *see also* Ex. A1 at § 8.7 (Application).
[8] Ex. A1 at 1-1 (Application).
[9] Ex. A1 at 8-7 (Application).
[10] Ex. A1 at 1-1, 8-1 (Application).
[11] Ex. A1 at 7-1 (Application).
[12] *See* Ex. A1 at 8-3 (Application).
[13] Ex. A7 at 2 (Pawlowski Rebuttal).
[14] Evid. Hrg. Tr. at 209 (Pawlowski).
[15] Evid. Hrg. Tr. at 209, 254-55 (Pawlowski).

change in turbine model and demonstrating compliance with all of the conditions of the permit for the Project.[16]

15. All turbines will be constructed within the Project Area consistent with the configuration presented in the updated map labeled Attachment 4-2 to Applicant's Responses to Intervenor's Fourth Set of Data Requests,[17] and subject to all commitments, conditions, and requirements of this Order.

16. sPower currently owns Prevailing Wind Park and is overseeing development of the Project. Prevailing Wind Park will own, manage, and operate the Project.[18]

17. Prevailing Wind Park presented evidence of consumer demand and need for the Project.[19] Prevailing Wind Park has entered into a 30-year Power Purchase Agreement (PPA) with a South Dakota load serving entity. The output from the facility, which could annually generate up to 933,116 megawatt-hours (MWh), will be used to meet the needs for South Dakota residential, commercial, and industrial customers.[20] The proposed Project would provide a new source of low cost energy in South Dakota and help the country move towards the goal of energy independence, while reducing pollution and carbon emissions.[21]

18. With regard to micrositing, Prevailing Wind Park provided evidence to support the need for turbine and associated facility flexibility.[22] With respect to turbine flexibility, Prevailing Wind Park and Staff agreed to the turbine flexibility and "material change" provisions set forth in Applicant's and Staff's Revised Joint Recommended Condition 23.[23] With respect to the access roads, the collector system, O&M facility, Project substation, temporary facilities, MET towers, and other facilities, Prevailing Wind Park and Staff agreed to Condition 24 of Applicant's and Staff's Revised Joint Recommended Conditions.[24]

19. The record demonstrates that Prevailing Wind Park has made appropriate and reasonable plans for decommissioning.[25]

20. With respect to financial security for decommissioning, Staff and Prevailing Wind Park have agreed to implement a decommissioning escrow account.[26]

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[16] Applicant's and Staff's Revised Joint Recommended Condition 29.
[17] Attachment C to Applicant's Brief.
[18] Ex. A1 at 5-1 (Application).
[19] *See* Ex. A1 at 6-1, § 6.1 (Application).
[20] Ex. A1 at 6-1 (Application).
[21] Ex. A1 at 6-5 (Application).
[22] *See* Ex. A1 at 8-2 – 8-3 (Application).
[23] Applicant's and Staff's Revised Joint Recommended Condition 23.
[24] Applicant's and Staff's Revised Joint Recommended Condition 24.
[25] *See* Ex. A1 at Ch. 24.0 (Application); Ex. A6 at 6 (Pawlowski Supplemental Direct); Ex. A7 at 4-5 (Pawlowski Rebuttal); Ex. A11 (Pardo Supplemental Direct); Ex. A11-2 (Decommissioning Cost Analysis).
[26] Applicant's and Staff's Revised Joint Recommended Condition 40.

21. The record demonstrates that Prevailing Wind Park has provided adequate information on potential cumulative impacts and that the Project will not have a significant impact.[27]

IV. FACTORS FOR AN ENERGY FACILITY PERMIT.

22. Under the SDCL 49-41B-22, the Commission must find:

> (1) The proposed facility will comply with all applicable laws and rules;
>
> (2) The facility will not pose a threat of serious injury to the environment nor to the social and economic condition of inhabitants or expected inhabitants in the siting area;
>
> (3) The facility will not substantially impair the health, safety or welfare of the inhabitants; and
>
> (4) The facility will not unduly interfere with the orderly development of the region with due consideration having been given the views of governing bodies of affected local units of government.

23. In addition, SDCL 49-41B-25 provides that the Commission must make a finding that the construction of the facility meets all the requirements of Chapter 49-41B.

24. There is sufficient evidence on the record for the Commission to assess the proposed Project using the criteria set forth above.

V. SATISFACTION OF REQUIREMENTS FOR ISSUANCE OF AN ENERGY FACILITY PERMIT.

A. <u>The proposed facility will comply with all applicable laws and rules.</u>

25. The evidence submitted by Prevailing Wind Park demonstrates that the Project will comply with applicable laws and rules.[28] Neither Staff nor Intervenors have asserted otherwise or submitted evidence to the contrary.

26. Construction of the Project meets all the requirements of Chapter 49-41B.

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[27] *See, e.g.,* Ex. A1 at Ch. 22.0 (Application).

[28] *See* Ex. A7 at 2-3 (Pawlowski Rebuttal); Ex. A6 at 3 (Pawlowski Supplemental Direct); Ex. A1 at §§ 27.1, 27.4 (Application); *see also, e.g.,* Ex. A1 at 9-3, 9-4, 12-6, 15-7 (Application).

B. The facility will not pose a threat of serious injury to the environment nor to the social and economic condition of inhabitants or expected inhabitants in the siting area.

1. Environment.

27. The evidence demonstrates that the Project does not pose a threat of serious injury to the environment in the Project Area and that Prevailing Wind Park has adopted reasonable avoidance and minimization measures, as well as commitments, to further limit potential environmental impacts.[29] South Dakota Game, Fish and Parks Department (GFP) did not identify any concerns unique to the Project.[30]

28. Construction of the Project will not result in significant impacts on geological resources. The risk of seismic activity in the vicinity of the Project Area is low according to data from the U.S. Geological Survey (USGS).[31]

29. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to soil resources.[32] The majority of impacts will be temporary and related to construction activities.[33] Permanent impacts associated with operation of the Project will be up to 45 acres, which is less than 0.1 percent of the Project Area.[34] Prevailing Wind Park will implement various measures during construction and restoration to minimize impacts to the physical environment, including segregating topsoil and subsoil, use of erosion and sediment control during and after construction, noxious weed control, and reseeding of disturbed areas.[35]

30. The Project is not anticipated to have material impacts on existing air and water quality.[36]

31. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to hydrology.[37] The record demonstrates that Prevailing Wind Park has minimized impacts to wetlands and water bodies.[38] The Project is not anticipated to have long-term impacts on groundwater resources.[39] The Project is not anticipated to impact floodplains. There are no FEMA-mapped floodplains within the Project Area and the nearest mapped floodplains to the Project area are along Choteau Creek, over 1 mile southwest of the Project Area.[40] No turbines are located within wetlands, and Project facilities would potentially result in permanent impacts to two wetlands (0.0042 acre and

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[29] *See, e.g.*, Ex. A1 at Ch. 10.0, 17.0 (Application); *see also* Ex. A1 at §§ 11.1.2, 11.2.2, 12.1.2, 12.2.2, 13.1.2, 13.2.2, 13.3.2, 13.4.2, 14.3, 18.2 (Application).
[30] Ex. S1 at 8 (Kearney Direct); Evid. Hrg. Tr. at 1119 (Kearney).
[31] Ex. A1 at 11-3 (Application).
[32] *See* Ex. A1 at §§ 11.2.2 (Application).
[33] *See* Ex. A1 at 11-9 (Application).
[34] Ex. A1 at 3-2, 11-9 (Application).
[35] Ex. A1 at 11-9 – 11-10 (Application).
[36] *See* Ex. A1 at Ch. 17.0, § 18.2 (Application).
[37] *See* Ex. A1 at §§ 12.1.2, 12.2.2 (Application).
[38] *See* Ex. A1 at § 13.3.2 (Application).
[39] *See* Ex. A1 at § 12.1.2 (Application).
[40] *See* Ex. A1 at §§ 12.2.1.4, 12.2.2.3 (Application).

0.0002 acre of impacts, respectively) and would cross three intermittent streams (62.4 linear feet of stream segments).[41]

32. The record demonstrates that Prevailing Wind Park has minimized impacts to vegetation.[42] Permanent impacts associated with operation of the Project would be up to 45 acres (predominantly cropland and grassland/pasture), which is less than 0.1 percent of the Project Area.[43]

33. Prevailing Wind Park coordinated with GFP to avoid and minimize impacts to potentially untilled grasslands. Based on the 2018 desktop review of potential untilled grassland areas, 1 of the 63 turbine locations is located in untilled grassland. Only approximately 1 acre of long-term Project disturbance would occur in potential untilled grasslands.[44] Permanent habitat loss due to construction of wind turbines would be minimal across the Project Area and localized.[45]

34. Prevailing Wind Park will reseed temporarily disturbed uncultivated areas with certified weed-free seed mixes to blend in with existing vegetation.[46]

35. Prevailing Wind Park has conducted numerous wildlife studies and surveys for the Project to assess existing use, identify potential impacts, and incorporate appropriate avoidance and minimization measures.[47] Prevailing Wind Park consulted with the USFWS and GFP to seek input on wildlife resources potentially occurring within the Project Area and to seek guidance on the appropriate studies to evaluate risk and inform development of impact avoidance and minimization measures for the Project.[48] Prevailing Wind Park followed the processes outlined in the USFWS Land-Based Wind Energy Guidelines (WEG), Eagle Conservation Plan Guidance (ECPG), and the SD Siting Guidelines for developing, construction, and operation of wind energy projects.[49] In addition, Prevailing Wind Park prepared a Bird and Bat Conservation Strategy (BBCS) in accordance with the WEG, which includes strategies for mitigating risks to avian and bat species during construction and operation of the Project.[50]

36. Construction of the Project may have impacts on wildlife species primarily as a result of habitat disturbance. However, following construction, all areas of temporary disturbance will be reclaimed with vegetation consistent with the surrounding vegetation types.[51] The Project was designed to avoid and minimize displacement of wildlife by

[41] Ex. A1 at 13-6 (Application).
[42] *See* Ex. A1 at § 13.1.2 (Application).
[43] Ex. A1 at 13-3 (Application).
[44] Ex. A1 at 13-4 (Application).
[45] Ex. A1 at 13-17 (Application).
[46] Ex. A1 at 3-4 (Application).
[47] *See* Ex. A1 at Table 2-1, § 13.4 (Application).
[48] *See* Ex. A1 at § 13.4 (Application).
[49] Ex. A1 at 13-7 (Application).
[50] Ex. A1 at Appendix L (Application).
[51] Ex. A1 at 13-19 (Application).

minimizing the Project's footprint in undisturbed areas.[52] Permanent habitat loss due to construction of wind turbines would be minimal across the Project Area and localized.[53]

37. The record demonstrates that, while the Project may directly impact birds and bats, avian fatalities due to the Project are anticipated to be low and to not have significant population-level impacts.[54] To prevent potential bird strikes with electric lines, collector lines will be buried underground and the Project will incorporate other avian safe practices consistent with guidelines from the Avian Power Line Interaction Committee.[55] Based on available data, bat fatalities and the degree to which bat species would be affected by the Project would be within the average range of bat mortalities found throughout the U.S.[56] The record demonstrates that the Project was designed to avoid and minimize impacts to bats. The Project Area was shifted to the north and away from the Missouri River, where more woodland habitat and higher bat populations are present. The Project has been sited in an area and designed in a manner to avoid and minimize impacts to birds and bats.[57]

38. Prevailing Wind Park conducted two years of pre-construction avian surveys.[58] Those surveys indicate that avian impacts from the Project are anticipated to be low.[59] Further, Prevailing Wind Park has committed to two years of post-construction avian mortality monitoring.[60]

39. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to federal- and state-listed species.[61] Only five federal- or state-listed threatened and/or endangered species have the potential to occur in the Project Area during some portion of the year: federally endangered interior least tern and whooping crane; and federally threatened piping plover, red knot, and northern long-eared bat.[62] The interior least tern, red knot, whooping crane, and piping plover could migrate through the Project Area during the spring and fall but are otherwise not expected to occur in the Project Area.[63] The northern long-eared bat is the only state and federally listed bat with the potential to occur within the area.[64] Impacts on federally-listed species due to Project construction and operations are anticipated to be minimal due to the low likelihood or frequency of species' presence in the Project Area and implementation of appropriate species-specific conservation measures.[65]

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[52] Ex. A1 at 13-19 (Application).
[53] Ex. A1 at 13-17 (Application).
[54] Ex. A1 at 13-19 (Application).
[55] Ex. A1 at 13-19 (Application).
[56] Ex. A1 at 13-20 (Application).
[57] *See* Ex. A1 at 13-19 – 13-21 (Application); Ex. A12 at 13 (Canty Direct).
[58] Ex. A1 at 13-14 (Application); *see also* Ex. A1 at Appendices F and G (Application).
[59] Ex. A1 at 13-19 (Application).
[60] Applicant's and Staff's Revised Joint Recommended Condition 34.
[61] *See* Ex. A1 at §§ 13.4.2.4, 14.3 (Application).
[62] Ex. A1 at 3-2 – 3-3, 13-10 – 13-12, 13-18 (Application).
[63] Ex. A1 at 3-2, § 13.4.2.1 (Application); *see also* Ex. A1 at Table 13-4 (Application).
[64] Ex. A1 at 13-16 (Application).
[65] *See* Ex. A1 at §§ 13.4.2, 14.2, 14.3 (Application); Ex. A12 at 11-13 (Canty Direct).

40. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to whooping cranes.[66] Prevailing Wind Park conducted a Whooping Crane Habitat Assessment in 2016 that included analysis of the Project Area.[67] The Project is located within an area where 10 percent or less of whooping crane migration occurs.[68] There have been no confirmed whooping crane sightings within the Project Area as of spring 2018.[69] Further, to date, no whooping crane has died as the result of a wind turbine.[70] Prevailing Wind Park will comply with applicable avoidance, minimization, and mitigation measures specified in the Upper Great Plains Wind Energy Final Programmatic Environmental Impact Statement (PEIS), prepared jointly by WAPA and the USFWS.[71] As part of the PEIS, Prevailing Wind Park has committed to a curtailment program whereby if a whooping crane is sighted within two miles of the Project, the turbines will be shut down until the cranes leave the area.[72] There will be two ways to stop operation of the turbines. First, monitors may call the operations center and ask them to shut the turbines down. Second, each monitor will have a laptop or tablet equipped with software that will allow him or her to shut down the turbines remotely if a whooping crane is sighted.[73] This software has been successfully implemented and is used by sPower on another wind project.[74] Additionally, Prevailing Wind Park has committed to monitoring during the spring and fall migration periods.[75] Prevailing Wind Park is coordinating with USFWS regarding the specific timing of that monitoring and has also engaged a consultant to assist in that process.[76]

41. Overall, there is a low level of risk for potential bald eagle impacts at the site.[77] Prevailing Wind Park conducted eagle nest surveys in 2015 and 2016.[78] No eagle nests were identified within the Project Area, and the nearest occupied bald eagle nest to the Project Area is located approximately 0.5 miles from the current Project Area boundary. The nest is located approximately two miles from the nearest proposed turbine.[79] Prevailing Wind Park conducted an updated search through the Natural Heritage Program of known bald eagle nest sites which identified this same single active nest.[80] In addition, Prevailing Wind Park has agreed to a number of avian-related impact minimization and avoidance measures, including: conducting post-construction avian mortality monitoring for two years; and implementing the BBCS developed in accordance

[66] *See* Ex. A1 at 3-2 – 3-3, 13-16, 13-18, 27-4 (Application); Evid. Hrg. Tr. at 432 (Canty).
[67] Ex. A1 at 13-16 (Application); Ex. A1 at Appendix K (Application).
[68] Evid. Hrg. Tr. at 467 (Canty).
[69] Ex. A1 at 3-2 – 3-3 (Application).
[70] Evid. Hrg. Tr. at 467-68 (Canty).
[71] Ex. A1 at 13-8 (Application).
[72] Evid. Hrg. Tr. at 432 (Canty).
[73] Evid. Hrg. Tr. at 1142 (Pawlowski).
[74] Evid. Hrg. Tr. at 461-62 (Canty); Evid. Hrg. Tr. at 1142 (Pawlowski).
[75] Evid. Hrg. Tr. at 432 (Canty).
[76] Evid. Hrg. Tr. at 468 (Canty).
[77] *See* Ex. A1 at 27-3 – 27-4 (Application).
[78] Ex. A1 at 2-2 (Application).
[79] Ex. A1 at 13-13, 27-3 – 27-4 (Application).
[80] Evid. Hrg. Tr. at 470-71 (Canty).

with the USFWS WEG to minimize impacts to avian and bat species during construction and operation of the Project.[81]

42. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to aquatic ecosystems.[82] The federally- and state-listed aquatic species with potential to occur in or near the Project are not anticipated to be affected by the Project.[83]

43. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to land use.[84] The Project will not displace existing residences or businesses.[85] Areas disturbed due to construction that would not host Project facilities would be re-vegetated with vegetation types matching the surrounding agricultural landscape. Agricultural uses may continue within the Project Area during construction and operation.[86]

44. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to recreation.[87] No Project facilities would be placed on USFWS Waterfowl Production Areas, GFP Game Production Areas, or GFP Walk-In Areas.[88]

45. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to conservation easements and publicly-managed lands.[89] Prevailing Wind Park coordinated with the USFWS to identify and avoid areas subject to USFWS easements within the Project Area. The Project has been designed such that no Project facilities (e.g., turbines, collector lines, access roads) would be placed on USFWS wetland or grassland easements, and thus, no direct impacts to these easement areas would occur.[90] As noted above, the Project will also avoid direct impacts to Game Production Areas and Waterfowl Production Areas.[91]

46. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to visual resources.[92] In accordance with Federal Aviation Administration (FAA) regulations, the turbine towers would be painted off-white to reduce potential glare and minimize visual impact.[93] No scenic resources with sensitive viewsheds are located within the Project Area. The nearest scenic resources to the Project Area are located approximately 12 and 13 miles away from the Project Area. At these distances, adverse visual impacts from construction or operation of the Project are not anticipated.[94]

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[81] *See* Ex. A12 at 13 (Canty Direct); Applicant's and Staff's Revised Joint Recommended Conditions 34 and 35.
[82] *See* Ex. A1 at § 14.3 (Application).
[83] *See* Ex. A1 at § 14.3 (Application).
[84] *See* Ex. A1 at §§ 15.1.2, 20.2.2 (Application).
[85] Ex. A1 at 15-3 (Application).
[86] Ex. A1 at 15-3 (Application).
[87] *See* Ex. A1 at § 15.2.2 (Application).
[88] Ex. A1 at 15-4 (Application).
[89] *See* Ex. A1 at § 15.2 (Application).
[90] Ex. A1 at 15-4 (Application).
[91] Ex. A1 at 15-4 (Application).
[92] *See* Ex. A1 at § 15.4.2 (Application).
[93] Ex. A1 at 15-13 (Application).
[94] Ex. A1 at 15-13 (Application).

Additionally, Prevailing Wind Park will install and use an Aircraft Detection Lighting System (ADLS) if approved by the FAA for use for the Project, thereby reducing visual impacts.[95] Furthermore, the FAA has issued a Determination of No Hazard to Air Navigation for each of the Project's proposed turbine sites.[96]

47. Prevailing Wind Park has demonstrated that it will minimize and/or avoid impacts to cultural resources.[97] Prevailing Wind Park conducted multiple cultural resource surveys to identify cultural resources within the Project Area.[98] Prevailing Wind Park conducted a Level I Cultural Resources Records Search for the Project Area and one-mile buffer area in April 2018. Prevailing Wind Park used this information to inform the siting of Project facilities and to identify areas that have a higher likelihood for containing intact cultural resources eligible for listing on the National Register of Historic Places (NRHP).[99] Prevailing Wind Park also completed a historical/architectural survey.[100] A draft report summarizing the results is expected by mid-November and will be submitted to the State Historic Preservation Office (SHPO) for review and concurrence.[101] Sites determined to be NRHP-eligible will be avoided by the Project. If avoidance is not practicable, Prevailing Wind Park will work with WAPA and SHPO to develop appropriate minimization or mitigation measures.[102] Further, Prevailing Wind Park has agreed to develop an unanticipated discovery plan for cultural resources.[103]

48. WAPA is preparing an Environmental Assessment (EA) for the Project interconnection in accordance with the applicable requirements and standards of the National Environmental Policy Act (NEPA). The proposed interconnection of the Project to WAPA's transmission system is a Federal action under NEPA.[104] As part of the NEPA process for approval of the WAPA interconnection, Prevailing Wind Park is coordinating with WAPA to support WAPA's compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. WAPA is consulting with SHPO and interested tribes as part of the Section 106 compliance process.[105] Prevailing Wind Park expects that WAPA will issue the draft EA in the fall of 2018.[106]

49. Staff and Prevailing Wind Park have agreed upon Conditions 12 through 14 regarding cultural resources.[107]

2. Social and Economic.

[95] Ex. A6 at 5 (Pawlowski Supplemental Direct).
[96] Ex. A6 at 5 (Pawlowski Supplemental Direct).
[97] *See* Ex. A1 at § 20.5.2 (Application); Ex. A12 at 14-16 (Canty Direct); Ex. A13 at 3-43 (Canty Supplemental Direct); Ex. A14 at 2-3 (Canty Rebuttal).
[98] *See, e.g.*, Ex. A1 at § 20.5.1 (Application); Ex. A12 at 14-15 (Canty Direct).
[99] *See* Ex. A1 at § 20.5 (Application).
[100] Ex. A14 at 3 (Canty Rebuttal).
[101] Ex. A14 at 3 (Canty Rebuttal).
[102] Ex. A1 at 20-14 (Application); Ex. A12 at 16 (Canty Direct).
[103] Applicant's and Staff's Revised Joint Recommended Condition 13.
[104] Ex. A12 at 7 (Canty Direct).
[105] Ex. A13 at 3 (Canty Supplemental Direct).
[106] Ex. A14 at 3 (Canty Rebuttal).
[107] Applicant's and Staff's Revised Joint Recommended Conditions 12 through 14.

50. Prevailing Wind Park acquired the Project in 2017 from Prevailing Winds, LLC, which was formed by a group of local investors who sought to create additional sources of income for area landowners and economic growth for the local communities through wind energy.[108] Since its October 2017 acquisition of the assets and development rights to the Project, Prevailing Wind Park has undertaken extensive development activities, consisting of landowner outreach and easement acquisition, detailed studies of resources in the Project Area, coordination with resource agencies, and design and refinement of the Project configuration.[109] Since acquiring the Project, Prevailing Wind Park negotiated additional lease agreements for approximately 40 percent of the total Project acreage.[110] Prevailing Wind Park has obtained all of the private land rights necessary to construct the Project.[111] The identification of the final Project site was primarily driven by: superior wind resources because of elevation, proximity and direct access to available transmission capacity, cost efficiency, and the Project's ability to avoid or minimize potential adverse environmental impacts.[112] Prevailing Wind Park also considered input from agencies and the public in siting the Project, specifically: distance from the Missouri River, where higher populations of many plant and animal species are present; distance from the Whooping Crane Migration Corridor; state and Federal lands within or near the Project Area; potentially undisturbed grasslands, wetlands, and other habitats within or near Project Area; and an existing eagle nest located near the Project Area.[113] The proposed configuration of Project facilities also reflects an optimal configuration to best capture wind energy within the Project Area, while avoiding impacts to residences, known cultural resources, wetlands, potentially undisturbed grasslands, and sensitive species and their habitats.[114]

51. In prior contested siting dockets, the Commission has considered the following socioeconomic issues in evaluating whether a project would pose a threat of serious injury to the social and economic condition: temporary and permanent jobs; tax revenue; and impacts on commercial, agricultural, and industrial sectors, housing, land values, labor market, health facilities, energy, sewage and water, solid waste management facilities, fire protection, law enforcement, recreational facilities, schools, transportation facilities, and other community and government facilities.[115]

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[108] Ex. A1 at 2-1 (Application); Ex. A6-3 at 6 (Damon Direct); *see also* Ex. A1 at § 9.1 (Application).
[109] Ex. A1 at 2-1 (Application).
[110] Evid. Hrg. Tr. at 215, 226 (Pawlowski).
[111] Ex. A1 at 2-1 (Application).
[112] *See* Ex. A1 at § 9.1 (Application).
[113] Ex. A1 at 9-2 (Application).
[114] Ex. A1 at 9-3 (Application).
[115] *See, e.g.*, *In the Matter of the Application of Dakota Access, LLC for an Energy Facility Permit to Construct the Dakota Access Pipeline*, Docket HP14-002, Final Decision and Order; Notice of Entry (Dec. 14, 2015) at ¶¶ 100-101; *In the Matter of the Application by TransCanada Keystone Pipeline, LP for a Permit Under the South Dakota Energy Conversion and Transmission Facilities Act to Construct the Keystone XL Project*, Docket HP09-001, Amended Final Decision and Order; Notice of Entry (June 29, 2010) at ¶¶ 107-110 (discussing socioeconomic effects, including tax revenue, jobs, and impacts on agricultural, commercial, and industrial sectors and public facilities); *In the Matter of the Application of 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*, Final Decision and Order Granting Permit to Construct Wind Energy Facility; Notice of Entry (July 23, 2018) at ¶¶ 50-57; *In the Matter of the*

52. The record demonstrates that the Project will not pose a threat of serious injury to the social and economic condition.[116] Prevailing Wind Park has demonstrated that the Project will not adversely impact property values.[117] Mr. MaRous, a South Dakota State Certified General Appraiser and a certified Member Appraisal Institute appraiser with experience evaluating the impact of wind turbines on property values, conducted a Market Analysis to analyze the potential impact of the Project on the value of the surrounding properties and found no credible data indicating property values will be adversely impacted due to proximity to the Project.[118] Mr. MaRous further noted that the additional income from participating in the Project may actually increase the value and marketability of participating agricultural land.[119]

53. There is no basis in the record to require a property value guarantee. There is no record evidence that property values will be adversely affected.[120]

54. The record demonstrates that the Project will not adversely impact hunting or gaming operations in the area. Mr. Jerome Powers testified regarding his concerns about the Project's impact on his guided hunting business. However, Mr. Powers' testimony did not support his claims and there is no credible evidence that the Project will impact Mr. Powers' hunting operation, or hunting in general. During his testimony, Mr. Powers acknowledged that he owns approximately 12.8 acres.[121] In the past, he has relied upon year-to-year leases for hunting rights on various properties.[122] He testified that some of those landowners have decided not to renew his leases for the coming year.[123] One of those landowners – Clearfield Colony – is a participating landowner in the Project. As acknowledged by Mr. Powers, the Project does not prohibit or otherwise restrict hunting.[124] Thus, it is Mr. Powers' ownership of limited acreage and his need to hunt on others' land that affects his hunting business and not the Project.

Application of Montana-Dakota Utilities Co. and Otter Tail Power Company for a Permit to Construct the Big Stone South to Ellendale 345 kV Transmission Line, Docket EL13-028, Final Decision and Order; Notice of Entry (Aug. 22, 2014) at ¶¶ 29-31 (discussing impacts to agriculture, property values, and local roads under this criterion).

[116] *See, e.g.,* Ex. A1 at 20-3 – 20-4, 21-1 – 21-2 (Application); Ex. A1 at §§ 20.1.2, 20.3.2 (Application); Evid. Hrg. Tr. at 257 (Pawlowski).

[117] *See* Ex. A1 at § 20.1.2.3 (Application); Ex. A15 at 8, 11, 12-13, 18-19 (MaRous Supplemental Direct); Evid Hrg. Tr. at 292 (MaRous); *see also* Ex. A15-1 (Market Impact Analysis).

[118] *See* Ex. A15 at 12, 18-19 (MaRous Supplemental Direct); *see also* Ex. A15-1 at 4-5, 55 (Market Impact Analysis).

[119] Ex. A15 at 12 (MaRous Supplemental Direct).

[120] *See* Ex. A1 at § 20.1.2.3 (Application); Ex. A15 at 8, 12, 18-19 (MaRous Supplemental Direct); Ex. A16R at 2 (Revised MaRous Rebuttal); *see also 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*, Docket EL18-003, Final Decision and Order Granting Permit to Construct Wind Energy Facility; Notice of Entry (July 23, 2018) at ¶ 55; *In the Matter of the Application by Crocker Wind Farm, LLC for a Permit of a Wind Energy Facility and a 345 kV Transmission Line in Clark County, South Dakota, for Crocker Wind Farm*, Docket EL17-055, Final Decision and Order Granting Permit to Construct Facilities and Notice of Entry (June 12, 2018) at ¶ 61.

[121] Evid. Hrg. Tr. at 1017 (Powers).

[122] Evid. Hrg. Tr. at 1017, 1023-24 (Powers).

[123] Evid. Hrg. Tr. at 1024, 1028 (Powers).

[124] Evid. Hrg. Tr. at 1018 (Powers).

55. The record demonstrates that the Project will, on the whole, have positive impacts on the community.[125] Construction and operation of the Project will result in substantial benefits to South Dakota and local economies.[126] The Project will create temporary job opportunities during construction, and permanent operations and maintenance job opportunities. During construction, up to 245 temporary construction jobs are anticipated at the peak of construction, and 8 to 10 permanent jobs will also be created in the community.[127] Additionally, local businesses would also likely benefit from construction-related expenditures for the Project.[128] The Project will make lease payments to participating landowners and will provide long-term benefits to the state and local tax base.[129] The Project is anticipated to result in more than $20.4 million in additional annual tax revenue for the state and local governments.[130]

56. With almost any energy infrastructure project, there is not unanimous support for the Project.[131] There are residents in the Project Area who do not support the Project, some of whom participated in these proceedings to advocate for their views. However, the opposition to this Project is similar to that for other energy infrastructure projects.[132] Moreover, while the Intervenors voiced their concerns, the Commission also

[125] *See, e.g.*, Ex. A1 at § 20.1.2, 21-1 – 21-2 (Application); Ex. A1 at 6-5 – 6-6 (Application); Evid. Hrg. Tr. at 394-98 (Brandt); Evid. Hrg. Tr. at 187, 200 (Peters).
[126] *See, e.g.*, Ex. A1 at § 20.1.2 (Application).
[127] Ex. A1 at 6-1 (Application).
[128] Ex. A1 at 20-4 (Application).
[129] Ex. A1 at 6-5 – 6-6 (Application).
[130] Ex. A1 at 20-3 – 20-4 (Application). At the evidentiary hearing, Commissioner Hanson questioned a portion of Mr. Damon's testimony that included a calculation regarding the anticipated benefits of the Project. *See* Evid. Hrg. Tr. at 270-71. As requested by the Commissioners, in its post-hearing brief Prevailing Wind Park clarified that the excerpt in question (on page 14 of Mr. Damon's testimony) corresponds to page 20-4 of the Application, which states: "construction of the Project would create a $14.9 million boost to the local economy. Prevailing Wind Park estimates that $220,000 of food, supplies, and fuel would be purchased locally by the Project and Project staff annually (or $20.4 million over the life of the Project)." The $20.4 million total cited in Mr. Damon's testimony and the Application includes the $14.9 million *plus* the $220,000 in annual purchasing over the life of the Project. Thus, there was no calculation error in Mr. Damon's direct testimony.
[131] *See, e.g., 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*, Docket EL18-003, Final Decision and Order Granting Permit to Construct Wind Energy Facility; Notice of Entry (July 23, 2018) (Two intervenors); *In the Matter of the Application by Crocker Wind Farm, LLC for a Permit of a Wind Energy Facility and a 345 kV Transmission Line in Clark County, South Dakota, for Crocker Wind Farm*, Docket EL17-055, Final Decision and Order Granting Permit to Construct Facilities and Notice of Entry (June 12, 2018) (Two intervenors); *In the Matter of the Application of Dakota Access, LLC for an Energy Facility Permit to Construct the Dakota Access Pipeline*, Docket HP14-002, Final Decision and Order; Notice of Entry (Dec. 14, 2015) (50 intervenors); *In the Matter of the Application by TransCanada Keystone Pipeline, LP for a Permit Under the South Dakota Energy Conversion and Transmission Facilities Act to Construct the Keystone XL Project*, Docket HP09-001, Amended Final Decision and Order; Notice of Entry (June 29, 2010) (15 intervenors); *In the Matter of the Application by Buffalo Ridge II LLC, a Subsidiary of Iberdola Renewables, Inc. for an Energy Conversion Facility Permit for the Construction of the Buffalo Ridge II Wind Farm and Associated Collection Substation and Electric Interconnection System*, Docket EL08-031, Final Decision and Order; Notice of Entry (April 23, 2009) (Six Intervenors); *In the Matter of the Application of Montana-Dakota Utilities Co. and Otter Tail Power Company for a Permit to Construct the Big Stone South to Ellendale 345 kV Transmission Line*, Docket EL13-028, Final Decision and Order; Notice of Entry (Aug. 22, 2014) (three intervenors).
[132] *See* Evid. Hrg. Tr. at 257 (Pawlowski).

heard the testimony of landowners who do support the Project and they explained their reasons for participating in the Project. Participating landowners Ms. Karen Peters and Mr. Dustin Brandt testified to their good working relationships with Prevailing Wind Park and how they believe the Project will benefit the community.[133] Ms. Peters and Mr. Brandt explained their reasons for supporting the Project, including that the Project will provide an additional stable source of income for landowners, generate much-needed revenue for the counties, townships, and local schools, and create good-paying jobs in the community that will open up new career opportunities.[134] The testimony demonstrates that while people may have differences of opinion concerning the Project, it is no more than expected from an energy infrastructure project and is not anticipated to have permanent adverse impacts on the community. As Mr. Brandt and Mr. Schoenfelder testified, people may disagree about the Project, but they are, and will remain, a community and neighbors.[135] Many of the comments expressed by opponents of the Project relate to fears regarding potential health impacts, noise, and shadow flicker; however, as discussed in the section below, allegations of potential health effects are not supported by record evidence. Further, as discussed below, Prevailing Wind Park has addressed other concerns raised such as by proposing a reasonable and appropriate sound limit and committing to utilize turbine control software to limit shadow flicker at non-participating residences.[136] In addition, Prevailing Wind Park is committed to continuing community outreach and dialogue in the community regarding the Project.[137]

57. The record demonstrates that the Project is not anticipated to adversely impact communications systems.[138] Prevailing Wind Park completed a study on the effects of the Project upon Federal Communications Commission (FCC)-licensed radio frequency facilities, including analyses of microwave point-to-point paths, airports, radar stations, military aircraft operations, and National Telecommunication Information Agency (NTIA) notification.[139] Based on the results of this study and consultation with NTIA, Prevailing Wind Park shifted a turbine 50 feet to the north to ensure avoidance of

[133] *See* Evid. Hrg. Tr. at 185-87 (Peters); Evid. Hrg. Tr. at 394-98, 426-27 (Brandt).
[134] *See* Evid. Hrg. Tr. at 185-87 (Peters); Evid. Hrg. Tr. at 394, 396-98 (Brandt).
[135] Evid. Hrg. Tr. at 403-04 ("It's not like there's a huge thing there. I mean, there's people for it. There's people against it. But life goes on. In the end we're all still Avon residents."); *see also id.* at 419-20 ("There is always some controversy with a project, but, as I stated before, I believe when this is all said and done, whether it is built or not, we are all still a community. I mean, these people are my neighbors. They're still going to be my neighbors when this is all said and done. So I do not believe that there's been so much [*word unclear*] that we can't get along and go about life."); Evid. Hrg. Tr. at 945-46 (Schoenfelder) ("I made a commitment early in this process that I would want to be treated the way other people want to be treated. I hope that other people feel the same way. These are my neighbors. A lot of those neighbors are taking the stands for a lot of different reasons. They're not evil people. I just – I – I refuse to – I refuse to hate anyone through this process.").
[136] *See* Applicant's Proposed Sound and Charles Mix Conditions; Applicant's and Staff's Revised Joint Recommended Condition 28; Evid. Hrg. Tr. at 42-43 (Anderson); Evid. Hrg. Tr. at 207 (Pawlowski).
[137] Evid. Hrg. Tr. at 1139-40, 1145-46 (Pawlowski); *see also* Ex. A1 at2-1 (Application).
[138] *See* Ex. A1 at § 15.6 (Application); Ex. A14 at 5 (Canty Rebuttal).
[139] Ex. A1 at 15-15 – 15-16 (Application); *see also* Ex. A1 at Appendix O (Application).

microwave beam paths.[140] In addition, Prevailing Wind Park and Staff have agreed upon Condition 25 regarding interference with communication systems.[141]

58. The record demonstrates that Prevailing Wind Park has avoided and/or minimized impacts to transportation.[142] Prevailing Wind Park will work with local units of government to obtain the necessary road crossing and utility permits for the Project.[143] Prevailing Wind Park will coordinate with applicable local road authorities to establish road use agreements, as needed, to minimize and mitigate Project impacts to haul roads.[144] The Project will participate in the South Dakota One-Call program.[145]

C. The facility will not substantially impair the health, safety or welfare of the inhabitants.

59. The record demonstrates Prevailing Wind Park has minimized impacts from noise.[146]

60. Section 1741 of the Bon Homme County Zoning Ordinance provides: "Noise level produced by the LWES shall not exceed forty-five (45) dBA, average A-weighted sound pressure at the perimeter of occupied residences existing at the time the permit application is filed, unless a signed waiver or easement is obtained from the owner of the residence."[147]

61. Charles Mix County does not have a zoning ordinance and does not require wind energy system permits.[148] Prevailing Wind Park worked with the County to address concerns and provide assurances.[149] Prevailing Wind Park negotiated Project siting commitments with the County, which included a commitment that noise from the Project's wind turbines would not exceed 43 dBA at any existing nonparticipating residences and 45 dBA at existing participating residences, unless a signed waiver is obtained from the owner of the residence.[150] Prevailing Wind Park executed an affidavit memorializing its commitments; this affidavit binds Prevailing Wind Park but imposes no obligations on Charles Mix County.[151]

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[140] Ex. A14 at 5 (Canty Rebuttal); Evid. Hrg. Tr. at 444-45 (Canty).
[141] *See* Applicant's and Staff's Revised Joint Recommended Condition 25.
[142] *See* Ex. A1 at § 20.4.2 (Application); Ex. A6 at 4 (Pawlowski Supplemental Direct); Ex. A6-2 (Examples of FAA DNH).
[143] Ex. A6-3 at 5 (Damon Direct).
[144] Ex. A1 at 20-10 (Application).
[145] Ex. A6-3 at 14 (Damon Direct).
[146] *See* Ex. A1 at § 15.3.4 (Application); Ex. A10-2 (Updated Sound Study).
[147] Ex. A10-2 at 1-1 (Updated Sound Study).
[148] Ex. A1 at 15-7 (Application).
[149] Ex. A7 at 1 (Pawlowski Rebuttal); Evid. Hrg. Tr. at 217, 251, 253-54 (Pawlowski).
[150] Ex. A7 at 1 (Pawlowski Rebuttal); Ex. I-22 (Letter from Charles Mix County with Affidavit of Peter Pawlowski); Evid. Hrg. Tr. at 217, 251, 254 (Pawlowski). Prevailing Wind Park also committed that shadow flicker produced by the wind turbines would not exceed 30 hours per year and/or 30 minutes per day at currently inhabited residences of nonparticipants. Ex. I-22 (Letter from Charles Mix County with Affidavit of Peter Pawlowski).
[151] Evid. Hrg. Tr. at 217, 253 (Pawlowski).

62. Hutchinson County does not have a specific sound level requirement for wind turbines in its zoning ordinance. Therefore, Prevailing Wind Park used the Bon Homme County ordinance sound level limit as a design goal for Hutchinson County.[152]

63. Prevailing Wind Park retained an independent expert to model the predicted sound levels for the Project.[153] The highest predicted sound level at an occupied residence is 41.9 dBA. Accordingly, all residences are expected to meet the requirements of Bon Homme County, as well as Prevailing Wind Park's commitment in Charles Mix County not to exceed 43 dBA at non-participant residences.[154]

64. The Project's sound modeling utilized conservative assumptions and was conducted in accordance with the international standard (ISO 9613-2). The modeling assumes all turbines were operating and producing maximum acoustic output, these emissions propagate out fully in all directions, and that atmospheric conditions will be relatively ideal for the propagation of sound.[155] Additionally, the modeling uses a conservative ground absorption value of 0.5 and did not include attenuation for sound propagation through wooded areas, existing barriers, and shielding.[156] The model takes into account source sound power levels, air absorption, ground absorption and reflection, and terrain.[157] Prevailing Wind Park's acoustical expert Mr. Howell has verified these conservative assumptions through field measurements at other operating wind projects; thus, the methodology for modeling sound levels has been tested and confirmed in the field.[158] Mr. Howell's post-construction studies have demonstrated that his conservative pre-construction prediction methods typically exceed actual operational sound levels of proposed projects.[159] Based on the conservative nature of the sound modeling for the Project, actual sound levels for the Project are expected to be lower than the modeled levels.[160]

65. The record demonstrates that 40 dBA at non-participating residences is an appropriate and reasonable sound limit to protect the welfare of non-participants. Sound limitations vary jurisdiction to jurisdiction.[161] There are no federal or state noise regulations that apply to this project and Applicant's sound limit goal for the project was based on the Bon Homme County ordinance.[162] During the evidentiary hearing, Commissioner Soukup, who was serving on the Bon Homme County Commission and

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[152] Ex. A1 at 15-7 (Application),
[153] Evid. Hrg. Tr. at 509 (Howell).
[154] Ex. A10 at 2 (Howell Rebuttal) and Ex. A10-1 at 2 (Memorandum Regarding Updated Modeling Results).
[155] *See* Ex. A10-2 at 17-19 (Updated Sound Study); Ex. A9 at 7 (Howell Direct); Ex. A10 at 8 (Howell Rebuttal).
[156] *See* Ex. A10 at 8 (Howell Rebuttal); Ex. A10-2 at 19 (Updated Sound Study).
[157] *See* Ex. A10-2 at 17 (Updated Sound Study); Ex. A9 at 8 (Howell Direct).
[158] Evid. Hrg. Tr. at 489 (Howell); *see also* Ex. A9 at 8 (Howell Direct) ("Our own post-construction studies have demonstrated that our pre-construction conservative prediction methods typically exceed actual operational sound levels of proposed projects."); *see also* Ex. A9 at 9 (Howell Direct) ("In-house and third-party monitoring has routinely demonstrated that our prediction methods are conservative, and monitoring results are typically between 1 and 3 dBA lower than our predictions.").
[159] *See* Ex. A9 at 8 (Howell Direct).
[160] Evid. Hrg. Tr. at 500 (Howell).
[161] *See* Ex. I-1 at 4-5 (James Direct); Evid. Hrg. Tr. at 746-48, (Hessler).
[162] *See* Ex. A9 at 5 (Howell Direct).

Zoning Board when the wind-specific ordinances were adopted, made it clear that the ordinance adoption process was difficult to understand and hard to recall.[163] At the evidentiary hearing, Mr. Hessler testified that he would like to see the project utilize a 40 dBA sound limit.[164] Mr. Hessler stated that there is no limit that could be set to avoid sound complaints.[165] Mr. Hessler acknowledged, that there is no need for a 35 dBA sound limit.[166] Mr. Hessler testified that a sound level of 40 dBA would better protect the residences than a sound level of 45 dBA.[167] Mr. James, the Intervenors' witness, testified that L_{10} is superior over Leq when measuring dBA, because the long-term average of Leq can result in large fluctuations around a particular sound level.[168] Only three non-participating receptors are currently at or above 40 dBA.[169] Thus, a 40 dBA limit at non-participants' residences unless a written waiver is obtained from the owner of the residence, and 45 dBA at participating residences unless a written waiver is obtained from the owner of the residence is fully supported on the record and is an appropriate sound level for the Project.

66. The record demonstrates that Prevailing Wind Park has minimized and/or avoided impacts from shadow flicker.[170] Where shadow flicker exceeds the commitments made by Prevailing Wind Park, Prevailing Wind Park has committed to use Turbine Control Software programmed to automatically shut down a specific turbine or turbines for an appropriate amount of time as necessary to comply with that commitment.[171] Specifically, the software will shut a turbine down before it exceeds the committed shadow flicker limits and will not turn the turbine back on until the shadow flicker at that location has ended.[172]

67. The record demonstrates that 30 hour/year limit is merely an industry standard.[173] Intervenors advocated that no shadow flicker should be allowed at non-participating residences.[174] There is no federal standard for shadow flicker exposure from wind turbines, and state and local standards are uncommon.[175] This standard is commonly applied in regulatory proceedings in other jurisdictions.[176] No jurisdictions

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[163] Evid. Hrg. Tr. at 686-687 (Soukup).
[164] Evid. Hrg. Tr. at 721-22, 784 (Hessler).
[165] Evid. Hrg. Tr. at 726-27, 780 (Hessler); *see also* Ex. S3 at 4 (Hessler Direct).
[166] Evid. Hrg. Tr. at 723 (Hessler).
[167] Evid. Hrg. Tr. at 721 (Hessler)
[168] Evid. Hrg. Tr. at 816-17 (James)
[169] Exhibit A10-2, pages 30-3
[170] *See, e.g.,* Ex. A1 at § 15.5.2 (Application).
[171] Evid. Hrg. Tr. at 207-08 (Pawlowski).
[172] Evid. Hrg. Tr. at 207-08 (Pawlowski); *see also* Evid. Hrg. Tr. at 54 (Anderson) ("It's part of the machine itself, and it's simply a modification of the control software for the turbine. And we can modify that so that if the flicker above a certain threshold occurs, whether that's hours per year, minutes per day, et cetera, we can adjust the turbine control settings and, simply put, tell it not to operate or to operate in a different way.").
[173] *See* Evid. Hrg. Tr. at 51, 73, 81, 83-84 (Anderson); Evid. Hrg. Tr. at 259-60, 1114 (Pawlowski).
[174] *See* Evid. Hrg. Tr. at 971, 981 (Huebner).
[175] Evid. Hrg. Tr. at 51 (Anderson).
[176] *See, e.g., In the Matter of the Application of Freeborn Wind Energy LLC for a Large Wind Energy Conversion System Site Permit for the up to 84 MW Freeborn Wind Farm in Freeborn County,* Minnesota Public Utilities Commission Docket WS-17-410, Minnesota Department of Commerce Energy Environmental Review and Analysis (EERA) Comments and Recommendations on Draft Site Permit at 18

prohibit shadow flicker at non-participating residences.[177] For this Project, a 15 hour/year limit is an appropriate standard to protect the welfare of non-participants.

68. There is no credible record evidence that the proposed Project will have adverse impacts on human health.[178] Construction and placement of facilities meet or exceed industry standards established for the protection of the health of residences and businesses in and around the Project.[179] Further, the South Dakota Department of Health provided Staff with a letter stating that the Department of Health has not taken a formal position on the issue of wind turbines and human health.[180] The South Dakota Department of Health referenced the Massachusetts Department of Public Health and Minnesota Department of Health studies and noted that those studies generally conclude that there is insufficient evidence to establish significant risk to human health.[181]

69. Prevailing Wind Park offered the testimony of two highly qualified medical doctors with unchallenged credentials: Dr. Mark Roberts and Dr. Jeff Ellenbogen.[182] Dr. Roberts is a medical doctor and a PhD epidemiologist who spent 18 years working in public health with the Oklahoma State Department of Health.[183] Dr. Ellenbogen, also a medical doctor, is a Board-certified neurologist and spent five years as a professor of

(December 5, 2017) (eDocket No. 201712-137950-01) ("Some of the comments indicated that non-participants should not experience more than 30 hours of shadow flicker per year. 30 hours of flicker per year was a suggested standard in a couple sources of information reviewed by EERA, but those sources do not provide supporting scientific data that would suggest there is a link between shadow flicker in excess of 30 hours per year of exposure and negative human health impacts."); *In the Matter of the Application of Lindahl Wind Project, LLC's Application for a Certificate of Site Compatibility for the Lindahl Wind Farm Project in Williams County, North Dakota*, Docket PU-15-482, North Dakota Public Service Commission Findings of Fact, Conclusions of Law and Order, (Dec. 2, 2016) at Order ¶ 8. *see also* Evid. Hrg. Tr. at 1127 (Kearney) ("Ultimately what I looked at was what the county was comfortable with as being a nuisance issue and if they were comfortable with 30 hours without some study saying that's right or wrong, I was comfortable with that.").

[177] Evid. Hrg. Tr. at 80 (Anderson).

[178] *See, e.g.,* Ex. A4 at 16 (Roberts Supplemental Direct) ("the levels of sound and infrasound from wind turbines are significantly lower than those that have been shown to cause harm.");; Ex. A18 at 4-5 (Ellenbogen Rebuttal) ("None of the limited epidemiological evidence reviewed suggested an association between noise from wind turbines and a wide range of topics we considered: pain, stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and/or headache/migraine. In addition, claims that infrasound from wind turbines directly impacts the vestibular system have not been demonstrated scientifically. . . . We did not find evidence in the human or animal literature to support that vibrations of the kind produced by a wind turbine could influence the vestibular system."); *see also* Ex. A4 at 4, 18, 21 (Roberts Supplemental Direct); Ex. A18 at 12 (Ellenbogen Rebuttal); Evid. Hrg. Tr. at 118, 171-72 (Roberts); Evid. Hrg. Tr. at 327, 375-76 (Ellenbogen).

[179] Ex. A1 at 25-1 – 25-2 (Application).

[180] Ex. S1 at 9 and DK-4 (Kearney Direct); s*ee In the Matter of the Application by Crocker Wind Farm, LLC for a Permit of a Wind Energy Facility and a 345 kV Transmission Line in Clark County, South Dakota, for Crocker Wind Farm*, Docket EL17-055, Exhibit S1 at DK-4, Letter, Kim Malsam-Rysdon, Secretary of Health, South Dakota Department of Health (Oct. 13, 2017) ("These studies generally conclude that there is insufficient evidence to establish a significant risk to human health.")..

[181] Ex. S1 at 9 and DK-4 (Kearney Direct).

[182] The expert qualifications of Prevailing Wind Park's experts are undisputed. For example, Dr. Roberts' expert opinion was supported by citation to corroborating studies representing reliable scientific knowledge, provided as schedules to his testimony. *See, e.g.,* Ex. A4-2 through A4-8 and A5-1 through A5-11.

[183] *See* Ex. A4 at 2-3 (Roberts Supplemental Direct); Ex. A4-1 (Roberts Statement of Qualifications); Evid. Hrg. Tr. at 87-88 (Roberts).

neurology at The Johns Hopkins University School of Medicine.[184] Both Dr. Roberts and Dr. Ellenbogen testified that there is no scientific evidence that wind turbines cause adverse health effects.[185]

70. The testimony of Prevailing Wind Park's medical doctors was unrebutted. Intervenors did not present any expert medical testimony. While Intervenors submitted pre-filed testimony from three individuals – Mr. James, Dr. Punch, and Dr. Alves-Pereira[186] – Intervenors withdrew Dr. Alves-Pereira as a witness the day she was to testify. Mr. James and Dr. Punch were precluded from testifying regarding health effects because neither has the education, training, nor experience to provide expert testimony on health effects.[187] Neither Mr. James nor Dr. Punch is a medical doctor, nor did either perform medical evaluations on any of the people that provided complaints to them.[188] Further, neither Mr. James nor Dr. Punch provided credible literature supporting their assertions regarding health-related effects.[189] Accordingly, the Commission ordered redactions of Mr. James' and Dr. Punch's pre-filed testimony and of the transcript of their oral testimony at the evidentiary hearing to reflect the hearing examiner's ruling that neither Mr. James nor Dr. Punch is qualified to testify about health issues.[190]

71. Prevailing Wind Park's two independent medical experts, Dr. Roberts and Dr. Ellenbogen, provided extensive testimony confirming that there is no scientifically proven link between wind turbines and any adverse health effect.[191] Dr. Roberts, a medical doctor and epidemiologist, analyzed and reviewed peer reviewed, published literature as well as literature generated through government process (such as a legislative committee or State Health Department) whereby the government empanels a group to review the literature and provide insight on a particular topic (known as "grey literature") and did not identify any credible scientific works that provide objective support

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[184] *See* Ex. A18-1(Ellenbogen Rebuttal); Ex. A18-1 (Ellenbogen Statement of Qualification); Evid. Hrg. Tr. at 318-19 (Ellenbogen).

[185] *See, e.g.,* Evid. Hrg. Tr. at 89, 92, 129, 154, 159-60 (Roberts); Ex. A4 at 4, 18, 21 (Roberts Supplemental Direct); Ex. A5 at 7-8 (Roberts Rebuttal); Evid. Hrg. Tr. at 325, 327, 360-61, 364-65, 366-67, 377-78, 382 (Ellenbogen); Ex. A18 at 4-5, 12 (Ellenbogen Rebuttal).

[186] On the day she was scheduled to appear, Intervenors withdrew Dr. Alves-Pereira as a witness. As such, her pre-filed testimony is not part of this record.

[187] *See* Evid Hrg. Tr. at 821-23 (James) and 833-35; Evid. Hrg. Tr. at 897-99, 902-03 (Punch) and 910-11, 914-15; *see also* Ex. A36 at 11 (*Williams v. Invenergy, LLC*, 2016 WL 1275990 (D. Oregon, April 28, 2016)) (holding that Mr. James "is not a doctor or epidemiologist. As a result, he does not have the training to opine that the infrasound and audible noise created by wind turbines activates physiological mechanisms in the body which produce adverse health effects"); *id.* at 14 ("Punch is neither a medical doctor nor an epidemiologist who could opine on the cause of Williams's symptoms solely on the basis of these qualifications. Therefore, for Punch's causation testimony to be admissible under *Daubert*, he must support his causation opinion with reference to foundational literature which establishes the causal relationship through the application of 'scientific knowledge.'").

[188] Evid. Hrg. Tr. at 823 (James); Evid. Hrg. Tr. at 897, 901-02 (Punch).

[189] *See* Evid. Hrg. Tr. at 825-27 (James); Evid. Hrg. Tr. at 901, 904 (Punch).For example, the paper authored by Mr. James and Dr. Punch and which both referred to in their testimony was not peer-reviewed, as that phrase is typically used. *See* Ex. A5 at 17-18 (Roberts Rebuttal).

[190] Order Redacting Exhibits and Testimonies (Nov. 1, 2018).

[191] *See, e.g.,* Evid. Hrg. Tr. at 89, 92, 129, 154, 159-60 (Roberts); Ex. A4 at 4, 18, 21 (Roberts Supplemental Direct); Ex. A5 at 7-8 (Roberts Rebuttal); Evid. Hrg. Tr. at 325, 327, 360-61, 364-65, 366-67, 377-78, 382 (Ellenbogen); Ex. A18 at 4-5, 12 (Ellenbogen Rebuttal).

for claims that wind turbines cause adverse health effects.[192] He concluded that there is no peer-reviewed, scientific data to support a claim that wind turbines are causing disease or specific health conditions.[193]

72. Dr. Ellenbogen, a Harvard-educated neurologist and a sleep specialist, led a Massachusetts heath impact study that concluded that wind turbines do not pose a risk to human health. Dr. Ellenbogen "specifically evaluated the merits of 'wind turbine syndrome'" and "found no basis for a set of health effects from wind turbines."[194] He also evaluated four individuals claiming to suffer from "wind turbine syndrome" and found that the claims could not be substantiated and in fact prevented the individuals from seeking appropriate treatment.[195] Dr. Ellenbogen testified: "[I]n my opinion, the misapplied blame to wind turbines prevented these individuals from seeking and obtaining much-needed medical treatment for their underlying conditions."[196]

73. There is no credible evidence in the record to support a finding that wind turbines cause adverse health effects.[197] This conclusion has been reached by well-respected, governmental agencies charged with protecting public health that have evaluated the available evidence and concluded that wind turbines are not a cause of adverse health effects.[198] For example, the Australian National Health and Medical Research Council concluded that there is no consistent evidence that wind turbines cause adverse health effects in humans.[199] Similarly, the Wisconsin Siting Council concluded that no association between wind turbines and health effects has been scientifically shown.[200] Researchers at the Lawrence Berkeley National Laboratory also found no link between wind turbines and adverse health effects.[201] In addition, an independent expert panel for Massachusetts (which included Dr. Ellenbogen) found that there was insufficient evidence that noise from wind farms directly causes health problems or disease.[202]

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[192] *See* Ex. A4 at 14-15 (Roberts Supplemental Direct) and Evid. Hrg. Tr. at 173-74 (Roberts). Intervenors questions Dr. Roberts about an article he authored in 2013 regarding his review of the literature available as of late 2012 on wind turbines and health effects. Evid. Hrg. Tr. at 99-100. As Dr. Roberts explained, he did not include his 2013 article as an exhibit to his prefiled testimony because he chose instead to include as exhibits the up-to-date, current reviews of the literature that have been conducted since his 2013 article. Evid. Hrg. Tr. at 174-75 (Roberts).

[193] Ex. A4 at 12 (Roberts Supplemental Direct); *see also* Ex. A4 at 15 (Roberts Supplemental Direct) ("Despite the attribution of various health events to wind turbines, there has not been a specific health condition documented in the peer-reviewed published literature to be recognized by the medical community or professional societies as a disease caused by exposure to sound levels and frequencies generated by the operation of wind turbines.").

[194] Ex. A18 at 5 (Ellenbogen Rebuttal).

[195] Ex. A18 at 7-8 (Ellenbogen Rebuttal).

[196] Ex. A18 at 8 (Ellenbogen Rebuttal).

[197] *See, e.g.,* Evid. Hrg. Tr. at 89, 92, 129, 154, 159-60 (Roberts); Ex. A4 at 4, 18, 21 (Roberts Supplemental Direct); Ex. A5 at 7-8 (Roberts Rebuttal); Evid. Hrg. Tr. at 325, 327, 360-61, 364-65, 366-67, 377-78, 382 (Ellenbogen); Ex. A18 at 4-5, 12 (Ellenbogen Rebuttal).

[198] *See* Ex. A4 at 4 (Roberts Supplemental Direct).

[199] Ex. A4 at 12-13 (Roberts Supplemental Direct).

[200] Ex. A4 at 13 (Roberts Supplemental Direct).

[201] Ex. A4 at 13 (Roberts Supplemental Direct).

[202] Ex. A4 at 13-14 (Roberts Supplemental Direct); Ex. A18 at 4-5 (Ellenbogen Rebuttal).

74. Infrasound is generally defined as sound in the approximately 0 to 20 Hz frequency range.[203] A level of 20 Hz is commonly considered the low end of the range of human hearing.[204] Infrasound is generated by both natural and man-made sources, including: the human heart, waves, thunder, waterfalls, washing machines, fans, and heating and refrigeration systems.[205] The levels of infrasound produced by wind turbines are not only below the threshold of human hearing but are multiple orders of magnitude below the threshold.[206] There is no scientifically proven evidence of adverse effects in this level range.[207] Infrasound is not unique to wind turbines, nor is the infrasound from wind turbines unique or distinct from infrasound produced by other sources at similar levels.[208] Further, the levels of infrasound produced by wind turbines are significantly lower than those that have been shown to cause harm, such as from jet engines or blast injuries.[209] There have been numerous studies analyzing wind turbine effects; none of these studies have found a causal relationship between wind turbine infrasound and human health effects.[210] As Dr. Roberts testified, these studies looked at sound overall from wind turbines when drawing their conclusions about health effects – these studies

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[203] Ex. A4 at 17 (Roberts Supplemental Direct).

[204] Ex. A4 at 17 (Roberts Supplemental Direct). In addition, Exhibit A40 is a graphic showing the relationship between sound pressure levels (dB) and frequency (Hz) as it relates to human hearing. As indicated on the graphic, sound pressure levels must be above 100 dB for humans to hear at very low frequencies.

[205] Ex. A5 at 6-7 (Roberts Rebuttal); Ex. A4 at 17 (Roberts Supplemental Direct).

[206] Ex. A5 at 7 (Roberts Rebuttal).

[207] Ex. A5 at 7 (Roberts Rebuttal). Ex. A4 at 17 (Roberts Supplemental Direct); *see also* Evid. Hrg. Tr. at 169 (Roberts) ("If we begin to have regulations about infrasound, we're going to have to consider the other sources. Our lungs, our heart, our diaphragm, my GI tract all make low frequency sounds. My joints make low frequency sounds as well."); Evid. Hrg. Tr. at 171 (Roberts) ("Infrasound is caused by a large number of different natural and technical sources. It is every day part of our environment that can be found everywhere. Wind turbines make no considerable contribution to it. The infrasound levels generated by them lie clearly below the limits of human perception. There is no scientifically proven evidence of adverse effects in this level range.") (quoting Ex. A5-1 at 12) Intervenors referenced a study conducted on guinea pigs to argue that wind turbine infrasound could be detected and/or somehow impact the inner ear. This study is neither relevant nor helpful, as Dr. Ellenbogen explained. First, there are significant differences between the inner ears of guinea pigs and humans. Second, it has nothing to do with adverse health effects. *See* Evid. Hrg. Tr. at 386, 389-90 (Ellenbogen) ("I actually don't have confidence that the study is relevant for this panel for two reasons. One, because of the animal comparison and also because it was not about health effects. It was about perception.").

[208] *See* Evid. Hrg. Tr. at 177 (Roberts); Ex. A4 at 17 (Roberts Supplemental Direct); Ex. A5 at 6-7 (Roberts Rebuttal).

[209] Ex. A4 at 16 (Roberts Supplemental Direct); *see, e.g.,* Evid. Hrg. Tr. at 150 (describing effects of sound levels of 110-120 dB from jet engines); Evid. Hrg. Tr. at 375-76 (describing blast injuries experienced by veterans from sound pressure levels exceeding 110 dB).

[210] *See* Evid. Hrg. Tr. at 118, 135, 139-40, 160-62, 171-74 (Roberts); *see also* Ex. A5 at 7 (Roberts Rebuttal); Ex. A18 at 5 (Ellenbogen Rebuttal); Evid. Hrg. Tr. at 516-17 (Howell) ("In general the absolute values that we're talking about for this wind farm don't require any further analysis of low frequency noise, in my opinion. . . . In this scenario we looked at dBA and I did an off the cuff look at the dBC values as well and none of the values exceeded that recommended differential to determine if there's a low frequency component. So I would not expect a significant low frequency component here.").

necessarily would have included infrasound.[211] Thus, there is no evidence in the record to support a finding that wind turbines cause adverse health effects.[212]

75. While there are no limits specifically addressing infrasound levels, it is well understood that limiting wind turbine noise emissions using a dBA standard automatically limits infrasound.[213] There is a fixed relationship between the dBA scale and infrasound. Thus, once one part of the spectrum is limited, the rest of the spectrum is limited as well. For this Project, the 40 dBA limit controls infrasound levels from the Project to levels that would not cause health effects and which are orders of magnitude below the human hearing threshold.[214] As Staff's witness Mr. Hessler testified, there are currently over 90,000 MW of wind power installed in the United States involving more than 50,000 wind turbines, with self-reported adverse health effect complaints at only a very small number of those turbines.[215]

76. The record demonstrates that shadow flicker from turbines is not harmful to the health of photosensitive individuals, including those with epilepsy.[216] Seizures that occur as a result of flashes of light (a condition known as photic-stimulated epilepsy) happen as a result of frequencies greater than 5 Hz, usually substantially higher.[217] The frequency of any shadow flicker from wind turbines will be approximately 0.5 to 1 Hz, which is considerably below the range that would elicit a seizure even in someone who is vulnerable to seizures as a result of flashes of light.[218] No supporting scientific data has been provided to suggest that there is a link between shadow flicker in excess of 15 hours per year of exposure and negative human health impacts.

77. Overall, the record shows that Prevailing Wind Park has met its burden to demonstrate that the Project will not substantially impair human health; indeed, there is no credible evidence in the record that the Project would impair human health (substantially or insubstantially). Although Intervenors provided some testimony

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[211] *See* Evid. Hrg. Tr. at 118, 135, 139-40, 143, 160-62, 171-74 (Roberts).

[212] *See* Ex. A5 at 7 (Roberts Rebuttal); Ex. A18 at 4-5 (Ellenbogen Rebuttal) ("None of the limited epidemiological evidence reviewed suggested an association between noise from wind turbines and a wide range of topics we considered: pain, stiffness, diabetes, high blood pressure, tinnitus, hearing impairment, cardiovascular disease, and/or headache/migraine. In addition, claims that infrasound from wind turbines directly impacts the vestibular system have not been demonstrated scientifically. . . . We did not find evidence in the human or animal literature to support that vibrations of the kind produced by a wind turbine could influence the vestibular system."); Ex. A4 at 16 (Roberts Supplemental Direct) ("the levels of sound and infrasound from wind turbines are significantly lower than those that have been shown to cause harm."); Evid. Hrg. Tr. at 118, 171-72 (Roberts); Evid. Hrg. Tr. at 327, 375-76 (Ellenbogen).

[213] *See* Evid. Hrg. Tr. at 382, 387 (Ellenbogen).

[214] Evid. Hrg. Tr. at 382, 387 (Ellenbogen).

[215] *See* Ex. S3 at 7 (Hessler) ("According to the latest quarterly report of the American Wind Energy Association there are now over 90,000 MW of installed wind power in this country involving more than 50,000 wind turbines. To my knowledge, instances of apparent adverse health effects from wind turbines have occurred at only a small handful of sites with only a few turbines each, such as Falmouth in Massachusetts (three 1.5 MW GE units) and Shirley Wind in Wisconsin (eight 2.5 MW Nordex units)."); Evid. Hrg. Tr. at 733 ("If this problem were common at all, it would be in the forefront of every project's Application and would be a totally disruptive issue.").

[216] *See* Ex. A18 at 5 (Ellenbogen Rebuttal); Evid. Hrg. Tr. at 94, 154, 159 (Roberts).

[217] Ex. A18 at 5 (Ellenbogen Rebuttal); Evid. Hrg. Tr. at 154 (Roberts).

[218] Ex. A18 at 5 (Ellenbogen Rebuttal).

concerning speculative health concerns, the large body of reliable and vetted medical evidence refutes these claims.[219]

78. The Project will utilize an Aircraft Detection Lighting System (ADLS) provided that the FAA approves it for the Project.[220] The FAA has issued a Determination of No Hazard to Air Navigation for each of the Project's proposed turbine sites.[221]

79. The record demonstrates that Prevailing Wind Park has taken appropriate measures to avoid and/or minimize the risk of ice throw occurring.[222] Although icing can occur on turbine blades during freezing rain conditions, the record demonstrates that it is not common and is generally controlled by ice detection systems on the turbines.[223] Project turbines will include the standard turbine control system on each turbine, as well as an additional purchased accessory software package, including Turbine Computer Monitoring (TCM).[224] The turbine controller senses when the rotor revolutions per minute are not consistent with the measured wind speed (which may occur as the buildup of ice breaks the perfected aerodynamic shape of the blade).[225] The turbine controller then evaluates the temperature and recognizes that icing conditions may exist. The TCM system measures vibration on many components of the turbine and, when it senses vibration above pre-set levels, the turbine automatically shuts down.[226] This shut-down will occur in less than two minutes from the time icing is detected.[227] The turbine will not attempt to restart until conditions (temperature) become favorable or human intervention occurs.[228]

80. The evidence presented in the record demonstrates that Project setbacks and the proposed permit condition regarding turbine icing will protect human health and safety.[229] Prevailing Wind Park provided testimony from Mr. Scott Creech, the construction manager for the Project, who has over a decade of experience working with wind turbines.[230] Specifically, Mr. Creech testified that the farthest distance he is aware of ice being thrown from a turbine is approximately 250 feet.[231] The Project is set back

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[219] For example, Intervenors solicited testimony from individuals regarding other wind projects (Scott Rueter, Vickie May). These witnesses clearly have strong feelings about wind projects. However, they did not provide any medical evidence of any adverse health effects and well-regarded medical research and literature – relied upon by many other regulatory bodies – refutes any claims they may be making regarding health issues and wind turbines.

[220] Ex. A6 at 5 (Pawlowski Supplemental Direct); Applicant's and Staff's Revised Joint Recommended Condition 39.

[221] Ex. A6 at 5 (Pawlowski Supplemental Direct).

[222] *See, e.g.,* Ex. A17 at 2-3 (Creech Rebuttal); Applicant's and Staff's Revised Joint Recommended Condition 38.

[223] Ex. A17 at 2 (Creech Rebuttal).

[224] Ex. A17 at 2 (Creech Rebuttal).

[225] Ex. A17 at 2 (Creech Rebuttal).

[226] Ex. A17 at 2-3 (Creech Rebuttal).

[227] Evid. Hrg. Tr. at 558 (Creech).

[228] Ex. A17 at 3 (Creech Rebuttal).

[229] *See, e.g.,* Ex. A17 at 2-5 (Creech Rebuttal); Applicant's and Staff's Revised Joint Recommended Condition 38; *see also* Evid. Hrg. Tr. at 525-256, 551 (Creech).

[230] *See* Ex. A17 (Creech Rebuttal); Evid. Hrg. Tr. at 534 (Creech).

[231] Ex. A17 at 3 (Creech Rebuttal).

at least 649.61 feet (1.1 times the tip height of the tower) from non-participating property lines.[232] In Hutchinson and Bon Homme Counties, the Project is set back at least 1,000 feet from non-participating residences. Per Prevailing Wind Park's commitments to Charles Mix County, Project turbines are set back at least 3.5 times the system height or 2,000 feet, whichever is greater, from non-participating residences in Charles Mix County.[233] The closest participating residence to a turbine is more than 1,550 feet away.[234] In addition, Prevailing Wind Park has agreed to the same turbine icing condition as the Commission imposed in the Dakota Range proceeding, which requires Prevailing Wind Park to use two methods to detect icing conditions on turbine blades.[235] Intervenors relied on an outdated article to assert that ice throw may occur as far as 6,500 feet away from a 20 MW wind turbine.[236] Such a machine is not proposed for the Project, nor does it exist. As such, the document is irrelevant. Rather, the real-world data and experience, coupled with the manufacturer recommendations and turbine control software, show that the Project as designed is appropriately sited and will minimize the potential for ice throw.[237]

D. The facility will not unduly interfere with the orderly development of the region with due consideration having been given the views of governing bodies of affected local units of government.

81. The record demonstrates that the Project will not unduly interfere with the orderly development of the region. The Project complies with all applicable local land use requirements, and the evidence demonstrates that Prevailing Wind Park has worked cooperatively with local governments, even where no local land use controls existed. Specifically: Bon Homme County granted a Large Wind Energy System approval for the Project on August 21, 2018; Hutchinson County granted conditional use approvals for the Project on September 4, 2018; and, the Project received building permits from Charles Mix County in July 2018 and has worked with Charles Mix County to address concerns regarding the Project.[238] Prevailing Wind Park executed an affidavit memorializing its commitments to Charles Mix County; this affidavit binds Prevailing Wind Park but imposes no obligations on Charles Mix County.[239]

82. Intervenors take issue with the development of zoning ordinances relating to the Project. As an initial matter, the local development of zoning regulations is outside

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[232] Ex. A17 at 5 (Creech Rebuttal).
[233] Ex. I-22 (Letter from Charles Mix County with Affidavit of Peter Pawlowski).
[234] Ex. A42 (Distance from Each Residence to the Nearest Wind Turbine, Modeled Shadow Flicker and Sound Pressure Levels).
[235] Ex. A17 at 4 (Creech Rebuttal).
[236] *See* Ex. A28 at 1 and Attachment B (Intervenors' Responses to Staff's Second Set of Data Requests); Evid. Hrg. Tr. at 533-34 (Creech).
[237] Ex. A17 at 2-3 (Creech Rebuttal); Evid. Hrg. Tr. at 534, 551, 554-55, 556, 558 (Creech); Ex. A31 at "Setback Considerations for Wind Turbine Siting" (Applicant's Updated Responses to Intervenors' Data Requests).
[238] Ex. A7 at 1 (Pawlowski Rebuttal).
[239] Ex. I-22 (Letter from Charles Mix County with Affidavit of Peter Pawlowski); Evid. Hrg. Tr. at 253 (Pawlowski).

the scope of the Commission's jurisdiction and is not relevant to this proceeding.[240] That said, the testimony from local officials demonstrates that those local officials listened to input from people on both sides and consulted many different resources before making their decisions.[241] Michael Soukup from the Bon Homme County Commission testified to the thorough and fair process the county undertook in adopting its wind energy system zoning ordinance; specifically, that the county looked to other zoning ordinances for guidance, and considered input from both supporters and opponents of wind energy systems in adopting its wind energy system zoning ordinance.[242] Keith Mushitz, Chairman of the Charles Mix County Commission, testified to the multiple public meetings and opportunities for public comment that were fully utilized by the public, and how the county considered all of these comments in making its decision.[243] Even Intervenor Mr. Hubner testified that he was unhappy with the outcome of such proceedings – not the process itself.[244]

83. Intervenors requested a two-mile setback from non-participating residences. There is no credible evidence in the record supporting a two-mile setback from nonparticipating residences.[245] The record demonstrates that the Project meets the Commission's siting requirements applying the current setbacks, as well as Prevailing Wind Park's voluntary commitments.[246] Additionally, there is no reasonable basis in the record to support a 1,500-foot setback from property lines.[247]

CONCLUSIONS OF LAW

From the foregoing Findings of Fact and the record in this proceeding, the Commission now makes the following Conclusions of Law:

1. The Commission has jurisdiction to consider the Application under South Dakota Codified Law Chapter 49-41B.

2. The wind energy conversion facility proposed by Applicant is a wind energy facility as defined under South Dakota Codified Law 49-41B-2(13).

3. The Application submitted by Applicant meets the criteria required by South Dakota Codified Law 49-41B-25, and construction of the Project meets the requirements of South Dakota Codified Law 49-41B.

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[240] Evid. Hrg. Tr. 627-28.
[241] *See* Evid. Hrg. Tr. at 685-93 (Soukup); Evid. Hrg. Tr. at 696-703 (Mushitz).
[242] *See* Evid. Hrg. Tr. at 668-69, 688-89 (Soukup).
[243] *See* Evid. Hrg. Tr. at 697-99, 703 (Mushitz).
[244] *See* Evid. Hrg. Tr. at 979 (Hubner) ("Well, I never contended their procedure. I mean, I – whether they made a mistake or didn't make a mistake as they were doing this. How they did it was really not an issue for me. It's what they did and who they listened to.").
[245] *See* Ex. A7 at 3 (Pawlowski Rebuttal); Ex. S1 at 11 (Kearney Direct).
[246] *See* Ex. A7 at 3 (Pawlowski Rebuttal); Ex. S1 at 11 (Kearney Direct).
[247] *See* Ex. A7 at 4 (Pawlowski Rebuttal); Ex. S1 at 11 (Kearney Direct).

4. The Commission satisfied the hearing and notice requirement in South Dakota Codified Law Chapter 49-41B.

5. Applicant satisfied the applicable notice requirements in South Dakota Codified Law Chapter 49-41B.

6. Applicant has demonstrated that the proposed facility will comply with all applicable laws and rules.

7. Applicant has demonstrated that the facility will not pose a threat of serious injury to the environment nor to the social and economic condition of inhabitants or expected inhabitants in the siting area.

8. Applicant has demonstrated that the facility will not substantially impair the health, safety or welfare of the inhabitants.

9. Applicant has demonstrated that the facility will not unduly interfere with the orderly development of the region with due consideration having been given the views of governing bodies of affected local units of government.

10. All other applicable procedural requirements in South Dakota Codified Law Chapter 49-41B have been satisfied.

11. No party has provided evidence sufficient for the Commission to impose a property value guarantee.

12. No party has provided evidence sufficient for the Commission to impose a two-mile setback from non-participating landowners.

13. No party has provided evidence sufficient for the Commission to impose a 1,500-foot setback from property lines.

14. To the extent that any Finding of Fact set forth above is more appropriately a conclusion of law, that Finding of Fact is incorporated by reference as a Conclusion of Law.

ORDER

From the foregoing Findings of Fact and Conclusions of Law, it is therefore:

ORDERED, that an energy facility permit is issued to Prevailing Wind Park, LLC for the Prevailing Wind Park Project.

ORDERED, that Applicant shall comply with the attached Permit Conditions, which are hereby incorporated into and made a part of this Order.

NOTICE OF ENTRY AND OF RIGHT TO APPEAL

PLEASE TAKE NOTICE that this Final Decision and Order was duly issued and entered on the 28th day of November 2018.

Dated at Pierre, South Dakota, this 28th day of November 2018.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this document has been served today upon all parties of record in this docket, as listed on the docket service list, electronically or by mail.

By: Adam de Hueck

Date: 11/28/18

(OFFICIAL SEAL)

BY ORDER OF THE COMMISSION:

Kristie Fiegen

KRISTIE FIEGEN, Chairperson

Gary Hanson

GARY HANSON, Commissioner

Chris Nelson

CHRIS NELSON, Commissioner

ATTACHED

PERMIT CONDITIONS

1. Applicant will obtain all governmental permits which reasonably may be required by any township, county, state or federal agency, or any other governmental unit for construction and operation activity of the Project prior to engaging in the particular activity covered by that permit. Copies of any permits obtained by Applicant shall be sent to the Commission.

2. Applicant shall construct, operate, and maintain the Project in a manner consistent with (1) descriptions in the Application, (2) Application supplements, (3) responses to any data requests, (4) the Final Decision and Order Granting Permit to Construct Facilities, Attached Permit Conditions, (5) any applicable industry standards, (6) any permits issued by a federal, state, or local agency, and (7) evidence presented by Applicant at the evidentiary hearing.

3. Applicant shall complete the Western Area Power Administration (WAPA) environmental review process as required by the National Environmental Policy Act. Further, Applicant shall comply with and implement any requirements or commitments set forth in the WAPA NEPA review. Applicant expects the environmental review to be composed of an Environmental Assessment and that Applicant would be required to comply with applicable mitigation measures set forth in the Upper Great Plains Wind Energy Programmatic Environmental Impact Statement.

4. Applicant agrees that the Commission's complaint process as set forth in ARSD Chapter 20:10:01 shall be available to landowners and other persons sustaining or threatened with damage as the result of Applicant's failure to abide by the conditions of the Permit or otherwise having standing to seek enforcement of the conditions of the Permit. Participating landowners are free to use the complaint process free from retribution or consequence regardless of any private easement term to the contrary.

5. At least 14 days prior to commencement of construction, Applicant shall provide each participating and non-participating landowner in the Project Area with the following information:

   a) A copy of the Final Decision and Order Granting Permit to Construct Facilities;

   b) Detailed safety information describing:

      1) Reasonable safety precautions for existing activities on or near the Project;

      2) Known activities or uses that are presently prohibited near the Project, and

      3) Other known potential dangers or limitations near the Project;

   c) Construction/maintenance damage compensation plans and procedures;

   d) The Commission's address, website, and phone number;

   e) Contact person for Applicant, including name, e-mail address, and phone number.

6. In order to ensure compliance with the terms and conditions of this Permit pursuant to SDCL 49-41B-33, it is necessary for the enforcement of this Order that all employees, contractors, and agents of Applicant involved in this Project be made aware of the terms and conditions of this Permit.

7. Except as otherwise provided in the Permit Conditions, Applicant shall comply with all mitigation measures set forth in the Application and Applicant's responses to Commission staff data requests. Material modifications to the mitigation measures shall be subject to prior approval of the Commission.

8. Applicant will negotiate road use agreements with Bon Homme County, Hutchinson County, Charles Mix County, and all affected townships, if required. Applicant will follow the terms of all road use agreements. Applicant shall take appropriate action to mitigate wind-blown particles created throughout the construction process, including but not limited to implementation of dust control measures such as road watering, covering of open haul trucks when transporting

material subject to being windblown, and the removal of any soils or mud deposits by construction equipment when necessary.

9. Applicant shall comply with the following conditions regarding road protection:

   a) Applicant shall acquire all necessary permits authorizing the crossing of federal, state, county, and township roads.

   b) Applicant shall coordinate road closures with federal, state, and local governments and emergency responders.

   c) Applicant shall implement a regular program of road maintenance and repair through the active construction period to keep paved and gravel roads in an acceptable condition for residents and the public.

   d) After construction, Applicant shall repair and restore deteriorated roads resulting from construction traffic or compensate governmental entities for their repair and restoration of deteriorated roads, such that the roads are returned to their preconstruction condition.

   e) Within 180 days of completing construction and reclamation of the Project, Applicant shall submit documentation to the Commission identifying that the roads were repaired in accordance with this Condition 8 and to the satisfaction of affected townships and counties. If the townships or counties will not provide such documentation, then Applicant shall provide a report to the Commission on the outstanding road repair issues and how those issues will be resolved.

   f) Privately owned areas used as temporary roads or crane paths during construction will be restored to their preconstruction condition, except as otherwise requested or agreed to by the landowner.

   g) Should Applicant need to widen any existing roadways during construction of the Project, Applicant shall return the roadways back to original width after completion of the Project, unless agreed upon otherwise with the federal, state, county, or township entities, or the landowner.

   h) Applicant shall use appropriate preventative measures to prevent damage to paved roads and to remove excess soil or mud from such roadways.

10. Applicant shall provide signage that identifies road closures and disturbances resulting from the Project in accordance with the most recent editions of the Manual on Uniform Traffic Control Devices as published by the Federal Highway Administration.

11. Applicant shall promptly report to the Commission the presence of any critical habitat of threatened or endangered species in the Project Area that Applicant becomes aware of and that was not previously reported to the Commission.

12. Applicant agrees to avoid direct impacts to cultural resources that are unevaluated, eligible for or listed in the National Register of Historic Places (NRHP). When a NRHP unevaluated, eligible or listed site cannot be avoided, Applicant shall notify the South Dakota State Historic Preservation Office (SHPO) and the Commission of the reasons that complete avoidance cannot be achieved in order to coordinate minimization and/or treatment measures.

13. Applicant agrees to develop an unanticipated discovery plan for cultural resources and follow SDCL 34-27-25, 34-27-26, and 34-27-28.

14. Applicant shall file the final cultural resources report with the Commission prior to construction. If any potential adverse impacts to NRHP unevaluated, listed, or eligible cultural resources are identified in the final cultural resources report, Applicant shall file with the Commission a report describing the SHPO-approved planned measures to ameliorate those impacts.

15. Applicant shall provide the Stormwater Pollution Prevention Plan (SWPPP) to the Commission when Applicant has a final design for the Project. The SWPPP will outline the water and soil conservation practices that will be used during construction to prevent or minimize erosion and sedimentation. The SWPPP will be completed before submittal of an application for a National Pollutant Discharge Elimination System (NPDES) general permit for construction activities. All contractors to be engaged in ground disturbing activities will be given a copy of the SWPPP and requirements will be reviewed with them prior to the start of construction.

16. Applicant shall repair and restore areas disturbed by construction or maintenance of the Project. Except as otherwise agreed to by the landowner, restoration shall include replacement of original pre-construction topsoil or equivalent quality topsoil to its original elevation, contour, and compaction and re-establishment of original vegetation as close thereto as reasonably practical. In order to facilitate compliance with this Permit Condition, Applicant shall:

    a) Strip topsoil to the actual depth of the topsoil, or as otherwise agreed to by the landowner in writing (e-mail is sufficient), in all areas disturbed by the Project; however, with respect to access roads, Applicant may remove less than the actual depth of topsoil to ensure roads remain low-profile and the contours align with the surrounding area;

    b) Store topsoil separate from subsoil in order to prevent mixing of the soil types;

    c) All excess soils generated during the excavation of the turbine foundations shall remain on the same landowner's land, unless the landowner requests, and/or agrees, otherwise; and

    d) When revegetating non-cultivated grasslands, Applicant shall use a seed mix that is recommended by the Natural Resource Conservation Service

(NRCS), or other land management agency, unless otherwise agreed upon with the landowner in writing.

17. Applicant shall work closely with landowners or land management agencies, such as the NRCS, to determine a plan to control noxious weeds.

18. Applicant shall stage construction materials in a manner that minimizes the adverse impact to landowners and land users as agreed upon between Applicant and landowner or Applicant and the appropriate federal, state, and/or local government agency. All excess construction materials and debris shall be removed upon completion of the Project, unless the landowner agrees otherwise.

19. In order to mitigate interference with agricultural operations during and after construction, Applicant shall locate all structures, to the extent feasible and prudent, to minimize adverse impacts and interferences with agricultural operations, shelterbelts, and other land uses or activities. Applicant shall take appropriate precautions to protect livestock and crops during construction. Applicant shall repair all fences and gates removed or damaged during construction or maintenance unless otherwise agreed with the landowner or designee. Applicant shall be responsible for the repair of private roads damaged when moving equipment or when obtaining access to the right-of-way.

20. Applicant shall bury the underground collector system at a minimum depth of four feet, or deeper if necessary, to ensure the current land use is not impacted.

21. Applicant shall repair or replace all property removed or damaged during all phases of construction, including but not limited to, all fences, gates, and utility, water supply, irrigation or drainage systems. Applicant shall compensate the owners for damages or losses that cannot be fully remedied by repair or replacement, such as lost productivity and crop and livestock losses. All repair, replacement and/or compensation described above shall be in accordance with the terms and conditions of written agreements between Applicant and affected landowners where such agreements exist.

22. Applicant shall, in the manner described in its written agreement with a landowner, indemnify and hold the landowner harmless for loss, damage, claim, or actions resulting from Applicant's use of the easement, including any damage resulting from any release, except to the extent such loss, damage claim, or action results from the negligence or willful misconduct of the landowner or his employees, agents, contractors, invitees, or other representatives.

23. Applicant may make turbine adjustments of 250 feet or less from the turbine locations identified in the Application without prior Commission approval, so long as specified noise and shadow flicker thresholds are not exceeded, cultural resource impacts and documented habitats for listed species are avoided, and wetland impacts are avoided or are in compliance with applicable U.S. Army Corps of Engineers (USACE) regulations. Prior to implementing the turbine

adjustment, Applicant will file in the docket an affidavit demonstrating compliance with the limitations set forth above. Any turbine adjustment that does not comply with the aforesaid limitations would be considered a "material change," and Applicant shall file a request for approval of the "material change" prior to making the adjustment pursuant to the following approval process:

- Applicant will file with the Commission and serve on the official Service List a request for approval of the adjustment that includes:
  - An affidavit describing the proposed turbine adjustment, the reason for the adjustment, the reason the adjustment does not comply with one or more turbine flexibility limitations set forth above, and information regarding compliance with all other applicable requirements; and
  - A map showing both the approved location and the proposed adjustment (in different colors);
- Once received, the information would be reviewed by Commission staff, and Commission staff will have 10 calendar days within which to request further Commission review.
- If no further review is requested, Applicant may proceed with the adjustment.
- If further review is requested, the Commission will issue a decision regarding Applicant's request at its next available regularly scheduled Commission meeting, subject to notice requirements, after the request for further review is made by Commission staff.

24. Applicant may adjust access roads, the collector system, meteorological towers, the operations and maintenance facility, the Project substation, and temporary facilities, so long as they are located on land leased for the Project, cultural resources and documented habitats for listed species are avoided, and wetland impacts are avoided or are in compliance with applicable USACE regulations.

25. If the Project causes interference with radio, television, or any other licensed communication transmitting or receiving equipment, Applicant shall take all appropriate action to minimize any such interference and shall make a good faith effort to restore or provide reception levels equivalent to reception levels in the immediate areas just prior to construction of the Project. This mitigation requirement shall not apply to any dwellings or other structures built after completion of the Project.

26. Applicant will provide Global Positioning System (GPS) coordinates of structure locations to affected landowners at any time during the life of the Project. Coordinates will be provided in writing to landowners within 30 days of a request.

27. The Project, exclusive of all unrelated background noise, shall not generate a long-term sound pressure level (L_{10}), as measured over a period of at least two weeks, defined by Commission staff, that includes all integer wind speeds from cut in to full power, of more than 40 dBA within 25 feet of any non-participating residence unless the owner of the residence has signed a waiver, and 45 dBA of any participating residence unless the owner of the residence has signed a waiver. Applicant shall, upon Commission formal request, conduct field surveys or provide post-construction monitoring data verifying compliance with specified noise level limits using applicable American National Standards Institute (ANSI) methods. If the long-term average level exceeds 40 dBA at any non-participating residence, or 45 dBA at any participating residence where the owner of the residence has not signed a waiver, then the Applicant shall take whatever steps are necessary in accordance with prudent operating standards to rectify the situation. Sound monitoring will not be repeated in a representative area during any five-year period unless operational or maintenance changes result in a reasonable assumption of higher turbine sound levels.

28. Applicant shall install turbine control equipment on the Project's turbines that allows for individual turbines to be shut down as necessary to ensure that shadow flicker does not exceed 15 hours per year with no more than 30 minutes per day at non-participating residencies and participating residencies that have not signed a waiver. Applicant shall also take steps to mitigate shadow flicker concerns at any residence that could experience shadow flicker levels above 15 hours with no more than 30 minutes per day.

29. Not less than 30 days prior to commencement of construction work in the field for the Project, Applicant will provide to Commission staff the following information:

    a) the most current preconstruction design, layout, turbine model, and plans;

    b) a sound level analysis showing compliance with the applicable sound level requirements;

    c) a shadow flicker analysis showing the anticipated shadow flicker levels will not exceed 15 hours per year with no more than 30 minutes per day at any non-participating residence and participating residencies that have not signed a waiver and an affidavit from the Applicant identifying the turbine numbers that will be operationally controlled in order to meet the shadow flicker requirements;

    d) such additional Project preconstruction information as Commission staff requests; and

    e) should Applicant decide at a later point to use a different turbine model, it shall provide the information required in parts a-d above. Applicant shall also demonstrate that in selecting locations for the other turbines, it considered how to reduce impacts on non-participating landowners.

30. Within 90 days after the Project's commercial operation date, Applicant shall submit a report to the Commission that provides the following information:

a) as-built location of structures and facilities, including drawings clearly showing compliance with the setbacks required by state and local governments and the voluntary commitments set forth in Table 9-2 of the Application;

b) the status of remedial activities for road damage, landowner property damage, crop damage, environmental damage, or any other damage resulting from Project construction activities; and

c) a summary of known landowner complaints and Applicant's plan for resolving those complaints.

31. For purposes of this Project and the commitments herein, "residences," "businesses," and "public buildings" shall include only those that are in existence and in use as of the date of the Commission's order issuing a permit. "Business" shall not include agricultural uses.

32. Applicant shall seek input from local emergency response personnel to properly and effectively coordinate an emergency response plan consistent with local resources and response abilities. Upon completion of construction, a Project operation emergency response plan shall be provided to Commission staff to make available to the general public on the Commission's website.

33. Prior to the construction of the Project, Applicant will notify public safety agencies by providing a schedule and the location of work to be performed within their jurisdiction. The agencies contacted will include the South Dakota Department of Public Safety, the sheriff in Hutchinson, Charles Mix, and Bon Homme counties, and the Office of Emergency Management in Hutchinson, Charles Mix, and Bon Homme counties.

34. Applicant agrees to undertake a minimum of two years of independently-conducted post-construction avian mortality monitoring for the Project, and to provide a copy of the report and all further reports to the USFWS, GFP, and the Commission.

35. The Bird and Bat Conservation Strategy (BBCS) developed for the Project shall be implemented during construction and operation of the Project.

36. At least thirty days prior to commencement of construction, Applicant shall submit the identity and qualifications of a public liaison officer to the Commission for approval to facilitate the exchange of information between Applicant, including its contractors, and landowners, local communities, and residents, and to facilitate prompt resolution of complaints and problems that may develop for landowners, local communities, and residents as a result of the Project. Applicant shall file with the Commission its proposed public liaison officer's credentials for

approval by the Commission prior to the commencement of construction. After the public liaison officer has been approved by the Commission, the public liaison officer may not be removed by Applicant without the approval of the Commission. The public liaison officer shall be afforded immediate access to Applicant's on-site project manager, its executive project manager, and to the contractors' on-site managers and shall be available at all times to Commission staff via mobile phone to respond to complaints and concerns communicated to the Commission staff by concerned landowners and others. As soon as Applicant's public liaison officer has been appointed and approved, Applicant shall provide contact information for him/her to all landowners in the Project area and to law enforcement agencies and local governments in the vicinity of the Project. The public liaison officer's contact information shall be provided to landowners in each subsequent written communication with them. If the Commission determines that the public liaison officer has not been adequately performing the duties set forth for the position in this Order, the Commission may, upon notice to Applicant and the public liaison officer, take action to remove the public liaison officer. The public liaison's services shall terminate ninety days after the Project commences commercial operations, unless the appointment is extended by order of the Commission.

37. If the Project is decommissioned, Applicant will follow Section 24 of the Application, and the decommissioning plan attached to the Supplemental Direct Testimony of Daniel Pardo. The Commission shall be notified prior to any decommissioning action.

38. Applicant will use two methods to detect icing conditions on turbine blades: (1) sensors that will detect when blades become imbalanced or create vibration due to ice accumulation; and (2) meteorological data from on-site permanent meteorological towers, on-site anemometers, and other relevant meteorological sources that will be used to determine if ice accumulation is occurring. These control systems will either automatically shut down the turbine(s) in icing conditions (per the sensors) or Applicant will manually shut down turbine(s) if icing conditions are identified (using meteorological data). Turbines will not return to normal operation until the control systems no longer detect an imbalance or when weather conditions either remove icing on the blades or indicate icing is no longer a concern. Applicant will pay for any documented damage caused by ice thrown from a turbine.

39. Applicant shall utilize an Aircraft Detection Lighting System if approved by the Federal Aviation Administration.

40. At least 30 days prior to construction Applicant shall file a plan with the Commission for Commission approval that provides a decommissioning escrow account. The plan shall provide as follows:

a) The escrow account is funded by the turbine owner annually at a rate of $5,000 per turbine per year for the first 30 years, commencing no later than the commercial operation date.

b) Beginning in year ten following commercial operation of the project and each fifth year thereafter, the turbine owner shall submit to the Commission an estimated decommissioning date, if established, and estimated decommissioning costs and salvage values. Based on the verification of the information in the filing the Commission may require additional funding equal to the estimated amount needed for decommissioning.

c) All revenues earned by the account shall remain in the account.

d) An account statement shall be provided annually to the Commission and become a public record in this docket.

e) The escrow account obligations will be those of Prevailing Wind Park and the escrow agreement shall include terms providing that the agreement binds Prevailing Wind Park's successors, transferees, and assigns. A sale of project assets shall include the associated Permit that requires Commission approval per SDCL § 49-41B-29.

f) The escrow account agent shall have an office located in South Dakota.

g) The escrow agreement shall be subject to the laws of South Dakota and any disputes regarding the agreement shall be venued in South Dakota.

h) To minimize the risk that the escrow account would be subject to foreclosure, lien, judgment, or bankruptcy, the escrow agreement will be structured to reflect the follow factors:

1) That Prevailing Wind Park agreed to the creation of the escrow account;

2) Prevailing Wind Park exercises no (or the least amount possible of) control over the escrow;

3) The initial source of the escrow;

4) The nature of the funds put into the escrow;

5) The recipient of its remainder (if any);

6) The target of all its benefit; and

7) The purpose and its creation.

i) Account funds are to be paid to the project owner at the time of decommissioning to be paid out as decommissioning costs are incurred and paid.

j) If the project owner fails to execute the decommissioning requirement found in section 40 of the Conditions, the account is payable to the landowner who owns the land on which associated project facilities are located as the landowner incurs and pays decommissioning costs.

41. The terms and conditions of the Permit shall be made a uniform condition of construction and operation, subject only to an affirmative written request for an exemption addressed to the Commission. A request for an exemption shall clearly state which particular condition should not be applied to the property in question and the reason for the requested exemption. The Commission shall evaluate such requests on a case-by-case basis, which evaluation shall be completed within 60 days unless exigent circumstances require action sooner.

42. Verification of compliance with the sound level requirement at the residences of the Intervenors shall be submitted to the Commission within 60 days of commencement of full operation.

ATTACHMENT 2

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION BY PREVAILING WIND PARK, LLC, FOR A WIND ENERGY FACILITY PERMIT FOR THE PREVAILING WIND PARK PROJECT	))))))	**NOTICE OF APPLICATION; ORDER FOR AND NOTICE OF PUBLIC INPUT HEARING; NOTICE OF OPPORTUNITY TO APPLY FOR PARTY STATUS** **EL18-026**

On May 30, 2018, Prevailing Wind Park, LLC filed with the South Dakota Public Utilities Commission (Commission) an application for a wind energy facility permit (Application) to construct the Prevailing Wind Park (Project), a 219.6-megawatt nameplate capacity wind energy facility located in Bon Homme, Charles Mix, and Hutchinson counties. The Project Area is comprised of 50,364 acres of private land between the towns of Avon, Tripp, and Wagner. The proposed Project includes 61 wind turbines, associated access roads, an underground electrical power collector system and collector substation, four permanent meteorological towers, an operations and maintenance (O&M) facility, and temporary construction areas, including crane paths, public road improvements, a laydown yard, and a concrete batch plant(s) (as needed). The Project would interconnect at Western Area Power Administration's (WAPA's) existing Utica Junction Substation, located approximately 27 miles east of the Project. The Commission has jurisdiction over this matter pursuant to SDCL Chapters 1-26 and 49-41B and ARSD Chapter 20:10:22.

Pursuant to SDCL 49-41B-15 and 49-41B-16, **the Commission will hold a public input hearing on the Application on July 12, 2018, at 5:30 P.M. CDT at the Avon School, 210 Pine St., Avon, S.D.**

The purpose of the public input hearing will be to hear public comments regarding the permit Application and the Project. At the hearing, Applicant will present a brief description of the Project, following which interested persons may appear and present their views, comments, and questions regarding the Application. A copy of the Application is filed with the county auditors of Bon Homme, Charles Mix, and Hutchinson Counties pursuant to SDCL 49-41B-15(5) and at the Commission's office in Pierre. The Application and all other documents in the case, including detailed maps of the Project, may be accessed on the Commission's web site at www.puc.sd.gov under Commission Actions, Commission Dockets, Electric Dockets, 2018 Electric Dockets, EL18-026 or by contacting the Commission in person at the Capitol Building, 500 E. Capitol Ave., Pierre, SD, or by phone at (605) 773-3201 or (800) 332-1782.

Pursuant to SDCL 49-41B-17 and ARSD 20:10:22:40, the parties to this proceeding are currently the Applicant and the Commission. Any person residing in the area of the Project; each municipality, county, and governmental agency in the area where the Project is proposed to be sited; any non-profit organization formed in whole or in part to promote conservation or natural beauty, to protect the environment, personal health or other biological values, to preserve historical sites, to promote consumer interests, to represent commercial and industrial groups, or to promote the orderly development of the area in which the Project is to be sited; or

any interested person, may be granted party status in this proceeding by making written application to the Commission. Applications for party status will be available at the public input hearing or may be obtained from the Commission's web site or by contacting the Commission. **Applications for party status must be received by the Commission on or before 5:00 P.M. CDT on July 30, 2018.**

Following the public input hearing, the Commission may schedule a formal evidentiary hearing conforming to SDCL Chapter 1-26 to consider any issues raised by any intervening party, the Commission's staff, or the Commission itself. At such formal hearing, all parties will have the opportunity to appear, present evidence, and cross-examine the other parties' witnesses and exercise all other rights afforded by SDCL Chapters 1-26, 49-1, and 49-41B and ARSD Chapters 20:10:01 and 20:10:22, including rights of appeal to the courts. Absent a contested issue, the Commission will schedule the matter for decision at a regular or ad hoc meeting of the Commission.

In order to receive a wind energy facility permit from the Commission, the Applicant must show that the proposed Project will: 1) comply with all applicable laws and rules, 2) will not pose a threat of serious injury to the environment nor to the social and economic condition of inhabitants or expected inhabitants in the siting area, 3) will not substantially impair the health, safety or welfare of the inhabitants, and 4) will not unduly interfere with the orderly development of the region with due consideration having been given to the views of governing bodies of affected local units of government. Based upon these criteria, the Commission will decide whether the wind energy facility permit should be granted, denied, or granted upon such terms, conditions, or modifications of the construction, operation, or maintenance as the Commission finds appropriate. It is therefore

ORDERED, that the Commission will hold a public input hearing on **July 12, 2018, at 5:30 P.M. CDT at the Avon School, 210 Pine St., Avon, S.D.** It is further

ORDERED, that **pursuant to SDCL 49-41B-17 and ARSD 20:10:22:40, applications for party status must be filed on or before 5:00 P.M. CDT on July 30, 2018.**

Pursuant to the Americans with Disabilities Act, this hearing will be held in a physically accessible location. Please contact the Public Utilities Commission at (605) 773-3201 or (800) 332-1782 at least 48 hours prior to the public input hearing if you have special needs so arrangements can be made to accommodate you.

Dated at Pierre, South Dakota, this 1st day of June 2018.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this document has been served today upon all parties of record in this docket, as listed on the docket service list, electronically or by mail.

By: Adam de Hueck

Date: 6/1/18

(OFFICIAL SEAL)

BY ORDER OF THE COMMISSION:

Kristie Fiegen

KRISTIE FIEGEN, Chairman

Gary Hanson

GARY HANSON, Commissioner

Chris Nelson

CHRIS NELSON, Commissioner

ATTACHMENT 3

Commission Minutes| previous page

South Dakota Public Utilities Commission Meeting
August 7, 2018, at 9:30 A.M. CDT
Room 413, Capitol Building
Pierre, South Dakota

MINUTES OF THE COMMISSION MEETING

Chairperson Kristie Fiegen called the meeting to order. Present were: Commissioners: Gary Hanson and Chris Nelson; Commission Attorneys: Karen Cremer and Adam de Hueck; Commission Advisor: Greg Rislov; Staff Attorneys: Amanda Reiss and Kristen Edwards; Staff Analysts: Darren Kearney, Brittany Mehlhaff, Joseph Rezac, Eric Paulson, Patrick Steffensen, Jon Thurber and Lorena Reichert; Grain Warehouse Manager: Jim Mehlhaff; Consumer Affairs Manager: Deb Gregg; and Staff: Joy Lashley.

Present were:
Cheri Whittler, court reporter; Bob Mercer, reporter; Gary Schumacher, Wilkinson & Schumacher Law Firm, representing grain sellers; Rich Coit, South Dakota Telecommunications Association; Darla Rogers, Riter, Rogers, Wattier & Northrup, LLP, representing West River Telecommunications Cooperative, RT Communications, Inc., Golden West Telecommunications Cooperative, Inc. and RC Technologies; Jesse Linebaugh, Faegre Baker Daniels LLP, representing CHI; Betsy Engelking and Melissa Schmidt, Crocker Wind Farm, LLC; and Steve Vanderbeek, HDR.

Joining the meeting by telephone were:
Eric Pauli, Northern States Power Company dba Xcel Energy; Ken Schlimgen, Central Electric Cooperative; Lisa Agrimonti and Mollie Smith, Fredrikson & Byron, P.A., representing Crocker Wind Farm, LLC; Greg Hubner, self; Karen Jenkins; self; Amanda Hosch, Brian Rybarik, Diane Votino, Jon Palmolea and Neil Hammer, MidAmerican Energy; Rodney Haag, Oahe Electric Cooperative, Inc.; Jeff Decker, NorthWestern Corporation dba NorthWestern Energy; Jason Topp, Qwest Corporation dba CenturyLink QC; Patrick Phipps, Peerless Network of South Dakota, LLC; Phil Apanovitch, ComApp Technologies LLC; Sharon Warren, Inteserra Consulting Group, Inc., representing ComApp Technologies LLC; Robin Thoreson, RC Technologies; Denny Law and Jill Reinert, Golden West Telecommunications Cooperative, Inc.; Jason Hendricks, RT Communications, Inc.; Michelle Perreault and Troy Schilling, West River Telecommunications Cooperative; Ryan Thompson, Santel Communications Cooperative Inc.; and Pat Mastel, Midcontinent Communications.

(NOTE: For the purpose of continuity, these minutes are not necessarily in chronological order.)

Consumer Reports

1. Status Report on Consumer Utility Inquiries and Complaints Received by the Commission (Consumer Affairs: Deb Gregg)

The Commission received a total of 28 contacts since the last report was prepared for the July 26, 2018, Commission meeting.

Five contacts involved telecommunication services, eight contacts were related to electrical services, two contacts were related to natural gas service, two contacts were related to wireless service, four contacts were related to the Do Not Call Registry, one contact was related to the Grain Warehouse Division and five contacts were related to issues not regulated by the PUC and one contact was related to One Call.

Complaints received in 2014: 1,914 of the 1,916 have been resolved.

Complaints received in 2018: 846 of the 858 have been resolved.

Electric

1. EL11-011 In the Matter of the Joint Request for an Electric Service Rights Exception between Northern States Power Company dba Xcel Energy and Central Electric Cooperative, Inc. **(Staff Analyst: Lorena Reichert; Staff Attorney: Amanda Reiss)**

Mr. Ken Schlimgen, Central Electric Cooperative (Central Electric) and Mr. Eric Pauli, Northern States Power Company dba Xcel Energy (Xcel Energy) asked that the Commission approve the service rights exception between Xcel Energy and Central Electric. Ms. Lorena Reichert, staff analyst, recommended that the Commission approve the request.

Commissioner Hanson moved to approve the requested service rights exception between Xcel Energy and Central Electric Cooperative. Motion carried 3-0.

2. EL17-055 In the Matter of the Application by Crocker Wind Farm, LLC for a Permit of a Wind Energy Facility and a 345 kV Transmission Line in Clark County, South Dakota, for Crocker Wind Farm **(Staff Analysts: Darren Kearney, Jon Thurber; Staff Attorneys: Kristen Edwards, Amanda Reiss)**

Ms. Mollie Smith, Fredrikson & Byron, P.A., representing Crocker Wind Farm, LLC (Crocker), asked that the Commission approve Crocker's proposal of Steve Vanderbeak as public liaison. Ms. Amanda Reiss, staff attorney, recommended that the Commission approve Crocker's request.

Commissioner Nelson moved to approve Crocker's proposal for public liaison. Motion carried 3-0.

3. EL18-026 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 **(Staff Analysts: Darren Kearney, Jon Thurber; Staff Attorney: Kristen Edwards)**

Ms. Lisa Agrimoniti, Fredrikson & Byron, P.A., representing Prevailing Wind Park, LLC (Prevailing Wind), stated Prevailing Wind does not object to the intervenors or the procedural schedule. Ms. Kristen Edwards, staff attorney, stated staff had no objection. The intervenors did not object to staff's proposed procedural schedule.

Commissioner Nelson moved to grant intervention to any person that may have filed. Motion carried 3-0.

Commissioner Fiegen moved to grant the Motion for Adoption of the Procedural Schedule. Motion carried 3-0.

4. EL18-030 In the Matter of the Filing by MidAmerican Energy Company for Approval of Tariff Revisions to its Rates for Cogeneration and Small Power Production Facilities **(Staff Analyst: Brittany Mehlhaff; Staff Attorney: Amanda Reiss)**

Mr. Brian Rybarik, MidAmerican Energy Company (MidAmerican), asked that the Commission approve MidAmerican's tariff revisions effective August 15, 2018. Ms. Brittany Mehlhaff, staff analyst, recommended that the Commission approve the request.

Commissioner Hanson moved to approve MidAmerican's tariff revisions with an effective date of August 15, 2018. Motion carried 3-0.

5. EL18-032 In the Matter of the Request for Approval of an Electric Service Territory Boundary Agreement between West Central Electric Cooperative, Inc. and City of Pierre **(Staff Analyst: Darren Kearney; Staff Attorney: Amanda Reiss)**

Mr. Darren Kearney, staff analyst, recommended that the Commission approve the electric service territory boundary agreement between West Central Electric Cooperative, Inc. and City of Pierre.

Commissioner Fiegen moved to approve the proposed electric service territory boundary agreement. Motion carried 3-0.

6. EL18-033 In the Matter of the Request for Approval of an Electric Service Territory Boundary Agreement between Oahe Electric Cooperative, Inc. and City of Pierre **(Staff Analyst: Darren Kearney; Staff Attorney: Amanda Reiss)**

Mr. Rodney Haag, Oahe Electric Cooperative, Inc. (Oahe Electric), asked that the Commission approve the electric service territory boundary agreement between Oahe Electric and the City of

Pierre. Mr. Darren Kearney, staff analyst, recommended that the Commission approve the electric service territory boundary agreement

Commissioner Nelson moved to approve the proposed electric service territory boundary agreement. Motion carried 3-0.

Grain

1. GW17-002 In the Matter of the Grain Buyer Bond of H & I Grain of Hetland, Inc. (Grain Warehouse Manager: James Mehlhaff; Staff Attorneys: Kristen Edwards, Amanda Reiss)

A lengthy discussion took place regarding docket GW17-002. An audio of the discussion can be found on the PUC website under Commission Actions, Commission Meeting Archives, 2018, August 7, 2018, recording located at: http://puc.sd.gov/commission/media/2018/puc08072018.mp3.

Commissioner Hanson moved to grant the petition to take receivership.

Commissioner Nelson made a substitute motion that the Public Utilities Commission, pursuant to SDCL 49-45-16.1, request permission from the circuit court to take receivership of H & I Grain of Hetland, Inc. for the sole purpose of selling the corporation to a consortium of individuals and entities who have not been fully paid for grain sold to H&I Grain. Motion carried 3-0.

Natural Gas

1. NG18-010 In the Matter of the Filing by NorthWestern Corporation dba NorthWestern Energy for Approval of a Contract with Deviations with Dakota Ethanol, LLC (Staff Analyst: Lorena Reichert; Staff Attorney: Amanda Reiss)

Mr. Jeff Decker, NorthWestern Corporation dba NorthWestern Energy (NorthWestern), asked that the Commission approve NorthWestern's contract with deviations with Dakota Ethanol, LLC (Dakota Ethanol). Ms. Lorena Reichert, staff analyst, recommended that the Commission approve the request.

Commissioner Hanson moved to approve NorthWestern Energy's contract with deviations with Dakota Ethanol, LLC and the associated tariff revisions. Motion carried 3-0.

Telecommunications

1. TC18-016 In the Matter of the Approval of a Third-Party Transit Provider Amendment to the Interconnection Agreement between Qwest Corporation dba CenturyLink QC and Peerless Network of South Dakota, LLC (Staff Analyst: Joseph Rezac; Staff Attorney: Kristen Edwards)

Mr. Jason Topp, Qwest Corporation dba CenturyLink QC (CenturyLink) and Mr. Patrick Phipps, Peerless Network of South Dakota, LLC, asked that the Commission approve the amendment to the interconnection agreement. Mr. Joseph Rezac, staff analyst, recommended that the Commission approve the request.

Commissioner Fiegen moved to approve the Amendment to the Interconnection Agreement. Motion carried 3-0.

2. TC18-020 In the Matter of the Application of ComApp Technologies LLC for a Certificate of Authority to Provide Interexchange Long Distance Services as an Alternative Operator Service (Staff Analyst: Eric Paulson; Staff Attorney: Amanda Reiss)

Mr. Phil Apanovitch, ComApp Technologies LLC (ComApp), asked that the Commission approve ComApp's Certificate of Authority. Mr. Eric Paulson, staff analyst, recommended that the commission grant the requested waivers for ARSD 20:10:24:05(3), (5) and (6). Mr. Paulson also recommended that the Commission grant ComApp's request for a certificate of authority for interexchange and alternative operator services.

Commissioner Hanson moved to grant ComApp Technologies LLC a Certificate of Authority to provide interexchange long distance services as an alternative operator service and grant the requested waivers. Motion carried 3-0.

3. TC18-055 **In the Matter of the Filing by Midcontinent Communications for Approval of Revisions to its Access Services Tariff (Staff Analyst: Patrick Steffensen; Staff Attorney: Kristen Edwards)**

Mr. Pat Mastel, Midcontinent Communications (Midco), asked that the Commission approve Midco's tariff revisions. Mr. Patrick Steffensen, staff analyst, recommended that the Commission approve Midco's request.

Commissioner Nelson moved to approve the revisions to Midcontinent Communication's Access Services Tariff. Motion carried 3-0.

4. In the Matter of Request for Certification Regarding the Use of Federal Universal Service Support in Dockets TC18-027, TC18-029, TC18-033, TC18-034, TC18-036, TC18-043, TC18-046 and TC18-053.

TC18-027 **In the Matter of the Request of RC Technologies for Certification Regarding Its Use of Federal Universal Service Support (Study Area: 391674) (Staff Analyst: Eric Paulson; Staff Attorney: Kristen Edwards)**

Ms. Darla Rogers, Riter, Rogers, Wattier & Northrup, LLP, representing RC Technologies (Company), asked that the Commission provide certification to the Federal Communications Commission and to the USAC regarding the proper use of federal universal service support. Mr. Eric Paulson, staff analyst, recommended that the Commission grant the Company's request.

TC18-029 **In the Matter of the Request of Golden West Telecommunications Cooperative, Inc. for Certification Regarding Its Use of Federal Universal Service Support (Study Areas: Armour-391640, Golden West Telecom-391659, Kadoka-391667, Sioux Valley-391677, Union-391684, Vivian-391686) (Staff Analyst: Eric Paulson; Staff Attorney: Kristen Edwards)**

Ms. Darla Rogers, Riter, Rogers, Wattier & Northrup, LLP, representing Golden West Telecommunications Cooperative, Inc. (Company), asked that the Commission provide certification to the Federal Communications Commission and to the USAC regarding the proper use of federal universal service support. Mr. Eric Paulson, staff analyst, recommended that the Commission grant the Company's request.

TC18-033 **In the Matter of the Request of RT Communications, Inc. Study Area: 512251 for Certification Regarding its Use of Federal Universal Service Support (Staff Analyst: Patrick Steffensen; Staff Attorney: Kristen Edwards)**

Ms. Darla Rogers, Riter, Rogers, Wattier & Northrup, LLP, representing RT Communications, Inc. (Company), asked that the Commission provide certification to the Federal Communications Commission and to the USAC regarding the proper use of federal universal service support. Mr. Patrick Steffensen, staff analyst, recommended that the Commission grant the Company's request.

TC18-034 **In the Matter of the Request of West River Telecommunications Cooperative Study Area: Mobridge–391671 for Certification Regarding its Use of Federal Universal Service Support (Staff Analyst: Patrick Steffensen; Staff Attorney: Kristen Edwards)**

Ms. Darla Rogers, Riter, Rogers, Wattier & Northrup, LLP, representing West River Telecommunications Cooperative (Company), asked that the Commission provide certification to the Federal Communications Commission and to the USAC regarding the proper use of federal universal service support. Mr. Patrick Steffensen, staff analyst, recommended that the Commission grant the Company's request.

TC18-036 **In the Matter of the Request of Kennebec Telephone Co., Inc. Study Area: 391668 for Certification Regarding its Use of Federal Universal Service Support (Staff Analyst: Patrick Steffensen; Staff Attorney: Kristen Edwards)**

Ms. Marlene Bennett, Consortia Consulting, representing Kennebec Telephone Co., Inc. (Company), asked that the Commission provide certification to the Federal Communications Commission and to the USAC regarding the proper use of federal universal service support. Mr. Patrick Steffensen, staff analyst, recommended that the Commission grant the Company's request.

TC18-043 In the Matter of the Request of Santel Communications Cooperative Inc. for Certification Regarding Its Use of Federal Universal Service Support (Study Area 391676) **(Staff Analyst: Eric Paulson; Staff Attorney: Kristen Edwards)**

Mr. Ryan Thompson, Santel Communications Cooperative Inc. (Company), asked that the Commission provide certification to the Federal Communications Commission and to the USAC regarding the proper use of federal universal service support. Mr. Eric Paulson, staff analyst, recommended that the Commission grant the Company's request.

TC18-046 In the Matter of the Request of Fort Randall Telephone Company for Certification Regarding Its Use of Federal Universal Service Support (Study Area 391660) **(Staff Analyst: Eric Paulson; Staff Attorney: Kristen Edwards)**

The Commission deferred the docket until the next Commission meeting.

TC18-053 In the Matter of the Request of Midcontinent Communications for Certification Regarding Its Use of Federal Universal Service Support (Study Area: 399005) **(Staff Analyst: Eric Paulson; Staff Attorney: Kristen Edwards)**

Mr. Pat Mastel, Midcontinent Communications (Company), asked that the Commission provide certification to the Federal Communications Commission and to the USAC regarding the proper use of federal universal service support. Mr. Eric Paulson, staff analyst, recommended that the Commission grant the Company's request.

In dockets TC18-027, TC18-029, TC18-033, TC18-034, TC18-036, TC18-043 and TC18-053, Commissioner Nelson moved to provide a certification to the Federal Communications Commission and to the Universal Service Administration Company regarding the use of Federal Universal Service Support in the above dockets. Motion carried 3-0.

Items for Commission Discussion

Ms. Brittany Mehlhaff, staff analyst, requested Commission guidance and input regarding a process to reduce the amount of tariff filings required for utilities regarding sample forms. Following discussion with each utility, staff provided to the Commission that it is comfortable with the concept that the tariff would include copies of the forms and a list of approved forms with a link to the company's website where the most current forms can be found, as an alternative to updating the tariff each time a minor change is made to the forms. The form in the tariff and the current version will be materially the same, however, minor edits, such as grammatical corrections could be made. Staff suggests the companies notify staff via email when changes are made to the forms so staff can review the update on the website and determine the changes do not require a tariff change. The company would file for approval when the change affects rates or conditions of service.

Ms. Mehlhaff noted that following discussion at the July 26, 2018, Commission meeting, staff relayed to the utilities the importance of staff having access to the most current forms when dealing with customer contacts either via the tariff or a link to the company's website. Staff's inquiry of the utilities indicated the utilities are supportive of the option for the website link as an alternative to the current practice of updating the tariffs. The Commission indicated support of staff's proposed process.

Public Comment

Chairperson Kristie Fiegen opened the floor to public comments. Those offering public comments about H & I Grain included Frank Virchow, Jerry Peterson, William Bryan, Sherrie Kersting and Chad Murphy.

There being no further business, at the hour of 11:37 a.m., the South Dakota Public Utilities Commission meeting adjourned.

/s/Joy Lashley
Joy Lashley
Administrative Assistant
PUC Email
August 7, 2018

ATTACHMENT 4

THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

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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

= =

Transcript of Hearing
October 9, 2018
9:00 a.m.
Volume I, Pages 1-331

= =

BEFORE THE PUBLIC UTILITIES COMMISSION,
KRISTIE FIEGEN, CHAIRWOMAN
GARY HANSON, VICE CHAIRMAN
CHRIS NELSON, COMMISSIONER

COMMISSION STAFF
Adam de Hueck
Karen Cremer
Greg Rislov

A P P E A R A N C E S

Mollie Smith and Lisa Agrimonti,
appearing on behalf of Prevailing Wind Park;

Reece Almond,
appearing on behalf of Intervenors Gregg Hubner, Marsha Hubner, Paul Schoenfelder, and Lisa Schoenfelder;

Sherman Fuerniss,
appearing pro se;

Karen Jenkins,
appearing pro se;

Kelli Pazour,
appearing pro se;

Kristen Edwards and Amanda Reiss,
appearing on behalf of Staff.

Reported By Cheri McComsey Wittler, RPR, CRR
Precision Reporting, 213 S. Main, Onida, South Dakota

always try to answer all of their questions, including a range of turbines. But it's not always written down. And certainly rotor diameter is a nuance that some people want to know and others don't.

Q. And consistent with your prior testimony, about 70 percent of this project was signed up through Prevailing Winds; correct?

A. I think I said 40 percent was signed up by sPower. So I'd say it's closer to 60 percent, not 70 percent.

Q. Okay. So 60 percent of the project area or acres signed up were signed up by Prevailing Winds; right?

A. Yes. The previous developer.

Q. Okay. And you have no knowledge of what representations were made by Prevailing Winds to the people signing up, do you?

A. Certainly as a part of our due diligence in the project, we needed to understand what was said to the landowners, what promises had been made, and to understand what obligations sPower was stepping into. So I feel comfortable that what was done and said all seemed reasonable.

Q. Walk me through that due diligence because I need to know that.

A. Sure. So as with anything, we review the documentation, often ask to speak to landowners and

understand interactions with the community just to get a sense.
Q. Did you speak with anyone from Prevailing Winds about them signing up people?
A. Yes. They were involved in the transaction. Certainly the previous developer -- so we spoke with them about it.
Q. So as this due diligence process, you guys conversed with those individuals who were going around and getting people signed up on behalf of Prevailing Winds?
A. That's correct.
Q. And who are those individuals?
A. So that would be Eric Johnson and Ron Hornstra.
Q. As part of your guys' due diligence process, did you speak with any other individuals other than Eric Johnson and Ron Hornstra?
A. Roland Jurgens and Keith Thorstad.
Q. Aside from those four individuals as part of your guys' due diligence process, did you speak with anyone else?
A. At the previous developer? Not that I can remember. Not to say that there wasn't a conversation that I don't remember.
Q. And this due diligence process you discussed, you said you had reached out to landowners to find out how

THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

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Commission to hear today.

THE WITNESS: Karen Jenkins, and I live at 289th and 410th Avenue in Hutchinson County just south of Tripp. And I'm here because I currently live three miles from the Beethoven Wind Farm.

I'm east of the north boundary, and there's 16 turbines in Hutchinson County. Three of them -- or probably about five of them are three miles from me.

And the proposed wind farm will introduce nine that will be within 1.07 and 3.3 miles of our home. I'll show you where we live. We're this dot right here, and this is the Beethoven -- or the proposed. And then the Beethoven is right here (indicating).

Sorry. I wasn't prepared for today. I thought we were going to be short on time.

The Beethoven Wind Farm has 43 turbines in the project. And I see -- I can't tell you how many, but a lot. And the main concern I have with that project is when -- we moved to the country to enjoy the country and the rural life. We moved from California. We've grown, both my husband and I -- when I say "me" or "I" I speak for us both.

We both grew up in small towns and lived in neighborhoods, and then as we were married and we moved to -- bought our first house in another neighborhood, we

were able to move from there to a more rural neighborhood. We acquired a third acre property. Lots of trees and very secluded kind of thing that we like.

And then my husband worked for the State of California on the highway department. He was a -- when he started his career he worked on the highway as a maintenance person. He would be actually on the road when the -- in California the highway is different. I'm sure you have an idea of that. But he would work on the road with all the noise and everything going by him, cars at 70 miles an hour and that.

And then as he went on in his career he became a supervisor and he was responsible for the striping of the highways for the large district.

And when it came time that he could retire and make as much working -- retired as he did working, it was right after the 2008 housing crisis and that, and we were right in the middle of that in the Stockton area, which was one of the worst in the country. And the properties were going downhill, and the neighborhoods were going down. And we just decided, you know, it's time to start thinking about leaving.

And we had always planned since we were married that we would -- when he retired we would go out of California, and we would live in the -- we would try to

get a small property, live in the country, experience the seasons, and live somewhere else besides California.

So we found this property that we own now in 2010, and we went and bought it. We went out and looked at it. We bought it just like that and we went back and worked nine months before he retired and then we moved out in 2011.

And then the -- it was all pretty good until I believe it was 2013 I was sitting on the couch reading the paper and noticed a Conditional Use Permit -- a hearing for a Conditional Use Permit, and it just caught my eye for some reason. And the further I looked at it the more I realized it was for a wind farm -- or wind towers, I should say.

And so I did a little digging, and I looked up -- I found B&H Wind and I found the compass points for the project and I was sitting there with my iPhone looking everything up. And that compass said it was just about the same coordinates. And that was a real hard moment.

So, you know, I got on the phone and I called Mr. Jurgens at that number for B&H Wind in Minnesota. And I asked him, Do you have -- I said, I'm wondering about this wind farm -- or these turbines at that point. I knew that it was -- I can't say I knew there was 43 at

that point, but I just asked him for that meeting in Hutchinson County, I said, are you only putting five turbines in Hutchinson County and -- excuse me. Six turbines in Hutchinson County? And he said, yes. Only six.

And I was looking out the window at my horizon that was not an industrial park yet, and I said, Well, they'll be in my sunset. And he said, Well, probably in the -- I don't remember if he said summer or winter, but he knew my property. He knew where the sun would be and where the towers would be.

MS. AGRIMONTI: Mr. de Hueck, I would ask that the witness speak to her personal knowledge and not recount conversations she had with those who are not here.

MR. DE HUECK: Did you understand her objection?

Let's not talk about what Roland Jurgens actually said verbatim. Just your experience without trying to say what he said.

MS. JENKINS: Okay. Even if it --

MR. ALMOND: Can I get some clarification on that ruling?

MR. DE HUECK: Sure.

MR. ALMOND: At the time I do believe Roland Jurgens was a representative of Prevailing Winds, LLC,

which was the owner of this project at the time. Him having communications with people like Ms. Peters [sic] would, therefore, be a party admission and not be hearsay and, therefore, she is able to recount exactly what Mr. Jurgens said.

MS. AGRIMONTI: Prevailing Winds is not the Applicant in this proceeding so that exception to the hearsay rule would not apply.

MR. DE HUECK: You're talking Beethoven?

THE WITNESS: Yes.

MR. DE HUECK: Okay.

MR. ALMOND: She's talking about conversations with Jurgens who at the time was with Prevailing Winds and the Beethoven project making representations on behalf of those projects.

MR. DE HUECK: Okay. Here's what we're going to do.

You're on the phone with Roland Jurgens, and you're discussing the wind turbines that are coming because you had just seen it in the paper so you made a phone call; correct?

THE WITNESS: Yes.

MR. DE HUECK: So let's just continue to give your Direct Testimony.

MS. JENKINS: Okay.

MR. DE HUECK: Keep in mind, try not to repeat what you think someone else said. If that makes --

MS. JENKINS: What I think they said or what they said?

MR. DE HUECK: What they said. That would be, you know -- just focus on yourself.

MS. JENKINS: Okay.

So I went to the hearing, and it was my first time in that setting. And I just basically looked -- listened to them. And I believe I asked if there were only going to be six. And I didn't object or anything. And they approved that Conditional Use Permit, and I went home.

And then about -- I was under the impression that there were only going to be six. So a few months later I'm looking in the paper again, and I see another public hearing for Conditional Use Permits for 10 turbines. And I located them, and they were north of -- north and west of the turbines that I knew about the six.

And in between this time I had started researching because my gut feeling was it wasn't a good thing, besides the fact that it was not anything I would ever want to come in to us when we were trying to live in the country.

I didn't mention that I worked in an industrial

park for 25 years in steel metal buildings and gates and fences and, you know, the country was a good place to retire to.

So I went to that meeting, and I raised my objections. I asked about the setbacks and, you know, property value, all the issues that we all have been talking about, and they didn't -- they didn't give it a second thought, and they permitted all 10 of them.

MS. AGRIMONTI: Mr. de Hueck, may I ask a clarifying question as to whether the witness is talking about the permitting of the Beethoven Wind Farm, which is not part of this proceeding?

MR. DE HUECK: Yes.

MS. AGRIMONTI: Ms. Jenkins, is the testimony that you've just been providing about your interactions with the permitting process related to the Beethoven Wind Project?

THE WITNESS: Yes.

MS. AGRIMONTI: I'm going to object to further testimony regarding the Beethoven Wind Project to the extent she's just recounting what occurred in that permitting process.

MR. DE HUECK: Okay. Here's what I'll do. I'm going to agree we won't need to go down a further road of Beethoven. I think you've successfully set the stage for

the culmination of you've got Beethoven, and now you're dealing with Prevailing Winds. So I think that's been set.

If we can move on to Direct Testimony more specific to this particular Application for the Prevailing Wind Park.

MS. JENKINS: Okay. I would say that my testimony is relevant because the -- parts of the conditions of granting this permit is how a wind farm affects you or the social -- you know the four criteria.

And it was devastating. I'll say that. And that's my experience. It's been hard accepting it. I feel like I was deceived, not told the truth, kept in the dark, and as a result of that because the developers of this project were the same developers of Beethoven, I'm leery of this project.

I'm doing okay on -- I'm not overstepping my bounds?

MR. DE HUECK: You're doing fine.

MS. JENKINS: Okay. All right.

So I'll say devastating in that just seeing the cranes in the background like for -- I still when I see a crane just driving in the road, you know, traveling it brings the negative feeling to you. To me. And I get over that pretty quick but -- and the same thing with

seeing a windmill, one of those old ones. Like that's the common decor now for farm style houses, and I could care less about seeing any windmill again.

So I'll go on and tell you that my main concerns that you probably could relate to is that the wildlife -- because we witnessed the migration of the ducks and the geese twice a year. The red lights. They disturb -- you know, it's never the same. And scenery is changed forever.

And most importantly with Beethoven is that I can hear them. When I'm outside -- not always but I can hear them sometimes, and almost always I can hear them inside my house when I'm on our second floor on the west side of the house.

My concern is if I can hear them, these existing turbines that are three miles and further from me, what will it be like when the -- if this project is approved and they're constructed, what will the noise be like then? And what will my quality of life be then?

And I can tell you it will substantially alter my quality of life because I did not -- I didn't want to live in an industrial park. The cumulative effect of both of these projects is -- it's hard for me to fathom.

And then there's the looming threat that another wind farm is in the -- we'll call it the pipeline.

Because I've come to understand -- and I'm not quite as naive as I was first -- that they don't just put up 42 turbines.

So, first of all, will we even want to live there? Then will it be livable? Will we be affected by the noise, the audible noise, the low frequency noise, the infrasound, and the effects that it can cause on our health? Will one of us be affected?

And if we are and we would need to move or if we decide we don't want to live there, would we be able to market the house? And ethically how would we -- if one of us were having trouble, how would we ethically try to sell it to somebody else? And we do depend on our home as our biggest asset.

So my other concern is the experience that I've had with the representation of the county government -- governments and the process of the development of this project. Excuse me a minute.

The way this went, I know it was now a different company, but it's always been the same developers. So the Prevailing Winds all of a sudden comes up, and they apply to the PUC. Then after the public hearing they withdraw their Application, and it is stated that it's to educate the misinformed community. It's stated that they would not divide it into smaller projects, and then

they --

MS. AGRIMONTI: Mr. de Hueck, I'm going to object again. The witness is testifying about what other entities may have said.

MR. DE HUECK: Yeah. Again, kind of going down that same road. But I understand what you're trying to say. If you can just do it without saying it in terms of they said this.

MS. JENKINS: Okay. Thank you. I'm sorry.

So it gets divided into 13 companies for the purpose of the -- selling the power, I guess. And when that happened not they -- when that happened I was concerned about it because I thought that the project would come in as Beethoven did, without PUC approval. So I sent an e-mail over here and asked if they -- if this was going to be considered one project or 13, and my response -- the response I received, that in the aspect of the 13 PURPA -- or 13 companies to sell the power the PUC still considered it one project.

And that -- to me, I don't understand that, and feel like it may have been against the law would be the way I would state that.

And then the sketchiness of how the easements for the project -- the rest of the people signed up for, the false press releases about the project being a go, a

done deal and that, which I feel coerced people into thinking why not sign up.

My concern is that not only as a resident, as a taxpayer, that my money is -- my taxes and my enjoyment of property, my rights are being taken advantage of and for the purpose of the production tax credit, what it offers to the companies that have a lot of money that build these -- or finance these wind farms.

And then in the county government I've -- I truly feel from my experience that we were not represented properly in each county. I had a right to speak and to advocate for our protection, which protection has always been what we would ask for. In my experience, it was that they really -- or my experience was there was no interest in assisting us to be protected.

I believe that the county -- counties were pressured. The zoning people didn't have this kind of experience with the big companies and --

MS. AGRIMONTI: Mr. de Hueck, I apologize, Ms. Jenkins, for interrupting again. There are a lot of beliefs blurring into conclusions of which the witness doesn't have any personal knowledge. And I don't mean to continue to interrupt, but I have to object at this point.

THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

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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

= =

Transcript of Hearing
October 11, 2018
8:30 a.m.
Volume III, Pages 644-988

= =

BEFORE THE PUBLIC UTILITIES COMMISSION,
KRISTIE FIEGEN, CHAIRWOMAN
GARY HANSON, VICE CHAIRMAN
CHRIS NELSON, COMMISSIONER

COMMISSION STAFF
Adam de Hueck
Karen Cremer
Greg Rislov

A P P E A R A N C E S

Mollie Smith and Lisa Agrimonti,
appearing on behalf of Prevailing Wind Park;

Reece Almond,
appearing on behalf of Intervenors Gregg Hubner, Marsha Hubner, Paul Schoenfelder, and Lisa Schoenfelder;

Sherman Fuerniss,
appearing pro se;

Karen Jenkins,
appearing pro se;

Kelli Pazour,
appearing pro se;

Kristen Edwards and Amanda Reiss,
appearing on behalf of Staff.

Reported By Cheri McComsey Wittler, RPR, CRR
Precision Reporting, 213 S. Main, Onida, South Dakota

A. Correct.
Q. And you said some individuals came forward to make improvements on something. What --
A. Oh, I would say a handful. About every time we always had a handful either in favor or against.
Q. And in terms of the improvements that were looking to be made, can you just give a flavor of what those improvements were?
A. Oh.
Q. Not the ones that were actually made but just what people were looking for.
A. Yeah. That's kind of what we did on Article 17. At that time, with our advice everything seemed to be up to par.
Q. Prior to the adoption of Article 17 did Bon Homme County have an article of their ordinances dedicated exclusively to wind energy systems?
A. It is hard for me to answer that question exactly. You know, we've always talked about it, but I can't say -- you know, it's always been on the back burner, the wind farm, for many years.
Q. And in --
A. I've got to apologize. I didn't brief up on that history from, you know, way back.
Q. And in the adoption of Article 17 I assume you

didn't pull out a computer and just start typing Article 17 from scratch, did you?
A. No. It probably took a few months, I'm sure.
Q. Rather than starting from scratch, did the county utilize the Draft Model Ordinance that was on the PUC's website?
A. We did a lot of our stuff with District III. So I guess -- I'm just a farmer. I didn't go to college. But we kind of acted on -- you know, asked them for advice and helped guide us -- guidance us.
Q. Well, why don't we compare the Draft Model Ordinance to Article 17 to see if we can conclude that that's kind of the document that the county used from scratch. Okay?
A. Okay.
MS. AGRIMONTI: Objection. The witness has testified he doesn't know. And if there's a comparison between the ordinances, I believe Mr. Almond can make that argument in his brief.
MR. DE HUECK: I'm going to let Mr. Almond make this comparison.
Q. So also in front of you is what's been marked as Exhibit I-23.
A. Okay. Two separate sheets?
Q. Are you on Exhibit I-23?
A. Yeah. 2018.

Q. Can you compare Section 17 -- okay. So I want you to put Exhibit I-14 and Exhibit I-23 side by side. And I'd like you to compare Section 1701 of the zoning ordinance to the PURPA section of the PUC ordinance. And you don't need to read it out loud, but read it to yourself.

So what I'd like you to do is compare Section 1701 of Article 17 with the PURPA section of the Draft Model Ordinance. Just compare the language of each.

(Witness examines documents.)

A. Okay. I read them both.

Q. Now go to Section 1703 of Article 17 and compare that to Section 2 of the model ordinance.

A. Now what do you want to know?

Q. I'd like you now to compare Section 1703 of Article 17 to Section 2 of the Draft Model Ordinance.

(Witness examines documents.)

A. Yes.

Q. Would you agree with me that the language of both Article 17 and the Draft Model Ordinance is substantially the same?

A. Yes.

Q. So for Article 17 why don't you flip down -- I'll help you.

A. Okay.

Q. -- to Section 1723 of Article 17.
A. Ain't there a few pages?
Q. In comparing Section 23 of Article 17 -- first what is Section 1723 of Article 17? What's the title of it?
A. On the setbacks?
Q. Section 1723. Setbacks?
A. Yeah.
Q. Now go ahead and compare Section 1723 titled Setbacks with page 6 of the Draft Model Ordinance.
A. Okay.
Q. Where it talks about setbacks.
(Witness examines documents.)
A. Okay. I read it, that Section 1723.
Q. Do you think Section 1723 matches the language from the Draft Model Ordinance regarding setbacks?
A. Unless I made a mistake when I read it, I think it's the same.
Q. That's what I thought when I read them too. So I don't think you made a mistake.
A. Yeah. I read sentence by sentence but I'm very nervous and I could easily make a mistake up there.
Q. No. And I get that.
I think that's the point. It's the same language; right?
A. Looks the same to me. I just read it.

Q. And we could continue this process, but for the sake of time, while you were considering Article 17 and what to adopt it, did you know something that's the state standard? Was there a state standard?
A. You know, back that many years ago I remember that word, "state standard," but I cannot sit here and say that I remember.
Q. I mean, did you refer to the state standard during these meetings?
A. I'm pretty sure we did.
Q. And what was the state standard that you were referring to? Was it the Draft Model Ordinance there?
A. I would say yes.
Q. Okay.
A. That was three years ago. And then in that summer of 2015 my dad died so we were in and out of the hospital quite a bit.
Q. And it makes sense.
A. Yeah.
Q. If the PUC has a Draft Model Ordinance, it would make sense that a county would start with that when drafting the zoning ordinance; right?
A. Right.
Q. I think you need to --
A. As far as my opinion, we did everything up to par.

I can't say that we -- we can't make a mistake because everybody watches us.

Q. Okay. So we can set aside --

MR. ALMOND: Well, at this time I'd like to move for the admission of Exhibit I-24 [sic].

MR. DE HUECK: Absent any objection, I'm going to go ahead and admit it.

MS. EDWARDS: Is that the Draft Model Ordinance?

MR. DE HUECK: Yeah.

MS. REISS: Staff would object just based on the fact that no appropriate foundation was laid. The County Commissioner never said that he reviewed it. He just reviewed the language and answered questions as to whether it matched or not.

MR. DE HUECK: Anything from the Applicant?

MS. AGRIMONTI: I'd join in the objection.

MR. ALMOND: Would you like a response from me?

MR. DE HUECK: Go ahead.

MR. ALMOND: I believe his testimony was that he just relied on the state standard, which was this PUC model ordinance.

MR. DE HUECK: With that, I'm going to go ahead and admit it.

Q. You can set aside the model ordinance now, and we're going to change topics. Okay?

A. Okay.
Q. Earlier when deciding whether or not to -- or in adopting Article 17 you mentioned you heard from the public and took in public input.
Who were some of the more active participants in the public input process?
MS. AGRIMONTI: Objection. I'd like to have a standing objection to this investigation into how a zoning ordinance was adopted.
I understand the Commission's ruling and I won't continue to interpose objections but I would like it to be maintained.
MR. DE HUECK: So noted.
MS. AGRIMONTI: Thank you.
Q. Who were involved -- who were the more active public participants in that public input process?
A. Mainly Mr. Hubner, who I've known forever. And his wife.
Q. Anyone else?
A. Mr. Van Gerpen from Avon.
Q. Anyone else from the public that was involved in the public input process?
A. Those would be the main two to three.
Q. Was anyone on behalf of the wind industry involved in the public input process?

A. Yes. Mr. Roland Jorgenson [sic] was there, and a couple of landowners that will eventually have windmills were at the meeting.
Q. Do you know the names of those landowners?
A. Well, I would say through the summer -- Mr. Bowdler and I don't know who else to say on the -- I guess just supporters of the wind farm.
Q. And you mentioned Mr. Roland Jurgens. Who is he?
A. I guess he's the project manager of the wind farm.
Q. You say the "wind farm." Which wind farm are you referring to?
A. Actually he was involved with both of them. I'm pretty sure he was on the -- with the first wind farm, the Beethoven Wind Farm.
Q. When you say both of them, are you referring to Beethoven and --
A. Right.
Q. -- this wind farm?
MS. AGRIMONTI: Objection. Vague. I would note that we have various entities that have owned -- or two entities that have owned the project that was before the Commission, and I'd just like the record to be clear what developer was being discussed in 2015 versus the Applicant in this proceeding.
MR. DE HUECK: Does Mr. Almond need to rephrase

that then?

MR. ALMOND: I think to the extent Ms. Agrimonti wants to clear up the record, she can do so on cross-examination.

MS. AGRIMONTI: I can do it that way. It seems to me we'd have a clearer record if we know what developer we're talking about when questions are being asked.

MR. DE HUECK: Yes.

So, Mr. Almond, please refer to the correct developer while asking questions.

But before I go any further, Mr. Soukup, could you please scoot your microphone a little closer to your mouth. Because you end up turning sideways and get a ways away. And you can move that around if you want to continue to sit sideways. It's absolutely fine.

Thank you.

Q. Again, so who is Mr. Roland Jurgens?

A. One of the -- the wind developer for this last wind farm.

Q. When you say "this wind farm," which one are you referring to?

A. The one we're talking about today.

Q. And did he hold himself out to the county as overseeing all development activities for the project?

A. Well, when he would come to our meetings he would tell us the future plans of what they wanted to do.
Q. Okay.
A. Briefed us on what was coming in the future.
Q. And Mr. Jurgens was involved in the public input process, as we've discussed.
A. Yes.
Q. Who's Eric Elsberry?
A. He's our zoning administrator. I suppose he's been there the last three years. Our other guy retired so we hired him and put him in there. And he does a very good job.
Q. And as the zoning administrator, do members of the public submit input and comments to Mr. Elsberry?
A. Yes, they do. And if there's any questions, he usually calls District III for some advice because there's a wide variety of knowledge you need to know.
Q. I'm going to ask you to turn to Exhibit I-24 for me, please. It's in the binder under the tab I-24.
A. With them yellow tags? There's 23, and there's 25. Right there? I-24. Okay.
Q. And is Exhibit I-24 an e-mail from Roland Jurgens to the zoning administrator, Eric Elsberry?
A. Yes, it is. I'm reading it right now. "Hi, Eric."
Q. And this e-mail was sent in October of 2015, around

the same time the county was looking to adopt Article 17; right?

A. Yes. I would say the Commissioner meeting was a week before that. And then according to what we looked on our records, we started acting on the first meeting of November, which would be November 3 of 2015.

Q. I want to take -- take your time and familiarize yourself with that e-mail, please.

MS. AGRIMONTI: I object. This document, to the extent the witness is just being asked to review a document, no foundation has been laid for it. I would request that foundation be laid before we investigate and ask questions about this document.

MR. ALMOND: Ms. Agrimonti, I believe you stipulated to the foundation of this document.

MS. AGRIMONTI: I stipulated to the document being an e-mail from Mr. Jurgens to Mr. Elsberry. The witness has not -- stated he's never seen this document before.

It's also a document from a prior applicant with this PUC than Prevailing Winds so it's not relevant. But I don't believe you've laid the foundation that this witness can speak to the document.

MR. DE HUECK: Continue reviewing the document.

I'm going to allow Mr. Almond to ask his

questions just based on this e-mail.

I'm assuming, yes, this gentleman cannot speak to the conversation that took place in this e-mail, but maybe there's some information within that he -- Mr. Almond's got some sort of line of questioning that will make sense.

(Witness examines documents.)

A. Okay. I've read it.

Q. As part of the public input process Mr. Roland Jurgens suggested to the county that a 35 dB nonparticipant noise restraint is absolutely the best way to protect nonparticipants?

MS. AGRIMONTI: Objection. He's just asking the witness to state what is in the document. The document speaks for itself.

MR. DE HUECK: Yeah. But I'm going to let the factual basis for these questions just merely go to the weight of what this witness responds and gives to the Commission. And we'll go from there.

Q. Would you like the question repeated?

A. What do you really want to know now?

MR. ALMOND: Cheri, can you ask the question again.

(Reporter reads back the question.)

MS. AGRIMONTI: Further objection of hearsay.

MR. DE HUECK: Well, and I'm just going to advise, Mr. Almond, you're basically testifying, and you're leading your direct examination. So let's try to avoid leading questions and leave them more open-ended.

Q. Did Mr. Jurgens propose a noise limitation to be placed on nonparticipants as part of the public input process?

A. I can't answer that. I can't remember. That was three years ago.

Q. Looking at exhibit -- what's been marked as Exhibit I-24, go to the fifth paragraph for me. Follow along as I read it out loud.

MS. AGRIMONTI: Objection. The witness has not seen this document except for today. He has not laid any foundation that the document in front of him influenced his decision or that he was even aware of it.

To have Mr. Almond read into the record what isn't otherwise admissible is improper, it's not relevant, and the foundation has not been laid.

MR. ALMOND: May I respond?

MR. DE HUECK: You may.

MR. ALMOND: We've heard this witness who is the County Commissioner also sitting on the Zoning Board. We've heard that the Zoning Board and the County Commission receives public input in whether or not to

adopt Zoning Ordinances. We've heard as part of that public input process people submit e-mails to Mr. Eric Elsberry, the zoning administrator for the county.

This is an e-mail from Mr. Jurgens to Eric Elsberry, the zoning administrator clearly providing public input into the process of the adoption of Article 17. As a County Commissioner and the board of -- a member of the Planning Board he's capable to speak to those -- public input that is submitted into the process.

MS. AGRIMONTI: The witness has not seen the document --

MR. DE HUECK: I got this.

So Mr. Elsberry should be on the stand because it's clear from his statement and from observing him he's never seen this. He's completely unfamiliar with this document. So I am not going to let you read it into the record.

I think you could formulate your questions without even having this e-mail in front of us right now.

MR. ALMOND: Well, I asked the question of whether or not Mr. Jurgens submitted public input, and I'm now attempting -- to the county, and I'm now attempting to impeach the witness.

MR. DE HUECK: He's never seen this public input. But Mr. Elsberry probably has. So I think --

MR. ALMOND: Very clear. Just so we're very clear on this record, I'm going to move to admit Exhibit I-24. And, as I'm understanding it, I'm not allowed to use Exhibit I-24 either for admission or for impeachment purposes with this witness.

MR. DE HUECK: Can the parties help me out. Did we have this one?

MR. ALMOND: No. It's not admitted.

MR. DE HUECK: Not admitted.

MS. AGRIMONTI: It's not admitted. And the Applicant does agree that it is a document from Mr. Roland Jurgens to Eric Elsberry so that that foundation --

I'm not suggesting that the document isn't what it is. But it is hearsay, and there's no foundation for this witness to opine on it.

MR. DE HUECK: In agreement. It's not admitted at this point in time.

MR. ALMOND: And, just to be clear, I cannot use this document for impeachment purposes with this witness?

MR. DE HUECK: I have not seen you try to do that yet.

Q. Did the county receive public input from Mr. Roland

Jurgens suggesting a 35 dBA limit for nonparticipants?
A. To my knowledge, I cannot remember that. It was three years ago.
Q. Looking at Exhibit I -- what's been marked as Exhibit I-24 in front of you, read along as I read for you.
"The 45 dB participant, 35 dB nonparticipant noise restraint is absolutely the best way to protect nonparticipants."
Did I read that correctly?
A. You're on the page of this I-24?
Q. Yes. It's the fifth paragraph.
A. Read that again for me.
Q. "The 45 dB participant, 35 dB nonparticipant noise restraint is absolutely the best way to protect nonparticipants."
Did I read that correctly?
A. That's what's wrote in the book.
Q. What was that?
A. That's what is written here.
Q. Okay. What noise limitation did the county ultimately adopt for nonparticipants?
A. I'd have to go through the book, and you'd have to show me what page. When we did that three years ago we did it.

Q. Do you frequently look to your Zoning Ordinances?
A. Well, I haven't been on the board for a couple of years and that -- we had read through, and this is all -- you know, we deal with many things, gravel to machinery to personnel and whatever.

We go through that book. And I guess I'll apologize. I did not read through this zoning book before I came here today.

I carried it in my briefcase for years. Got it -- but our big concern now is the hog barns. You know, you ask me questions about hog barns and setbacks, and I can answer them.

Q. Well, let's look to Article 17 and find the noise setback for nonparticipants. Can you turn to Article 17 of your Zoning Ordinances for me?
A. What page is that on?
Q. It starts on page 57.
A. Okay. I'm on page 57, Article 17. What do you want to know?
Q. I want to know what the county's noise restriction is for nonparticipating residences of a wind energy system, a large wind energy system?
A. Well, I know it's in here, but I'm not going to be able to tell you right offhand where that paragraph is. Because we did study that three years ago.

Q. And I'll help you out. It's Section 1741.
A. Okay. "Noise level produced by" --
(Witness examines document.)
A. Okay. Now what do you want to know here?
Q. Yeah. What is the noise limitation placed on large wind energy systems for nonparticipating residences?
A. I guess I will admit the truth. This is a little above my head. You know, we went through this three years ago, and according to the zoning administrator and everything, other counties, it worked.
Q. Looking specifically at the first line of Section 1741 it says, "Noise level produced by the large wind energy system shall not exceed 45 dBA average A-weighted sound pressure at the perimeter of occupied residences."
What does that 45 dBA average A-weighted sound pressure mean?
A. Well, they monitor that and not supposed to go over it; right? Is my understanding.
Q. And the 45 dBA average A-weighted sound pressure, I understand you're saying that they monitor it and they can't go over it but what is it?
A. Well, it's the sound from the windmills.
Q. And it says, "average A-weighted." How is it averaged?

A. I cannot answer that. That is over my intelligence.
Q. Is there a certain time period over which it's averaged that you're aware of?
A. No.
Q. And that same Section 1741 deals with shadow flicker. Do you see that?
A. Yes, I do. To the bottom. I read that.
Q. Why did the county think it needed to regulate shadow flicker?
A. I guess with advice from other counties and other wind farms, there has been issues with shadow flicker. So according to District III and whatever, they understand that. That's why it was put in there.
Q. And what are the issues? You said there had been issues.
A. That shadow flicker. You know, I personally don't -- I do understand it, but I don't. I mean, I know what it is, and that's why it was put in there, to the best of my knowledge.
Q. You said there had been other issues. Do you know what those other issues are?
A. No.
Q. Okay.
A. But when we -- from some county or whatever, they said that -- you know, we kind of relied on everybody

else's advice is how we acted on that, other --
Q. In adopting the ordinances, did the county ever consider the concepts of infrasound or low frequency noise?
A. Oh, I'm sure that was brought up. About everything you've talked about has been brought up in them three years prior a little bit.
Q. And in anywhere in those Article 17 of your ordinances does the county place any sort of limitations or restrictions on infrasound or low frequency noise?
A. I did not read up on that. I cannot answer that.
Q. Well, you have Article 17 in front of you so feel free to -- if you can find --
MS. AGRIMONTI: Objection. Argumentative.
MR. ALMOND: I'm attempting to refresh the witness's recollection of his Zoning Ordinances.
MS. AGRIMONTI: I think it's an unfair test to ask him to read the entire ordinance and answer the question. It's either in the ordinance or it's not.
MR. DE HUECK: I agree. And he gave the answer he's unaware.
A. I guess we adopted this three years ago, and at that time we started up we thought everything was up to par at that time three years ago.
I've flipped through it here and there. You know,

we've heard about this many times and flipped through, whatever. Should be good. And you're asking me these in-depth questions, and they are over my intelligence.

Q. At some point was it communicated to the county that the PUC model ordinance should not be used as a resource?

A. I honestly can't recall that.

MR. ALMOND: I don't have anymore questions for you, Mr. Soukup. Thank you for coming in.

THE WITNESS: Okay. But I do recall the night at Avon when it was 100 degrees, and your speaker system did not work. Remember that? And I sat there for three hours.

MR. DE HUECK: Mr. Soukup, you're not quite done yet. What I have to do now is to tender you for cross-examination. Which means that now we let the Applicant ask you questions. And then I'll turn it over to these other Intervenors in room and then we'll go to Staff and then the Commission will have an opportunity to ask you some questions as well.

So, with that, Prevailing Winds, would you like to cross-examine this witness?

MS. AGRIMONTI: I have no questions. I thank you for coming in today.

MR. DE HUECK: Mr. Fuerniss, do you have any

(A lunch recess is taken.)

MR. DE HUECK: Welcome back, everyone. We're going to get back in our proper order. We're back in session in EL18-026.

I guess we are missing an Intervenor, but I'm sure she'll be here soon. And we'll let Reece continue with his case in chief and call his next witness.

MR. ALMOND: Intervenors call Rick James.

MR. DE HUECK: Mr. James, we can see you up there on the Skype TV. And welcome to South Dakota.

MR. JAMES: Thank you.

MR. DE HUECK: My name is Adam de Hueck. I'm the hearing examiner for this proceeding, and I'm going to go ahead and swear you in.

(The oath is administered by Mr. de Hueck.)

MR. DE HUECK: You are sworn in.

Go ahead, Mr. Almond.

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Mr. James, can you introduce yourself to the Commission and briefly describe your education and experience?

A. My name is Richard James. I go by the name Rick for all practical and business persons, Rick James. I'm an acoustician who has been working in the field of

measurement noise and the impact of noise on people since the late '60s, officially 1972 after I formed a new company.

I started working for Chevrolet Motor Division and left them to form my own company in 1972.

In the intervening years my companies -- and I had two -- became the consultants who were considered the subject matter experts for noise to corporations like General Motors, Goodyear, Anheuser-Busch, major corporations who had both employee issues and who desired to keep their names out of the newspaper for noise complaints with community noise.

So my focus has always been on how do you design a new project or how do you operate a project so as to minimize the adverse impacts on a community and on workers, although it's less of an issue here. And I am very much a pro business acoustician, but my focus is not on getting the project done one way or the other. It's getting a project done that's compatible with a host community.

In 2006 due to some serious health issues with my heart, my partner and I closed my old company, James Anderson & Associates, and I decided that I would go into semiretirement. Shortly thereafter, actually almost immediately thereafter, I started getting calls

from people in Michigan where wind projects had been proposed. One of those wind projects is actually one that Mr. Hessler worked on back in the late 2000s.

My first analysis of that was these machines don't belong in quiet rural areas. They're going to cause a problem. And I presented that to the County Commissioners, but they decided to build the project my way.

Since then I have focused mainly on wind turbine noise, although I do other types of complaint-driven noise generally as an expert related to hearings like this or lawsuits. I don't seek out just general business. At 70 years old I need a little bit of time off.

Over the past 10 years I've really become very interested in one issue of why is it that wind turbines which don't produce high levels of audible noise as measured on a dBA scale generate so much complaints, and why are we seeing symptoms such as dizziness, tinnitus, migraines, pressure, odd sensations that have nothing to do with audible sound? And so that's led me into the area of kind of going into detail into infrasound.

Q. I think that's a good recap of your experience, unless you want to add anything in addition to that that you think --

A. Well, I was just going to add one thing. In 2009 I had an opportunity to use very high end acoustical equipment, and that was the first time we managed to measure the infrasound pulses from wind turbines.

The measurement methods that I used were the same ones that the Shirley Wind study team used. And since then I have focused basically on that type of measurement, along with microbarometers.

So I'll open it up for any of your questions, Mr. Reece.

Q. Thank you, Mr. James.

Did you prepare prefiled testimony in this matter?

A. Yes, I did.

Q. And that prefiled testimony has been marked as Exhibit I-1. I understand you want to make a change to that testimony?

A. Yes, I do.

Q. And what change to the testimony do you want to make?

A. This is on page 1, line 24. The question is, "What experiences have you had that qualify you as a," and it currently reads, "health expert in cases involving wind turbine noise?"

I would ask that the words "a health" be scratched out and be replaced with "an acoustical."

So it would read, "What experiences have you had that qualify you as an acoustical expert in cases involving wind turbine noise?"

Q. Are there any other changes to your prefiled testimony that you'd like to make?

A. None that are substantive.

Q. And along with your prefiled testimony were there exhibits attached to that?

A. Yes, there were. There were five exhibits.

Q. I count six.

A. Six. Excuse me.

Q. And those have been marked as Exhibits I-1A through F.

A. That's correct.

Q. And during the course of this proceeding did you have an opportunity to respond to some questions raised by the PUC Staff via a data request?

A. Yes, I did.

Q. And I don't know if you have Exhibit I-34 in front of you.

A. Yes, I do.

Q. Okay. And are those the responses that you provided in response to questions raised by PUC Staff?

A. Yes, they are.

Q. At least responses next to your name?

A. Yes.
Q. And if I were to ask you all of the questions that are included in your prefiled testimony, as well as those questions that the PUC Staff asked you, would you give the same answers today?
A. Yes, I would.
MR. ALMOND: At this time I'd move for the admission of Exhibit I-1 as well as Exhibits I-1A through F.
MS. EDWARDS: No objection from Staff.
MR. DE HUECK: I'll hear any objection from Prevailing Wind.
MS. SMITH: No objection.
MR. DE HUECK: So admitted, Mr. Almond.
Q. Mr. James, were you listening in to the testimony from earlier this morning?
A. I was able to hear parts of it.
Q. And there was some discussion about the measurement of infrasound, how to do it, et cetera. Have you ever measured infrasound?
A. Yes, I have.
Q. And how far have you measured infrasound -- let me ask you a different question.
Have you ever measured infrasound generated by a wind turbine?

A. Yes, I have. Very specifically, wind turbine infrasound as contrasted to other types of infrasound from wind. Low frequency trucks, et cetera.
Q. And in your -- how many times have you measured infrasound generated by wind turbines?
A. I probably measured infrasound in over 50 homes ranging from projects here in the U.S., Ridgetop Projects out west to -- in Oregon, New York, Massachusetts, Maine, West Virginia, Michigan, Wisconsin, Illinois. Pretty much almost all of the states.

And those measurements are always inside a home because it is almost impossible to get an accurate infrasound measurement outside of a home.
Q. And in your experience -- and I think a question was asked earlier, approximately how far infrasound from a wind turbine can travel.

Can you answer that question?
A. Yes. And if you'd give me permission, I'd like to reference one of my exhibits, which gives a visual depiction, and that is -- I guess it would be my Exhibit 5, which was three pages of densely annotated color charts.
Q. And I think you're referring to what your Exhibit 6 was, which was Exhibit I-1F. And it's a three-page exhibit with colorful graphs. Is that what you're

referring to?
A. That's what I'm referring to, yes. Colorful graphs.
Q. Okay.
A. Pictures.
If we could look at page 3 of that exhibit, I'll explain it because I'm sure that it's not self-explanatory to most people.
These two graphs, the top one and the bottom one, represent measurements using a microbarometer, and that's an instrument designed specifically to measure infrasound that was left in a home. In both cases -- the one on top represents a home that's actually the same home that Mr. Hessler was talking about, R-1 from Shirley Wind, where the people living in it were very sensitive to the infrasound, and the top one shows a period of about, oh, let's say 12 hours or so from the left to the right.
The bottom one is a home four miles away over much of the same period. If you look at the big circle with -- the big white circle with the dashes, those two correlate to the same time period.
What we're looking at in the top graph, you'll see these horizontal bands of light blue lines. Those are the spikes or the tones produced by the wind turbine blade as it passes in front of the tower, releasing the energy causing a pulse. And when we look at it over --

compressed into like a 12-hour window they begin to look like narrow bands. This is actually specific enough in this case you can see where the solid circle is on the top. You can see the wave. And that shows that the wind turbines that were being measured were changing in RPM.

So we can trace -- using this kind of a method we can trace very specifically the sound from a wind turbine as contrasted to other sounds.

If we look over at the right-hand side of that graph, just to the right of the white solid circle, we see a period where wind turbines aren't operating. And so the comparison between what's happening in the home when the wind turbines are operating within that dashed circle and then when they're not is dramatic. We see that there's no longer any tones. There's also a lot less scatter on the bottom, the red and yellow spikes along the bottom.

We come down to the bottom graph. This shows a home for the same period of time roughly four miles away. And we can see within the dashed circle there that even at four miles these horizontal bands, which represent the wind turbine tones, are still distinctive.

So what this shows is that even at a distance of four miles infrasound inside a home is measurable, and the occupant of that home, the reason we were there was

reporting to the Brown County Board of Health that she was suffering headaches whenever the wind turbines operated.

Now when I investigated the home I found that it was impossible to see the wind turbines from their home. They're actually down in a little valley with a hill separating them from the wind turbines so there wasn't even a line of sight.

My point here is that people who say that wind turbine noise blends in with the background infrasound or that it's not measurable beyond a short distance, really that's a result of them not having the right tools and not having the right analysis methods. Properly analyzed, a simple instrument like a microbarometer produces very clear graphs.

And this has now become a norm within measuring wind turbine infrasound that microbarometers are the preferred tool because of their simplicity and the durability. A infrasonic microphone is very delicate, very expensive. A microbarometer is durable enough you can drive a truck over it if you need to.

So that's my explanation for how far. And also to show just how clearly wind turbine infrasound can be defined when properly measured.

Q. And have you had the opportunity to review that

German study that was attached to Dr. Roberts's Direct Testimony?

A. Yes, I did.

Q. That discussed the measurement of infrasound and seemed to suggest that infrasound dissipated at 700 meters?

A. Yes.

Q. Do you have a response for that?

A. Yes. And I believe this corresponds fairly well with what Mr. Hessler said this morning.

When you have a microphone outside, any air movement over that microphone will generate what's called pseudo noise. It looks like noise, but it's really just the air movement causing the microphone diaphragm to move. So it's not surprising that they were doing tests outside and couldn't find any difference between the wind turbines on or off because they weren't measuring --

They weren't measuring wind turbine infrasound. They weren't measuring ambient wind turbine sound or nonwind turbine sound. They were really just measuring the artifact of wind blowing over the microphone.

This is a common mistake. I've seen it in Australian studies. I've seen it in others.

The other mistake in that report is that they started with the premise that unless the sound pressure

levels were sufficient to be audible -- this is the threshold of audibility -- that they weren't of any significance.

And what we have found -- in fact, we've known since the 1980s when Dr. Neal Kelly first did an experiment using pressure pulsations. What we found is when the infrasound is pulsed, when it occurs as a whoomp, whoomp, whoomp, although you feel it rather than hearing it, that the human vestibular system can pick that up.

And the sensations, when they're picked up, when people have that sensitivity -- we can get into Dr. Schomer's paper later that explains how that happens. But when the vestibular system is triggered the body tends to produce nausea.

It's an impact caused by the eyes are giving a certain input. The body sensations don't pick up movement. But we have vestibular data saying something's moving. The end result of that is people get dizzy or they get nauseous or they have headaches.

Q. Thank you, Mr. James.

Are you familiar with the Steven Cooper study that we've been discussing quite a bit this morning?

A. Yes. I've worked with Steven Cooper since my first paper in 2010 demonstrating how to measure the infrasonic pulses. Steve modeled his study at Cape Bridgewater

after the design that we used at Shirley and at other studies.

I also helped him in his analysis of his data, and I'm quite familiar with it.

Q. And did you hear testimony from Mr. Hessler this morning that said once he saw this Cooper study it really linked up, in his opinion, the issue of infrasound and the complaints related thereto?

I guess can you just expand on that or comment on that and how that relates to everything you've just been talking to about infrasound?

A. Okay. Yes. I can expand upon it.

As I said, back in the 1980s Dr. Neal Kelly working for the Department of Energy and NASA did a study of early model wind turbines and the complaints of -- the similar complaints of dizziness, nausea, tinnitus, headaches, et cetera, and he concluded that it was from an infrasonic pulse caused by the blade passing in front of the tower.

The wind industry was aware of that -- it was presented at conferences -- but has chosen instead to argue, and do so very effectively, that unless the pressure pulses exceed the threshold of audibility, that they can't be perceived. The source of that is an acoustician in Britain called Dr. Jeff Leventhal who said

if you can't feel it, you can't hear it. I mean, if you can't hear it, you can't feel it.

The problem here is Dr. Kelly proved him wrong four years after he made that statement. But that concept of that infrasound has to exceed the thresholds of audibility has been promoted very heavily through other acousticians who have picked up on it, not done the proper research, and have repeated test after test saying, well, I've tested wind turbines in Australia and they don't exceed the threshold of audibility so there can't be any problem.

But there is a problem. In fact, the German paper you referenced earlier made an interesting comment. They said they noticed some tones at the very low frequent infrasound, but those didn't matter. Actually those are the ones that matter.

So that whole German paper and many of the others that are similar to it have consistently ignored the place where the problem is, looked at places where the problem is not, and then concluded there is no problem, which whether for the purposes of pleasing a client or through improper research has led to the confusion we have.

We know that -- we know that infrasonic pulses can be perceived. My home office where I'm sitting right now

is on the flight path between Detroit and Lansing for helicopters. The Governor comes in and out of this area all the time. I can hear that helicopter coming, the thump, thump, thump of its blades, long before it's audible.

I've had many people who were combatants in either Vietnam or the Iraq wars who said they can also feel infrasound long before it's audible. With people --

I wrote a paper in 2012 on sick building syndrome -- other evidence. When people are in large buildings and the large high-rise buildings, knowledge worker high-rise offices, if the fan is a little bit out of balance, it causes a pulse, and people begin to make the same complaints.

Acousticians who have dealt with these low frequency problems over the years have no problem understanding why people in homes in wind projects are having complaints. It's the acousticians who have not dealt with that who seem to be causing the confusion.

Q. Thank you, Mr. James.

I want to switch topics now away from infrasound and focus -- talk a little bit more on your prefiled testimony, page 3, and the ANSI Standard ASA S12.9 and this notion of modeling the community's response to a new project.

And I think we heard some testimony earlier from Mr. Hessler so if you could just explain how that concept ties into this project.

A. Well, there are standards that we follow as acoustical professionals to try to guide our work. One of them is the standard ANSI/ASA -- I'm reading line 69 of page 3, S12.9, Part 4, Noise Assessment and Prediction of Long-term Community Response.

This is a standard designed, for example, when I was designing noise for new automotive plants, that I would refer to as a way to determine what would be the type of levels that would be acceptable.

That standard includes a caution in Part 4 of Appendix F that says, F3.4.4, "In newly created situations, especially when the community is not familiar with the sound source in question, higher community annoyance can be expected, and that difference is worth up to 5 dB."

Also if there's -- in quiet rural communities there's a greater expectation for peace and quiet worth 10 decibels. And if you take the two factors, and for a project like Prevailing Winds both would apply, what this is saying is that guidelines that would be compatible in the suburban environment, for example, 45 dBA need to be reduced either by 10 or 5 dB to result in the same level

of annoyance for a quiet rural environment.

And it's this part of -- it's this part of our professional standards that seem to be routinely ignored by people like Mr. Howell. We can't quibble -- we can't equate annoyance potential for a community that is rural residential to one that is more adjusted to noise.

If people come to the wind turbine project, then they have no expectation of quiet. But they move there with the expectation of peace and quiet. The project's coming to them. Therefore, the burden should be on the project developer to not increase annoyance.

And levels of 40, 45 dBA, as I show in my testimony with the Health Canada, will result in about one out of every 10 people -- one out of every 15 people being highly annoyed. And highly annoyed means they're annoyed enough that over a long-term we have health effects, whether the annoyance is due to sleep or due to dizziness or nausea. Whatever the high annoyance may be, the result is that over periods of weeks or months it leads to deteriorating health.

And that's what this whole section of ANSI is trying to avoid. When you have people whose lifestyle is for quiet -- they sleep with their windows open. They enjoy the outdoors -- then a new noise source that may have been more than acceptable in an urban environment or

suburban environment becomes a serious source of complaints.

Q. And have you seen the ambient measurements taken for this project area?

A. Yes, I have.

Q. And what are the -- what's your opinion in terms of this area and the ambient measurements of the area?

A. Well, I looked at the table that Mr. Howell presented. I know he summarizes it as ranging from 21 to 45 dB. And the only columns on those that are of significance for background sound are those labeled L90, the 90th percentile. The Leqs are of little use for anticipating annoyance. But he says the range is 21 to 45.

Well, 45 dB is an outlier. There's no way that a normal, rural community background sound would be that high. But if we look at the table for trends, we can see that even at 10 o'clock in the morning, 5 o'clock in the afternoon, and at midnight the sound levels in most of those measurement sites were between 22 dB and maybe 28, 29 dBA. And that's what I find in rural communities.

The other thing is that that includes the sound of normal wind. Not high winds. And then I heard Mr. Hessler this morning talking about wind noise masking wind turbines. That's not the time when people have

their complaints. They complain about it when it's a quiet night, no wind at the ground, and the wind turbines overhead are whooshing away.

So this background sound level issue is critical. We know that if -- we know that if the project was designed to not increase that level significantly, then we'd have few complaints. But we see a project here that looks like it's going to raise the levels anywhere from 10 dB or higher at many of these homes, and that is -- that is just a prescription for complaints once the project is permitted and operating. There will be complaints.

Q. And just to be fair, you've never been to the project area, have you?

A. No, I haven't. But I've been to many similar projects in Iowa, Illinois, Indiana. All over the -- principally east of the Mississippi. But I've also been involved in projects out in Oregon. And in many of these cases because they were parts of formal proceedings, I was privy to the data that the opposing party's acousticians had taken and able to re-analyze it.

And based upon what I have seen in those studies and what I can see about Prevailing Winds, I think I have a reasonably good understanding of the Prevailing Wind project.

Q. And you said there was no way that one measurement was 45. And to be fair to Mr. Howell, you don't know exactly what was there next to that measuring tool. There could have been a grain elevator or something like that.

But you're exaggerating when you say no way; right?
A. Well, no way that that's a background sound. A truck could have driven by that had a bad muffler. When we're taking averages with a sound level meter a single loud noise has a very significant impact.

So let's say the sound level was 30 and a truck drives by at 55 but it's only there for a minute, that could easily give you a 45 average over the limit. Or an L90 could mean that they parked the truck and was there for the full 90 percent of the time.

Either way, a 45 dBA sound level at -- in a rural community means that something not related to the background sounds -- background sounds are those things you hear from a distance. They're not the things up close.

They're when you walk outside at night you can hear the barking dog in your neighbor's farm a quarter-mile or a half-mile away. Those sounds that you hear are the background sound, and that's what our auditory system uses as the basis for assessing annoyance. It's always

comparing the sound it's hearing to those quiet periods. And that's why when you put a noise source into a quiet community you can expect complaints.

Q. And the question was raised earlier about whether or not once a noise source is introduced to a quiet area if the area will just get used to that noise source.

Can you respond or answer that question?

A. Yeah. I can respond to that. I'll first respond with a study that was done in Britain back in the 2000s in which they found that, given time, complaints don't decrease. They increase.

Or the people become so resolved to the fact that no one will listen to their complaints that they what I say suffer in silence. Or they abandon their homes.

Ontario where there are many projects designed to meet a 40 dBA criteria now have abandoned homes all over the rural communities because people have just left them. Or they were elderly, and when they passed away the family just left them to deteriorate.

Having the experience of dealing with people who are the -- who are living in wind projects and who find something objectionable, I call them the complainant, has made me really sensitive to how the ANSI standards about expectation of peace and quiet come into play. And so -- I'll see if that answered your question.

Q. Thank you, Mr. James.

Were you listening in when Mr. Hessler opined on the number of people who have complained about infrasound or complained about the symptoms that they believe were caused by infrasound and that he believes that the number of people who -- you know, who have that sensitivity to infrasound is very small?

Did you hear that testimony?

A. Yes. Yes, I did.

Q. Do you want to respond to that?

A. Well, many of the projects that I've studied are projects that Mr. Hessler and his father developed. And while he may not be aware that complaints occurred, I am constantly in contact, usually as the recipient of e-mails saying here's another day when I couldn't take it.

What happens in the communities -- and the Wisconsin communities in the middle of the state have had wind projects now for almost 10 years -- A, the complaints have not stopped. B, the complaints have increased. And, C, the reason why nobody does anything about it is once a project is permitted no one has the funds to contest it.

In Brown County, for example, they declared a two-and-a-half-mile radius around Shirley Wind as a human

health hazard. That's a Wisconsin legal definition for an area that has a problem and they want to notify the public.

When the operator of Shirley Wind was asked to respond to that they just denied that there was any problem. That denial has gone on now for almost eight years, leaving the Brown County Board of Health having monthly meetings on noise and concluding that even the City of Green Bay and the town of -- the County of Brown do not have the funds to pursue a lawsuit against the utility.

So what answer is there? The answer is it needs to be done right the first time. Once that project is permitted, if the complaints occur, there is no solution that is economically viable, and the imbalancing of funding between the operators and the local communities or, for that matter, a complainant trying to file a lawsuit is so unbalanced that there will be very little chance of success.

Get it right the first time, or you live with it forever.

Q. And have you seen how the Applicant wants this project to be measured in order to comply with a 45 dBA limitation? Have you seen that?

A. I don't know if I remember. I heard Mr. Hessler

talking this morning about several weeks worth of measurement and an average level or something like that.

Q. Yeah. The measurement is over a two-week level.

A. Yes. That completely misses the point. Annoyance is not about a long-term average --

MS. SMITH: I'm going to object. I'm not sure the witness has seen what is being asked. And I would also say this is going far beyond the scope of the Direct Testimony.

MR. DE HUECK: I was thinking the same thing, that we're having new Direct Testimony introduced on today's date. Though I appreciate you fleshing out some of the unanswered questions just as the Applicant does when they call a witness as well. This one just talks a lot more.

So just keep in mind that we don't need new filed testimony today orally. And, additionally, if you could clarify how sound will be measured for this project before we go any farther.

Q. Do you have access to Exhibit A33, the PUC's web portal in front of you?

A. I will pull it up here. Prefiled exhibits. It's A --

Q. 33. It's proposed condition --

A. A33. Okay. Proposed conditions.

Q. Yep. Number 27. If you could read that quickly, please.
A. Okay. That was basically what I understood.
Q. And if you could explain whether you believe that's an appropriate way to measure any limitation on noise, and why or why not.
A. That is not an appropriate way to measure wind turbine noise. The reason being that if you measure over a period of at least two weeks, the average level will always be low because there's periods when the wind turbines don't operate.

And the condition that we're trying -- or the characteristic of wind turbines that cause annoyance have nothing to do with the long-term average. They have to do with short-term fluctuations.

If, for example, we did a long-term average and it came out to 40 dBA Leq but we then looked at how the sound fluctuated around that, we would see that there were periods when it might have been 55, periods where it might have been 35. It's these fluctuations above and below the average that cause the annoyance, cause sleep disturbance, and are the root of the complaints.

So using a long-term measurement as a criteria is essentially an open door to the project creating annoyance and there being no method whatsoever then to

ask for mitigation because over a two-week period it will always average less than 45, particularly if we're looking at a project that was designed where we now say the maximum levels are 42, let's say, dBA Leq.

It's the fluctuation that is important, and that's why in my testimony I referenced the use of Lmax or an L10 or some other measurement that looks at the peaks. When someone describes a wind turbine -- and Mr. Howell did -- a whooshing sound.

A whoosh when you describe it means that there is a sound that rises and then falls. What we should be trying to do is eliminate that whooshing sound by controlling how much it can rise. And in our Michigan cases, which I think Dr. Punch referenced, we said 45 dBA.

Q. I think you've answered the question.

And I've got to push back on you here a little bit because if you read Condition No. 27, it actually, I think, calls to not take into account when the wind turbines are operational.

If you can look at line 4.

A. Yes, it does. But wind turbines operate over a broad range.

Mr. Hessler, for example, in his NARUC document said that measurements will be plus or minus 5 dB around the

predicted mean. So there will be periods during that two weeks where that wind turbine -- let's say it was 40 -- is running at 35, and there will be periods where it's running at 45. And the complaint times are when it's running at 45, not the average over those times.

If we were going to use an Leq or an average as a criteria, it should be a short-term average, a 10-minute average, because anything else is not looking at the characteristic we're trying to control, which is the fluctuating low frequency noise.

MR. ALMOND: Thank you, Mr. James. I don't have anymore direct for you. We will turn this witness over for cross.

MR. DE HUECK: Mr. James, I'm now going to turn you over for cross-examination, and we'll begin with the Applicant, Prevailing Winds.

THE WITNESS: Okay.

MR. DE HUECK: We're just going to move our video camera over to the attorney who will be questioning you.

(The camera is adjusted.)

THE WITNESS: I have no audio on this end.

MS. SMITH: I think we're all just very quiet Mr. Hessler -- or Mr. James. I apologize.

CROSS-EXAMINATION

BY MS. SMITH:

Q. Mr. James, my name is Mollie Smith. You will see me. I'm raising my hand, if you can see me. I'm over here.

Do you have anyone in the room with you?

A. No, I don't.

Q. And do you have any documents in front of you other than your filed exhibits or the filed exhibits in this case?

A. No, I do not.

Q. You haven't conducted any acoustic modeling related to the Prevailing Winds project; is that correct?

A. No, I have not.

Q. And I would -- that was not part of the scope of your work why you were retained?

A. No, it was not.

Q. And you also did not conduct any analysis of existing sound levels at the project site; is that correct?

A. That is correct. I relied upon the information from Mr. Howell.

Q. And you did not conduct any site-specific surveys of either low frequency or infrasound for the project area. Is that also correct?

A. I relied upon the information from Mr. Howell's reports.
Q. In your testimony you indicate that the purpose of your testimony is to provide your opinion regarding appropriate thresholds for audible and inaudible wind turbine sound at nonparticipating properties; is that correct?
A. That would be fair to say, yes.
Q. So given, as you just noted, that you didn't conduct any site-specific studies, you're relying solely on the information that's either provided by others in this docket -- you're not relying on your own data for the project; correct?
A. As I explained earlier, I have studied many projects, similar conditions with similar wind turbines, and I relied upon that plus Mr. Howell's data.
Q. Okay. In your testimony you indicate that you believe the noise limit should be imposed at the property line; is that correct?
A. That's correct. The reason for that is so that the --
Q. You did not cite -- excuse me.
You didn't cite any specific data to support that, did you, in your testimony? Did you cite any specific data in your testimony to support that statement?

A. I stated that -- yes, I did, in my testimony.
Q. Can we go to your testimony, please.
MR. ALMOND: Can the witness be allowed to answer the questions without being interrupted?
MR. DE HUECK: Everything's fine as is.
A. Page 6, line 174?
Q. Yes. And so I'm looking at the first lines -- 175 through 177. It says, "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."
There's no citation here for any source to support that statement, is there?
A. Just my belief that I've grown up in the United States where property rights are protected by the government.
Q. So that's your personal opinion?
A. I think that's personal and legal.
Q. You're not testifying as a medical expert; is that true?
A. That's correct.
Q. And you're not a licensed physician; is that also correct?

A. That would be obvious, yes.
Q. And you are not testifying as an economics expert; is that also true?
A. That's correct.
Q. And you're not testifying as a psychology expert; is that also true?
A. Only to the extent that acousticians are cross-trained in both health and psychology because, otherwise, when you investigate complaints you are hampered.
I have 45 years of investing complaints, and I've learned a lot about people and psychology that would not be tossed in a court. So, yes, I have some background, but it's experience.
Q. It's experience. You're not a licensed psychologist?
A. That's right.
Q. And yet in your testimony you provide statements regarding health effects from wind turbines; is that true?
A. That is correct. Because as an acoustician I've been trained to read medical journals, to interpret them for my purposes.
MS. SMITH: Object.
Q. I didn't ask -- you offered health effects testimony

in your written testimony; is that true?
A. Only those within the scope of my profession.
Q. Are your opinions based on complaints that you have heard from people?
A. My opinions are based upon complaints and my own personal experiences.
Q. And, again, you're not a medical doctor; is that true?
A. That's true. But I don't see the relevance to your question.
Q. So you have not conducted a medical examination on any of the people that have provided complaints to you. Is that also a fair statement?
A. No. But I've reviewed the medical records that the doctors provided.
Q. I only asked you if you --
Did you rely on other people's work for this as well, other people's studies for your opinions?
A. Yes. The reports from medical doctors who have examined my clients.
Q. Would you agree that anyone who is relying on other people's work that the -- what they're relying on has to also be credible?
A. That is true. But that's the -- that's the purpose of an expert to make that decision --

Q. I'm just going to ask you, Mr. James, if you can just answer my question because I don't -- you'll have your opportunity to elaborate if your counsel so chooses to ask you additional questions.

You provided some exhibits with your testimony; is that correct?

A. That is correct.

Q. And I believe -- and I may have not the same numbering so I will try to look at the versions that are online. Mine are sort of 5 and 6 to your testimony, which may be -- I'll see if I can find yours.

So I think it is listed as maybe I-1E and I-1F. It may also be 5 and 6 on yours. I have two different labels.

A. Okay. Just give me the titles. I'll be able to go from there.

Q. Let's see here.

So I believe that 5 -- what I'm looking at is -- one was one that you referenced previously with the colored charts, so I think that was the last exhibit to your testimony.

A. Okay.

Q. Then the one right before that one, which also has a wind turbine and a chart.

A. Those are the two you're looking at now?

Q. Yes.
A. Okay.
Q. Neither of those exhibits address health effects; is that correct?
A. They explain the --
Q. Do they address health effects?
A. No. They're not on health effects. No, they're not.
Q. Okay. Thank you. And if you look back one exhibit, so that would be 3 or D, I believe -- so this is a possible criterion for wind farms.
A. Okay.
Q. That also does not address health effects, does it?
A. Indirectly it does.
Q. It does not directly address health effects, does it?
A. The recommendation from Dr. Schomer included the consideration of health effects. He mentions the Health Canada Study, which is about health effects --
Q. Does this paper itself address health effects? Not the citations. Does the paper itself address health effects?
Do they offer any opinions on health effects in this document?
A. Without having to read it very carefully, I'll say

it was not directly about health effects. It was about the criteria needed to prevent them.
Q. If we look then at the noise wind farms article, so that would be 2 or B to your --
A. Okay.
Q. If you could turn to the last page in that article. And I -- hold on. I think it would be actually page 13.
A. Yes.
Q. Make sure I'm looking at the correct one here.
So if we look under Conclusions at the -- I'm going to read the last sentence of the first paragraph under the Conclusion.
It says, "Unfortunately then for policymakers there appears to be no proportional relationship between wind turbine noise levels and health as these outcome factors will be influenced by characteristics associated with both the noise and the listener."
Is that accurate?
A. That is an accurate way of stating a complex set of relationships, not just --
Q. I'm just asking if that is an accurate recitation of the statement in the article.
A. It can't be answered yes or no.
Q. Are those the words on the page?
A. Those are the words on the page, yes.

Q. And if you'll turn then to Exhibit 4, this may also be D. This is called a theory to explain some physiological effects of the infrasonic emissions at some wind farm sites.
A. Okay. I'm going to that now.
Q. And if you'll look at pages 1,364 I think it is, Section 6, it says, "Additional research and data collection recommendations."
A. Okay.
Q. If you look under that it says, "Research to date does not tend to just study the effects on humans reported anecdotally in what is probably a minority of wind farms."
Is that an accurate statement?
A. I think Dr. Schomer believed that at the time he wrote the paper. Since then he's seen Steve Cooper's --
Q. I'm just asking about the --
(Discussion off the record.)
MS. SMITH: Mr. de Hueck, for Cheri's sake and mine, could you direct the witness to please answer my questions.
MR. DE HUECK: Yes.
Mr. James, I know you want to elaborate on every single question that's asked of you, but in order for our court reporter to adequately capture this, we can't talk

over each other. And I believe Ms. Smith would just like you to specifically answer her questions as asked.

Thank you.

THE WITNESS: Okay.

Q. Mr. James, in that section under Additional Research and Data Collection Recommendations they're actually making recommendations for additional research to do regarding reports; is that correct?

A. That is correct.

Q. And they provide even a test case in their Appendix A; is that true?

A. That is correct.

Q. Mr. James, you've been retained as an expert witness in other proceedings; is that correct?

A. That is correct.

Q. I believe you mentioned that you participated in a case in Oregon; is that true?

A. That's correct.

Q. So would that be Williams v. Invenergy, LLC?

A. That is correct.

Q. I'm going to -- Ms. Agrimonti is going to send you -- and maybe we can hand this out too.

Give us just a second, Mr. James. We're just handing out -- and Ms. Agrimonti is sending to you what I'm referencing as Exhibit A36.

And, Mr. James, if you can let me know when you receive it.
A. I have it up in front of me.
Q. Okay. And this is an Opinion and Order from United States District Court, District of Oregon case; is that true?
A. That is correct.
Q. From 2016?
A. That is correct.
Q. In this case were you excluded from testifying regarding the causal health effects from wind turbines?
A. I was excluded from testifying to the cause and effect of wind turbines only to the extent of not having supporting literature because we weren't able to submit it.
Q. Can you turn to page 11 of the case.
A. I assume these are numbered sequentially?
Q. Yes. I believe it's in the lower right-hand corner that you'll see the number.
A. Yes.
Q. And if you'll look at the very last two sentences of the page -- so the initial -- you'll see a 13. It says, "James." And that James, is that you that it's in reference?
A. Yes, it is. Yes.

Q. I'll read the bottom. It says, "He has a long career studying the noise and sound pressure produced by industrial wind turbines. However, he is not a doctor or epidemiologist. As a result, he does not have the training to opine that the infrasound and audible noise created by wind turbines activates physiological mechanisms in the body which produce adverse health effects."

Do you see that language?

A. Yes, I do.

Q. And we were discussing the information that had been submitted. The Court also noted that the documentation that you were relying on for your opinions was also not credible; is that true?

A. I don't -- I don't remember that specifically. Can you point to that?

Q. Certainly. So if we look first at -- let's stay on the same page. I believe you had referenced in your earlier testimony a Dr. Kelly; is that true?

A. That's right. I referred to him earlier in my testimony today, Dr. Neal Kelly.

Q. And so if we look down at the bottom of page 11 over on the left-hand column towards -- at the very bottom, the bottom paragraph, it says, "However, like James's other sources, the Kelly study has significant scientific

shortcomings. First, Kelly takes data from only seven subjects. He admits that the experiment would have to be repeated with a much larger number of evaluators population to confirm his results as scientific knowledge. Moreover, there's no evidence that Kelly's study was published in a reputable scientific journal or that it was subject to any manner of peer review."

And I'll skip down to the last sentence. "The study does not support the proposition that wind turbine infrasound is capable of producing broader adverse health effects, including anxiety, panic attacks, and sleeplessness."

Is that accurate?

A. That's what it says.

Q. And if you'll turn back to the prior page, there's a reference to the Cape Bridgewater study as well. And I believe that's on page 10. Do you see that?

A. That is correct. Yes.

Q. If you look at page 9, it also addresses the Cape Bridgewater study and Mr. Schomer's review of the Cape Bridgewater study on pages 8 and 9.

Do you agree?

A. I agree there's that -- they're talking about it, but what are you pointing to?

Q. If you look at the bottom of page 8, it says, "The

Court agrees with defendants that the Schomer documents do not represent reliable scientific knowledge which James may use as a foundation for his expert conclusions."

Is that accurate? It's at the bottom of page 8.

MR. ALMOND: Objection. Vague. Are you asking if it's -- the statement's accurate, or you're accurately reading the statement or --

MS. SMITH: Yes. I apologize. I should be clearer.

Q. Am I accurately reading the statement on the bottom of page 8?

A. You're accurately reading it. I don't agree with the Court's agreement, but that's fine. Dr. Schomer is the Emeritus Director of the Acoustical Society of --

Q. I think that's all. I just needed to know if I read it correctly.

Mr. James, have you been excluded or had your testimony in part excluded in any other cases?

A. Not in any significant manner other than issues where it treads into medical.

Q. So any -- would it be fair to say that you have been disqualified as an expert from testifying regarding health effects?

A. Only those that are medical. Not health effects

that are visually confirmable.

Acousticians have to be able to listen to the complaints --

Q. I'm just going to stop you there.

MS. SMITH: And I would say that at this point I would move to strike any testimony by Mr. James regarding health effects attributable to wind turbines.

MR. DE HUECK: I'll allow Mr. Almond to respond and Staff if you so wish.

MR. ALMOND: Yeah. In Mr. James's Direct Testimony, written Direct Testimony, he discusses an acoustician's responsibility to be aware of vague health effects -- the general health effects caused by certain wind turbines, facilities, et cetera when looking at projects.

Specifically he talks about -- I mean, it's all throughout his background in his prefiled testimony. Certainly he can't make any medical diagnosis. He's not doing so here. I don't think he's given the opinion that he's making any diagnoses or anything like that.

So I'd need to know exactly what opinion it is or what statement Mr. James has made that Ms. Smith is looking to strike, I guess.

MS. SMITH: Mr. James is making assertions of a causal relationship between wind turbines and health

effects. He is not qualified to do so. He is not --

As his own testimony, he is not a medical doctor. He's not an epidemiologist. He's not a psychologist. There's no basis for him. The literature he's relying on is not supportive of that either, as we're seeing. He doesn't have any basis to make those statements.

MR. DE HUECK: Go ahead, Staff.

MS. EDWARDS: As much as I would like to speed it along, I would argue it goes to weight, not admissibility, and it's an issue that's -- I would intend to brief in my prehearing brief -- posthearing.

MR. DE HUECK: Just in terms of Mr. Fuerniss, Ms. Jenkins, and Ms. Pazour, I'm assuming you're in agreement with Mr. Almond?

Ms. Smith, I'm going to agree with you. He should not be testifying about any health effects or rendering any expert opinion regarding medical causation or -- along the lines of what you've stated.

However, I'm concerned what is it that we're going to strike and who's responsible for pointing that out? Certainly it's not Cheri to go back through the transcript and strike it out. So how do we actually deal with figuring out what statements need to be stricken?

To some degree I'd like to allow some of the

exhibits he relies on because they're based on infrasound. Not necessarily saying I want to allow it to show that it's causing health effects, but the guy's an expert in infrasound and measuring that type of stuff as an acoustician. Thank you.

MS. SMITH: I can address the exhibits.

From my read of the exhibits, I don't believe that those would support the causation assertion anyway. So to the extent that I'm not -- I don't have a problem with the exhibits themselves coming in, but his testimony -- and I would be happy to propose in a written format -- take his testimony and strike the portions that I believe should be stricken and provide that tomorrow.

MR. DE HUECK: Let's do that.

MS. SMITH: Would that be appropriate?

MR. DE HUECK: That would be appropriate. So I'm going to go ahead and sustain your objection and your motion to strike, grant that, and we'll figure it out at that point in time.

MS. SMITH: All right. Thank you.

MR. DE HUECK: And then also I'd like to prohibit any -- oh, Commissioner Hanson.

COMMISSIONER HANSON: No. I was waiting for you. I was just signaling you that I had something to say pertaining to before you made your final decision

here.

I think that he certainly should be allowed to provide us with his opinion of observable health effects. Certainly not any medical. And I'm parsing it here, but even I would be able to say that Commissioner Nelson was obviously happy to hear something because that's observable.

I wouldn't be able to say what physical reaction he had within his body, any medical effects from it and hearing or things of that nature, but anyone can talk about the health effects that are observable, readily observable.

So I know that makes it more difficult.

MR. DE HUECK: It doesn't make it too much more difficult. I just don't want to get into the gray water of allowing an expert testifier to enter into lay witness testimony and start elaborating on matters of common knowledge because that's not why he's been here to testify.

COMMISSIONER HANSON: Excellent.

MR. DE HUECK: So, with that, where did we leave off? You're in the middle of cross-examination.

MS. SMITH: That probably concludes my cross-examination at this point.

MR. DE HUECK: So we'll move over to

Mr. Fuerniss. Did you have cross-examination?

MR. FUERNISS: No.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: No.

MR. DE HUECK: Ms. Pazour?

MS. PAZOUR: No.

MR. DE HUECK: Staff.

MS. EDWARDS: Yes.

CROSS-EXAMINATION

BY MS. EDWARDS:

Q. Earlier you stated that you were discussing I believe it was somebody else's study, that there were other types of infrasound from wind that needed to be parsed out.

Did I understand that right?

A. The term I used was "pseudo noise," I believe. When air -- microphone on a sound level meter is very, very sensitive. If air moves over that microphone and causes a false sound, pseudo noise.

That's why we put these foam balls on top of the microphones, to try to block that wind. Infrasound goes right through the foam balls. So any movement of air around the microphone generates a false signal, particularly in the infrasonic range.

So when they're measuring outside even after they

take all of their cautions with foam balls, it's very common to see no difference between wind turbine on or off just because what they're really measuring is the air moving over the diaphragm.

And then Mr. Hessler, I think, agrees with me on this. The proper place to take an infrasound measurement if you want to avoid that is inside the home where the complainant says when I sit in this chair I feel these sensations.

Q. Okay. Earlier you stated that one out of 15 people are -- and correct me if I misstate this. Are at risk of being annoyed; is that correct?

A. Yes. The Health Canada Study found that when the model sound levels were 35 dBA and below, 2 percent of the population were highly annoyed. Between 35 and 40, 10 percent were highly annoyed. And between 45 and above, 14 percent and higher.

That's where I got my numbers from and that's from the Health Canada Study and there was a chart in my testimony graphing those results.

Q. Okay. So you anticipated my next question and answer, which was where did the number come from.

Would you say that the majority of your experience with wind turbine noise and its effects on people comes from firsthand observations and measurements at

operational projects?
A. For my own?
Q. Correct. Firsthand.
A. Yes. Yes. But I've corroborated that. I have a number of colleagues who do similar work and we compare our notes, we compare our findings and we compare our methodologies.
Q. Have you ever --
A. And we corroborate each other's work.
Q. Okay. Have you ever conducted a sound monitoring survey of at least one week at an operational wind project?
A. No. Because I find it pointless. If you -- if you aren't standing at the microphone -- or standing in the area where the microphone is located so you can hear at your own ears -- that's called an observed measurement -- then you have no idea what caused the highs, the lows, the in-betweens.

Unobserved monitoring, which is what is used for two-week measurements, requires an awful lot of guesswork afterwards. Whereas, if you're on site and you're measuring the sound, you have your own senses to corroborate the meter's measurements.

You know whether there's wind. You know whether there's insects. You know whether a car went by, dogs

barked. And, therefore, observed measurements are the preferred measurement in acoustics, as codified in ANSI 12.93, measurements with an observer present. And I focus on that kind of measurement.

As to whether that measurement represents other conditions, I rely upon operational data for the noise source, whether it's a wind turbine or a machine in a factory, to let me know other times when that noise might have been in a similar operating mode.

Q. Have you ever worked on a wind turbine project for any group or individual that was not opposed to or complaining about the project?

A. No. And that is because when I wrote my first paper in 2008 the wind industry decided I was persona non grata. They don't hire consultants that recommend 35 Leq. I don't even get the offers.

Q. Thank you.

On page 7 of your Direct Testimony you refer to a sound study that was carried out at the Shirley Wind Farm in Brown County, Wisconsin.

Are you familiar with what I'm talking about?

A. Oh, yes. That was at my client's home.

Q. You indicated that this same study alluded to by Mr. David Hessler who just testified for PUC Staff in his Direct Testimony -- is that correct?

A. That is correct.
Q. You --
A. That's the same study -- when he made the suggestion to the Public Service Commission that a study be done my clients contacted me, the attorney for them contacted me and we developed the protocols and we selected the acousticians and Hessler Associates is one of the companies that I recommended be involved in that test along with Schomer, Walker, and Rand.
Q. You also indicate that you -- you also indicate that you essentially orchestrated the study and developed the test protocol for it; correct?
A. Yes. The test protocol was based on my 2011 or 2012 paper showing the need for certain types of instruments and measurement techniques to detect the infrasound. I was also -- I was also appointed by the PSC to do a peer review of that test, and I submitted that to the PSC with data showing the pulsations in all three homes, although strongest at the home R-1, I believe, the N's farmhouse that Mr. Hessler also focuses on.
Q. You just said you were appointed by the PSC. You were hired by the Commission?
A. Part -- yeah. Part of the agreement between the PSC and my clients to have access to their house was that I have access to all of the data from the test that

Schomer, Hessler, Rand, and Walker conducted and have that for my own review and then report back to the PSC on what I found.

Q. Was the PSC your client?

A. No. The client was the Intervenors, but the PSC was the coordinator for the -- I guess for initializing the project. And my clients would not allow anyone in their homes unless I had an opportunity to review the work of the study team.

Q. But you did not actually participate in the study; correct?

A. No. Because since they were my clients, I had already done testing in the homes. I knew what would be found. It would have been inappropriate for me to be one of the testers. Everyone would have said it was biased.

MS. EDWARDS: Thank you, Mr. James. No further questions.

THE WITNESS: Okay. Thank you.

MR. DE HUECK: Okay, Mr. James. This is where we go to Commission questions, meaning the Commissioners get to cross-examine you. So while Katlyn comes up here to move the camera down to Chairman Fiegen, I'll just go ahead and kick off with the only question that I have.

And it is you've testified a lot and reported to a lot of commissions and governments across the

United States. You've done that in situations such as this when the wind farm has yet to be built; correct?

THE WITNESS: That is correct.

MR. DE HUECK: And so are you aware of any commission or government that has created a condition to encapsulate your theories on infrasound?

THE WITNESS: Infrasound is still something that hasn't been addressed in any regulatory setting.

And there's a reason for that. Before we started putting wind turbines in quiet rural areas there was never a source of infrasound that caused pulsations so it's not studied. It hasn't been studied. The funding is not available, and it is just now, as with Mr. Cooper's work, we're beginning to develop the methods where we can duplicate the sensations in a laboratory.

It's very much an unstudied area, but it's one that from my point of view should be a major concern since the people who are affected are severely affected.

Some of my clients, for example, the people that owned the house that Mr. Hessler tested in, have left it. That house has sat vacant for years. And they only return when there's a need to do another test.

MR. DE HUECK: Okay. Thank you.

So to date you're not aware of any permit being

denied based on infrasound?

THE WITNESS: Not infrasound specifically.

MR. DE HUECK: Okay. Thank you. And now I'm going to move over to Chairman Fiegen to allow her to cross-examine you.

CHAIRWOMAN FIEGEN: So it seems like you have been in the field for a while, although in the U.S. -- you know, wind development has really increased the last, I don't know, five to 10 years. I mean, if you look at the chart, it certainly has increased quickly. Yet there's not a lot of research done, and so do people mostly -- do people in the U.S. mostly look at research in foreign countries and has -- and I know I can't introduce new evidence so -- yeah. I guess that's my question.

THE WITNESS: I guess to your first question about wind turbines are new, yes, they're new. But because of serendipity and a number of other factors, I've been intimately involved in many of the early wind projects in Maine, New Hampshire, Vermont, out in the east, and have tracked what's happened at those. Also in Wisconsin we started a wind project in 2008, the one that Mr. Hessler and his company worked on.

So my experience, I think, is somewhat unique. There's three other acousticians in the country that I

would say have similar experience. But all of this has been funded by local families. There is no research money available to fund my work. Steve Cooper is in the same boat. His whole lab and everything else was funded out of his own money.

Research money doesn't go to people who have ideas that may inhibit current government policies, and with the current government policy promoting wind, the chance of getting funding for the kind of work I do is nil so that also means that there's limited research available.

CHAIRWOMAN FIEGEN: Okay. Thank you.

MR. DE HUECK: Mr. James, up next will be Vice Chairman Hanson.

THE WITNESS: Okay.

COMMISSIONER HANSON: Good afternoon, Mr. James.

THE WITNESS: Good afternoon.

COMMISSIONER HANSON: I want to look at the witness box when I'm talking to you.

On page 5 of your prefiled testimony on line 153 you state, "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."

So, obviously, to a layperson -- and we've had

these in previous wind dockets, discussions of a variety of different dockets and projects. However, it's always curious to me, in your example then of moving down to a 40 dBA you state that it's equivalent to turning off half of the wind turbines in a project designed to meet the 40 dBA.

If a 3 dBA change is doubling or halving, what is the -- going from a 45 to a 40 dBA? Do you know that?

THE WITNESS: Well, it's 5 decibels. It could be the equivalent of somewhere between a quarter, maybe a third. These are logarithms. I can't do them in my head, but it would be a very significant change.

And that's why these debates get so heated between a 40 or 45 dBA limit. It represents a big change in the number of wind turbines that can be put into any given area of a project.

COMMISSIONER HANSON: Well, you just stated that it would be a change of about a quarter?

THE WITNESS: It would be about a third of the wind turbines. Let me give you a simpler example.

If I have a noisy fan in front of me and I have my sound level meter and the noisy fan is 40 dBA and I have another noisy fan right alongside of it and I turn that on, then the sound level's going to go up 3 decibels to 43.

If I started out with four noisy fans and they were 45 and I cut them in half, turned two off, then it would drop to 43. So when we talk about small changes in decibels we're talking about big changes in acoustic energy. And that's the point I was trying to make.

And it's also why I think the answer to this is having nonparticipants negotiate agreements in easements and get compensation for the noise pollution.

There's no easy way to site a wind turbine at levels that are going to satisfy everybody. So the proper method in my mind is to set criteria that are safe and then allow monetary negotiations to occur for easements.

COMMISSIONER HANSON: Okay. Now thank you. I understand that. But I'm not quite following. I thought originally you said a change of 45 to 40 was a quarter. And then I believe you said that it was a change of a third -- of turning off one-third of the machines. Am I hearing you incorrectly?

THE WITNESS: Well, like I said, the relationships are logarithmic. So as long as we move in 3 decibel moves, it's easy to estimate, but when you have a 5 dB, I'd say that's harder. I would say it's equivalent to turning off one out of every -- one-third -- that would be equivalent to turning off

about two-thirds of the machines to drop 5 decibels. Or to increase the setbacks greater, which is really the answer. To increase the distance.

COMMISSIONER HANSON: Okay. Intuitively I'm having a little bit of a challenge with that because if you're shutting off -- did you just say two-thirds of the machines to turn off 5?

THE WITNESS: To have an equivalent drop in sound level -- or to have a wind project -- the average sound level over the whole wind project because we're talking about not just one location but the whole project, to get a reduction of 5 decibels would require turning off about two out of every three of the machines. And then not being measured -- not taking a measurement right near one of the currently operating machines.

My point -- my point in that statement was to show how difficult it becomes to put wind turbines into rural residential areas as the limits are reduced unless there is a safety valve to compensate people for the noise and allow them to enter into separate negotiations for an easement across their property.

COMMISSIONER HANSON: Thank you. And I -- I appreciate your clarifications and explanations as you've gone through this. However, if you're at 45 dBA and you decrease by 5 to 40 dBA and in order to accomplish that

you have to eliminate two-thirds of the machines, that means one-third of them are creating the 40 dBA. And I know -- I understand it's not quantity there necessarily. One machine could produce 40 dBA.

THE WITNESS: If you're close to it.

COMMISSIONER HANSON: Correct. But you're also saying that you're eliminating those that are closest to the receiver by --

THE WITNESS: In my example I wasn't being that precise. I was trying to give an example of the overall magnitude of the problem of putting a large number of wind turbines into an area and why a couple decibel difference in the criteria makes a big difference to the Applicant.

COMMISSIONER HANSON: Thank you. And you're certainly not advocating that the Applicant should remove two-thirds of their machines.

THE WITNESS: No. I'm advocating that those machines that are up -- in the model we see some levels about -- above 40. But they seriously look at getting those levels down to 40. And that for the people who are in the impacted range that are nonparticipants, that they work out easement agreements.

COMMISSIONER HANSON: I understand that. Thank you for your participation and information. Appreciate

it.

THE WITNESS: Okay. Thank you.

COMMISSIONER NELSON: Mr. James, this is Commissioner Nelson.

I understand that you heard most of Mr. Hessler's testimony this morning; correct?

THE WITNESS: I heard probably 80 percent of it, yes.

COMMISSIONER NELSON: Did you hear the portion where he explained to me that from his perspective it is very, very, very difficult to measure infrasound?

THE WITNESS: Yes. But he's been doing that with instruments with microphones.

As illustrated in the example I gave and described earlier with all the blue lines and colors, I've moved over to using a microbarometer, which is much less sensitive to air movement, et cetera, and it makes it much easier to get clear readings.

With the right instruments, infrasound is easy to measure. With the standard acoustical instruments, it's very complicated and very expensive.

COMMISSIONER NELSON: So we've been talking about this whole issue of the test or study of the Shirley Wind Farm and you developed the testing protocols.

But apparently he didn't use your testing protocols; is that correct?

THE WITNESS: No. No. They followed the testing protocols exactly, and that was to use infrasonic-rated microphones, make recordings, and then use what's called narrow band analysis to do the subsequent analysis of that data. And they executed the methods that I had recommended exactly.

COMMISSIONER NELSON: And so why didn't you recommend using the microbarometer?

THE WITNESS: Because at that time I wasn't aware that it was a much less expensive tool. It became clear to me after that when I had calls from people to come do testing that I needed a different way.

So doing some research into how other fields of science test infrasound, particularly for weather detection, tsunami detection, et cetera, that microbarometers are available, they're highly reliable, very durable, and relatively inexpensive, and not subject to the same artifacts that a microphone was.

COMMISSIONER NELSON: So help me understand just a little bit about how a microbarometer works. I understand a typical barometer measures pressure.

THE WITNESS: That's correct.

COMMISSIONER NELSON: And so a microbarometer

does the same thing?

THE WITNESS: Except that it measures the little ripple. The pressure you see when someone says the pressure outside is X inches of mercury is the overall pressure.

A microbarometer is designed to measure the little ripples that occur at that pressure level. It's a variant on a standard barometer with the exception that instead of measuring the overall pressure it just measures the rapid pressure changes as a breeze goes by, for example, or a pressure pulse from a wind turbine is picked up. And it has very little sensitivity to audible sound, literally no sensitivity to audible sounds.

It's measuring the pressure changes that rise above and below the barometric pressure at any given point.

COMMISSIONER NELSON: In the charts you were pointing out to us very early on in your discussion I will be honest when I saw those exhibits when they were initially submitted they looked Greek to me so I didn't study them.

Now that you've explained them I'm going to go back and study them, and if I remember correctly, one of the axis on there talked about different frequencies; is that correct?

THE WITNESS: That's correct.

COMMISSIONER NELSON: And so does the microbarometer test various frequencies? And, if so, what frequency range?

THE WITNESS: The microbarometer I'm using tests between 0 and 20 hertz.

COMMISSIONER NELSON: So you can identify the specific sources of the infrasound that you're testing; correct?

THE WITNESS: That's right. Because -- and it's only because wind turbines turn at the same RPM, which means the blade moves in front of the tower at the same point.

Usually within the wind project they operate at similar RPMs. And when you take the microbarometer readings and you compress hours worth of this data and plot them as I have, what you get are these horizontal lines that show the specific frequency -- or the specific rotation speeds of the wind turbines. And in this particular case I think that was .7 hertz. .7, .75 hertz.

COMMISSIONER NELSON: So what is the scale of measurement of the infrasound?

THE WITNESS: Well, the scale of measurement's on the right-hand side. That's in decibels just like we

would measure other sounds but without any A-weighting, without any G-weighting, without any filtering of the sound. We're just looking at all of the sounds 0 to 20.

The analysis method called Fast Fourier Transform, narrow band analysis, allows us to take that long string of pressures -- it samples 50 times a second -- and convert it into frequencies as we can see depicted in the chart in the upper right-hand corner. We can see the little graph with the spikes and then the arrows pointing to where those traces are in the spectrogram.

And it is only by using these kind of tools that you can detect those pulses. Not that the pulses are that faint because they're up in the 50 -- maybe 50 to 60 dB range. But those are sufficient as -- as Steve Cooper's study presented, those are inaudible but some people will pick those up and feel a pressure pulse or they'll get a migraine or they'll get dizzy. They will have these symptoms that can't be explained --

Excuse me. Turn those off.

Can't be explained by normal audible sound effects.

COMMISSIONER NELSON: And I'm not looking for a medical conclusion because I don't think you're qualified to do that, but of individuals that you have observed

that have made these type of complaints and where you have measured the level of infrasound in their home, what level of infrasound have you associated with complaints?

THE WITNESS: When the average sound pressure level of the tones gets over 50 dB then we see people with serious complaints. The most sensitive people can respond at 40, but I'm talking about average.

Remember I said it's a pressure pulse so if we have a wind turbine blade coming down and it creates a pulse, there's a high rise much above 50 -- in fact, let's say the average was 50. The pulse would probably be 65 to 70 and then a long period without anything.

So the average doesn't look that high. It's the peak or the crest of the pulse that's triggering the physiological response.

COMMISSIONER NELSON: And so, again, so the pulse at 50 dB is where you have received or observed complaints; correct?

THE WITNESS: Yes. Yes. There are some that are very sensitive who even at 40 average will have complaints, but when it gets to 50 people start complaining. And in homes where you get over 60 they start talking about leaving their home. When it's over 60 by any significant amount on a regular basis they will leave their home, and it's because they just give up.

COMMISSIONER NELSON: Thank you. I appreciate going through that discussion.

I want to shift now to the dBA measurements that are being proposed for this wind project. And you indicated that -- and you explained why you don't believe a two-week measurement works. You've suggested a 10-minute average.

Is it correct that you would only do that 10-minute average when the turbines are at full speed?

THE WITNESS: That would be the point of making the measurement, yes. That's why the -- Mr. Hessler was asked this morning about an on/off test. The proper way to take a test of a machine like a wind turbine is to find an ANSI S12.9 Part 3 compliance test, and on a day when the wind turbines are operating at full power and there's no wind at the ground -- this is a stable atmospheric condition. It's very common in the Midwest.

The National Renewable Energy Labs has done studies in prairie states saying it's roughly two out of every three nights where this condition occurs with calm winds with high upper-level winds. So the wind turbine's running, but there's no leaf rustle to mask them.

You take that condition. You have the wind turbines operating. They're turned off. Another reading is taken, and as long as there's a 6 decibel or so

difference between the on and the off, you can be fairly sure in saying that the on condition measurement was the wind turbines and not background sound. If it's over 10, then it's absolute, if there's a 10.

And as long as we have Mr. Howell's data showing that levels in the community are 22 to 28 at night, if the wind turbine sound was 40 and it was turned off, I would expect the sound then to drop to 28, and we would know then the contribution of the wind turbine without any concern over whether other things had contaminated or affected the sound.

There's operational data, SCADA data, S-C-A-D-A, that I have used in hearings where I can correlate my readings with the exact operating mode, the speed, the blade angles, the power output, et cetera, and all of that can be brought to bear for a simple on/off test to make sure that the test is fair and assesses only wind turbine noise and not other types of noise. And it can all be done in one night, not two weeks.

COMMISSIONER NELSON: But from what you're explaining to me it's got to be the right night, and nobody really knows when that is going to be; correct?

THE WITNESS: That's right. It may mean that we set up the instruments and we have to spend some evenings waiting for the conditions to be right, yes. But that's

still a lot less time than two weeks.

COMMISSIONER NELSON: The condition that you described, windy up above, still down below, so I'm a South Dakotan for my entire life. Wind in South Dakota -- we've got a windy state.

Is the phenomenon that you described, is that something that occurs everywhere? Because I know that wind is not the same everywhere.

THE WITNESS: It's a phenomena created by solar heating. Let me explain how that happens.

During the day the sun warms the ground. The warm ground causes air near it to rise and this mixes with the upper-level winds creating a smooth gradient. The wind speed increases. The more you go from the ground up, the wind speed goes up.

At night when the sun goes down the ground cools. Now we have cool air at the bottom, warm air up above, and cool air sinks so we have this layer of maybe 100 feet deep. Sometimes less than that. Sometimes you can see the top of the trees wiggling, but there won't be enough breeze at the ground to induce leaf rustle.

The National Renewable Energy Lab study -- and I think one of the places they did the test was South Dakota, either that or one of the other plain states -- showed that that occurs about two out of three

nights during the warm season. And it is a characteristic that meteorologists in other cases where I've testified have agreed. And in acoustics we use that condition as the best test condition.

For example, the model, the ISO model that Mr. Howell used for his prediction, makes the assumption that the weather conditions are calm wind at the ground, and if you'll read it, it will say a stable atmospheric environment. That is the ideal condition for testing noise, and that is what I'm saying would be the condition for testing wind turbines knowing from my own experience and from what I have learned about meteorology over my 45 years that there will be many nights when the wind turbines will be at full power even though the wind at the ground level is moderate.

COMMISSIONER NELSON: I think the last -- and I appreciate that discussion. I think the last question.

You made the statement in relation to infrasound and you said, and I think I quote this correctly, "It's unstudied, but a major concern."

How can we make sound decisions on something that is unstudied?

THE WITNESS: You can't. All you can do is -- the precautionary principal says that we err on the side of safety. If we know that we have people complaining

about the distances of a mile and a quarter or two miles, then we have to take that into consideration until the science shows us that that isn't a problem.

And this is something that's always baffled me. Why are the project -- why are we permitting projects near homes when there's still other areas where we could have wind turbines out at greater distances while the research goes on?

So my position has been under the precautionary principal that until we know enough about why these problems occur, that we should be more cautious in allowing wind turbines near residential homes.

COMMISSIONER NELSON: Thank you.

MR. DE HUECK: Commissioner Hanson.

CHAIRWOMAN FIEGEN: Go ahead. I have one more question whenever.

MR. DE HUECK: We'll go down to Commissioner Fiegen. And I'll just announce for the room, Cheri really needs a break. She's been at it for a long time. So when we're done with Commission questions we're going to take a recess.

CHAIRWOMAN FIEGEN: In your testimony, Mr. James, your written prefiled testimony, you talk about Michigan and Ohio and a noise trespass.

Have they used that in regulation, the noise

trespass in Michigan and Ohio?

THE WITNESS: In Michigan, yes. A number of communities have passed ordinances that encourage that to happen. Basically encourage -- they set restrictive limits, 45 not to exceed, for example. That's an Lmax. And then they let the developer negotiate with the landowners for easements.

CHAIRWOMAN FIEGEN: And they haven't used it in Ohio.

THE WITNESS: I don't know. Ohio's still arguing over things that -- actually in a case that Mr. Hessler and I were involved in called Buckeye Wind back in the early 2000s. They're still arguing over that case.

CHAIRWOMAN FIEGEN: Thank you.

COMMISSIONER NELSON: My apology to Cheri. I have another couple of questions.

Help me understand how infrasound dissipates over distance, if it does.

THE WITNESS: Infrasound is a -- I'll call it infrasound is not absorbed by air. The energy infrasonic rate is not absorbed by air as the audible sounds are.

The farther you get away from a high frequency noise, even speech, not only is distance a factor but

that energy's being absorbed by ear molecules.

Infrasound doesn't do that. Infrasound isn't blocked by physical things, for example. It goes through a house as though the house wasn't even there. And I believe that Mr. Hessler's work at Shirley Wind showed that the levels outside the house and inside were almost roughly the same.

Infrasound is a particularly long propagating. But elephants, for example, in Africa use infrasound to communicate, a deep bellow. And they can communicate over hundreds of kilometers. We use infrasound to detect distant nuclear bombs, for example. The microbarometer that I use is used by the U.S. government with detectors to detect when bombs are set off halfway around the world.

An infrasonic pulse, if it's sufficiently strong enough, can go around the world and have almost as much intensity as afterwards. There's anecdotal evidence when Krakatoa erupted microbarometers all over the world went off, and they showed the echo of that eruption propagating around the earth several times. So infrasound is just one of those things that is hard to stop.

And even though wind turbines aren't like a nuclear bomb, the sound is more than sufficient to

propagate miles. I have measured infrasound tones at distances of six miles. I have colleagues who have measured in the distances of 50 miles. Where you can clearly see the tones that we see in my examples.

And, again, this depends on how many wind turbines. One wind turbine isn't going to be detectable 50 miles away. But a bank of 200 wind turbines will be clearly distinguishable at much greater distances than the single one. And when we start talking about these projects getting larger and larger we get to the point like we have up in Ontario where there's no place within southern Ontario where we can't put up a microbarometer and detect wind turbine tones.

COMMISSIONER NELSON: So when you measured infrasound at six miles what was the level?

THE WITNESS: It was down around 40. Average 40.

COMMISSIONER NELSON: And so presumably as you would move further out it would ratchet down and at some point hit zero.

THE WITNESS: No, it doesn't hit zero. It just blends into the other infrasound that's there. I mean, just the fact that the earth is rotating, and friction in the atmosphere produces some infrasound. So you get to the point where there's a background infrasound even when

you don't have wind gusts and other things triggering it.

But at this point when I'm asking what is the distance we should be concerned of, the Board of Health in Brown County, which has debated this for eight years now basically has said that the radius of the human health hazard is two and a half miles around the wind project. And that seems to encapsulate most of the people who are sensitive, and it takes people who are really sensitive beyond that, one of which I have an example in my exhibit, to sense it.

But for practical purposes, anytime you're within -- a mile is going to be very significant. And even at two and two and a half miles we'll have people who if they are sensitive will report those sensations. Whether it triggers, you know, an adverse reaction or not depends on them.

I have an acoustician friend, Dr. Malcolm Swinbanks, who has published papers about his own sensitivity. And he uses his sensitivity to infrasound pulsations as an expert for the U.S. Department of Defense in protecting our military against infrasound. Because he can feel it, he doesn't have to look at his meter to know whether it's present.

I know three other acousticians who also can sense these pressure pulsations. It's not as rare as

Mr. Hessler might like to make it out. If my limited number of acousticians friends include three that are using it as tools, then it's more prevalent in the population than we might expect.

COMMISSIONER NELSON: Thank you.

COMMISSIONER HANSON: Mr. James, all of the positions and thoughts and premises that you're using seem to boil down to a conclusion, and I would like to read what I believe is your conclusion. I've written that down, and I -- it may be a little bit lengthy, but I'd just like you to pause and wait until I ask you if that is correct or not.

You're obviously a strong supporter of property rights. And on page 6 line 174 there's a question pertaining to that. And all this seems to boil down to your position that sound levels that are generated from the wind turbines may not exceed the ambient sound level existing at the property line of nonparticipants unless the utility developer/operator is willing to provide compensation for the what you call noise trespass -- or the what I would call sound as opposed to noise; is that correct?

THE WITNESS: That's close. You're probably -- you're probably right sound trespass, but noise means unwanted sound. If a person didn't bother them, then it

wouldn't be a trespass.

What I'm concerned about is uncompensated easements. And when we begin to have government bodies set a standard that goes to a home, not to the property line, it results in uncompensated easements. And that's what concerns me.

COMMISSIONER HANSON: I'm a strong believer in property rights as well. But there's -- and semantics aside from noise and sound, when you get into something of that nature, does my air conditioning unit outside my house -- do I need to compensate my neighbor for the noise that that creates or the airplane that flies overhead or the street construction work or on and on and on that take place throughout the world daily in everyone's life?

I mean, that just seems so extraordinarily unworkable and unrealistic. It's when the noise is -- is really in a trespass sense. And I know you're trying to get to that point, but I just don't see that you're reaching that.

THE WITNESS: You know, I -- I understand the issue of air conditioners, but let me use that as an example.

The air conditioning industry since I was a young kid back in the '50s has done extensive work in

making the sound of an outdoor air conditioning condenser compatible with community noise standards or community lifestyle.

When I bought my new air conditioner a couple of years ago it came with all sorts of noise data showing the impact on my neighbor and how that impact would be acceptable. Also in my community there are other sounds at night that raise the level up to about 30, 35 dBA. So my expectation here is that the -- my neighbor, if they put in a wind turbine or an air conditioner, will also put in one that has been designed to be compatible with the acoustic environment of the community.

Wind turbines haven't been designed for that. Wind turbines are still in their early years. That doesn't mean that someday they won't have one. It just means that right now a wind turbine is like an old air conditioner in 1950 with a noisy fan or noisy pump and other mechanical sounds, that until they can design wind turbines that are more compatible with being close to homes, they should put their hardware out in areas where people aren't there. Or if a person's willing to accept the noise, compensate them.

In my career with workers, there are a number of jobs where the noise was unbearable, but my employers -- or my clients who were their employers would pay them

extra, and they would take that extra money as compensation for the noise.

People have a -- people have a right to privacy, but if you say are you willing to exchange it for X number of dollars a year, they're willing to do it. And that allows each property owner to participate in the process to the extent they want. And that's why I kind of lean towards it.

COMMISSIONER HANSON: Thank you.

THE WITNESS: Yeah. If wind turbines were air conditioners, it may be different.

COMMISSIONER HANSON: Thank you, Mr. James. I understand that we have moved a great deal with, for instance, automobiles or -- you can hardly even hear them when you're standing right next to them.

THE WITNESS: That's right.

COMMISSIONER HANSON: And there's been a great deal of -- however, you would have to accept that there have been significant advances in the wind turbines of today as compared to 20 or 30 years ago.

I won't take exception with your premises and argue those premises. That's up to the other folks here. But I'll give it as much weight as I can to what you've said where I feel that it's justifiable to do so.

So thank you for your presentation.

THE WITNESS: Okay. Well, thank you.

MR. DE HUECK: We will recess until 4 o'clock.

(A short recess is taken.)

MR. DE HUECK: We are back in session. Mr. James is on the witness stand.

Mr. James, you're still under oath. We finished with cross-examination first round. We're going back to Mr. Almond for redirect.

REDIRECT EXAMINATION

BY MR. ALMOND:

Q. First question, Mr. James. Have you ever been permitted to testify in the United States Court to give opinions on noise generated by wind turbines' effects on people?

A. Yes.

Q. And can you provide a citation to the Commission of what that case was?

A. The case --

Q. Maybe not the citation, but can you tell us the case name and where it was located at?

A. Yeah. The case was here in -- well, there's been many cases where I've been qualified, but there's one where I went through a Daubert hearing in a court here in Michigan. It was McBain, Michigan. I can get the specific reference for the record later. I don't have it

in my hands. But in that case I was -- after the Daubert hearing I was qualified as an acoustician.

In fact, if everyone would turn to my Exhibit 1, my bio materials, I have the exact quote from that decision on that page so that people can follow along. It's the page bio materials for Richard R. James, November 8, 2017.

At the bottom of that page there is a table showing some of the example qualifications, and at the very bottom is the Michigan court case where I went through a Daubert hearing and the judge concluded that I was an acoustician with expertise in measurement of wind turbine noise and its effects on people and I was qualified to opine that the Plaintiff's symptoms were caused by the Defendant's wind turbines after that special Daubert hearing.

In Alberta, Canada I've also been similarly qualified to speak to not only the noise but also human response to noise, and that is the typical qualifications that I have been granted in other jurisdictions.

Q. And what was the name of that Michigan case?

A. I will have -- it was -- I remember my clients' names. If you want -- let me pull it up here. I can get it.

Q. Well, no. Let's not do that. Unless the Commission

would like him to.

MR. DE HUECK: Just provide it to us later.

Q. We'll just provide it later. Okay?

A. I will.

MR. ALMOND: I don't have any other questions for you, Mr. James.

THE WITNESS: Okay. Thank you.

MR. DE HUECK: Mr. Fuerniss, any cross-examination based on Commission questions?

MR. FUERNISS: No.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: No.

MR. DE HUECK: Ms. Pazour.

MS. PAZOUR: No.

MR. DE HUECK: And Staff.

MS. EDWARDS: Briefly.

RECROSS-EXAMINATION

BY MS. EDWARDS:

Q. Can you turn to Staff Exhibit S-5? Do you have all the exhibits in front of you?

A. I will get them up here again. Let's see. Staff Exhibit -- S4, S5, additional data requests?

Q. Yes. S5.

A. Okay. Opening it up here. I think everyone else is opening it too because it's slow to respond.

Q. Just let me know when you get there.
A. I will. It's opening slowly.
Okay. I have the document open.
Q. Okay. And I would like to --
A. Which page?
Q. -- direct your attention to page 8 of 27.
A. Okay. Is that 2-8? Or 2-7? Is that the page with question 2-7?
Q. Right.
A. Or 2-8?
Q. I'm looking at the question before that, which would be 2-6, but I'm looking at the answer so --
A. Okay. Okay. Okay. I believe that was the response by Dr. Alves-Pereira.
Q. Correct. And do you see at the very end there where she responded that, "There are currently no scientifically valid studies providing numerical data on safe distances that can effectively protect families against ILFN contaminated homes"?
A. That is very true because acousticians have ignored low frequency and infrasound since the '70s when I started out, and they concluded that audible -- A-weighted sounds would be the focus of regulations.
We've underserved the communities by ignoring the low frequency end of the spectrum.

Q. How could you set a limit if there's no statistically reliable data?
A. Well, to be very honest, the same way we set the criteria back in the 1970s. Acousticians who were familiar with different types of problems got together and pooled their data and came up with, for example, the EPA has an LDN of 55 for urban environments.

It was based upon consensus among acousticians and their experiences in the field. And acousticians have plenty of experience with IFLN, but governments don't because they've all focused on dBA criteria.
Q. Okay. You testified, and I don't remember in response to which Commissioner question, that there's nowhere you can go in Ontario and not be subject -- or not be able to pick up infrasound; correct?
A. I said southern Ontario. Basically if you go from the western edge of southern Ontario on Lake Huron over to the east of Toronto along Lake Erie, any area along there there is I think 1,700 wind turbines in that area. Anywhere in that area you will measure the tones from wind turbines as long as you don't have such high wind levels, et cetera, that they mask them.
Q. And earlier you testified that 15 percent of the population would be susceptible to infrasound. So would not then 15 percent of the population of southern Ontario

be ill?

A. No. That was 15 percent were subject to the audible sound. 15 percent found levels of 40 Leq and higher were susceptible.

In my -- let's look at Shirley Wind. When Shirley Wind -- when the Brown County Health Department began to explore it the initial complaints were three families. By the end of their investigation they had 70 families that had reported either audible sound or infrasound-related symptoms. And this was for a small project with eight wind turbines in a relatively small dairy farming community.

So what is the percentage that are affected? We don't know. Health Canada, for example, their study found that at one and a quarter mile -- so we're talking two kilometers they asked people within that distance if they had tinnitus, ringing in the ears, migraines, dizziness, et cetera.

Well, we know that the general population -- that the percentage of the general population with dizziness and tinnitus, et cetera, is roughly around one out of 10 people, and yet at a mile and a quarter from the wind turbines in the Health Canada Study they were reporting 20 percent and higher prevalence rates.

They couldn't explain what caused it. They tended

to ignore it. But I used to say a mile and a quarter was a safe distance. Safe meaning safe. Now I can't say that. The Health Canada data calls it into question because we can't explain why these symptoms of low frequency noise, tinnitus, migraines, pressure pulsations, et cetera, nausea are so prevalent at that distance.

Audible sound would have died off by a mile and a quarter. It would only be the low frequency and infrasound that's present in those homes. So the more we learn about the problem the more we begin to see that even what would be considered large setbacks may not prevent some of the complaints.

MS. EDWARDS: Thank you. No further questions.

MR. DE HUECK: Any Commission follow-up?

Okay. Commissioner Nelson has a question for you.

THE WITNESS: Okay.

COMMISSIONER NELSON: Earlier I asked you to try to explain dissipation to me. And I understood your answer.

So it would appear that the dissipation of infrasound would occur uniformly over distance since there appears to be no impediments to it. Is that accurate?

THE WITNESS: Yes. It -- it -- it propagates with very little decrease in sound level over great distances, which is an advantage if you're an elephant trying to communicate to another elephant, but it's a disadvantage if you're looking at a noise source that produces infrasonic pulses because that problem propagates much farther than the audible sounds.

COMMISSIONER NELSON: So how many -- since it dissipates at a uniform rate over distance, how many dB does it decrease per mile?

THE WITNESS: Well, it -- again, it -- sound drops off proportional to the distance. If we're talking about audible sound.

COMMISSIONER NELSON: No. We're not talking about audible sound. We're talking about infrasound.

THE WITNESS: Well, audible sound decreases at 6 dB per doubling of distance. Infrasound is more like 1 or 2 dB per doubling of distance.

And in my tests I kind of lean towards the two mile, mile and a quarter as the separating difference between a lot of people, a significant number, let's say 10 percent, having complaints, and after that it becomes much more spotty.

COMMISSIONER NELSON: Let me delve into your answer 1 or 2 dB per doubling of distance.

So between 5 feet and 10 feet it reduces 1 and 2 -- 1 or 2.

THE WITNESS: Yeah.

COMMISSIONER NELSON: That doesn't make sense.

THE WITNESS: Well, let's say it starts out at 100 at 1 meter away. And I'll use meters because it's smooth. 1 meter away it's 100. So at 2 meters it will be, let's say, 98. At 4 meters it becomes 96. At 8 meters it becomes 94.

And so you can see that as we get to a significant distance like 500 meters, it now -- in order to get another decibel of reduction, we've got to go 500 more meters.

COMMISSIONER NELSON: Okay. So I understand that math. And so then my question is, is it 1, or is it 2 decibels? That's a big difference.

THE WITNESS: Yes. It depends upon the atmospheric conditions, and it depends upon the surface conditions but -- and that's why I say 1 or 2. Because it -- depending on where you're measuring, it could be either.

But for the levels emitted by wind turbines, the infrasound is significant enough to trigger the sensations of the distances of a mile and a quarter to two miles in those sensitive individuals.

COMMISSIONER NELSON: Have you measured infrasound -- the level of infrasound at a turbine?

THE WITNESS: Right at a turbine it wouldn't be very high and that's because the sound's occurring up above and it's radiating out.

I mean, a wind turbine the sound is radiating off the blades and, therefore, when you're close to it -- actually one of the quietest places near a wind turbine is right at the base of the tower.

COMMISSIONER NELSON: And I understand that. So at what distance would the infrasound be maximized?

THE WITNESS: It becomes more rotatable when we're out at distances of let's say a thousand feet. And for a 1 hertz infrasonic tone it takes a thousand feet for the wavelength to form.

So within that you can get numbers -- within that distance the numbers can vary all over, but as you get a little further away, the wave form is fully developed, and the propagation becomes somewhat measurable.

But it depends on how it's reflected off the ground, how it's reflected off the ionosphere, and other atmospheric conditions. And it's very variable. Low frequency noise problems are hard to trace because of these issues.

And wind turbine sounds fit into that category. One day it could be perfectly fine. The next day it could be much noisier just due to -- I'm assuming they're operating the same. Just due to how the atmospheric boundary layers are reflecting the sound.

COMMISSIONER NELSON: So I'm going to ask, have you measured infrasound 1,000 feet away from an operating turbine?

THE WITNESS: Yes. Multiple times.

COMMISSIONER NELSON: And what level would you typically find there?

THE WITNESS: Probably in the 60s to 70s average with peaks up around 85. That was my first paper was at that distance.

COMMISSIONER NELSON: And what would cause the difference between it being 60 or it being 85?

THE WITNESS: Well, the 60 is the average, but remember a pulse and then quiet. So what we're doing is we're averaging a very large short-term sound with a lot of quiet after it so that average drops down. But it's the peak of the pulse that's causing the sensations.

COMMISSIONER NELSON: Right. And I know you explained that already so I assumed that the numbers you were giving me were just the peak numbers.

So 85 would be the peak?

THE WITNESS: Yeah. 85. Whereas the average would be 50 to 60.

COMMISSIONER NELSON: Thank you.

MR. DE HUECK: Reece, any redirect after Commissioner Nelson's question?

No.

Mr. James, thank you for your testimony --

MS. SMITH: Excuse me, Mr. de Hueck. I got skipped, and I didn't want to interrupt.

Is it okay? I just have one question.

MR. DE HUECK: Yep.

RECROSS-EXAMINATION

BY MS. SMITH:

Q. Mr. James, you had previously talked about the Shirley Wind Farm in response to some of the questions that you were asked; is that correct?

A. That's correct.

Q. And you mentioned that the Board of Health declared the wind farm a human hazard; is that true?

A. The exact term is "human health hazard."

Q. Human health hazard.

Are you aware that that designation was rescinded in 2015 due to insufficient evidence of a link between wind farms and people's health issues?

A. No, I'm not. In fact, 2015 the --

Q. I just asked if you were aware of that.
A. I'm aware that it was not rescinded at that point.
Q. Was it ever rescinded?
A. No. The board has maintained that in spite of efforts to have it rescinded.

MS. SMITH: I have no further questions.

MR. DE HUECK: Thank you for your testimony, Mr. James. That will conclude it.

(Discussion off the record.)

MR. DE HUECK: I'm going to turn to Mr. Almond to call his next witness.

(The witness is excused.)

(A short recess is taken.)

MR. DE HUECK: EL18-026 is back in session. Mr. Almond, you may call your next witness.

MR. ALMOND: Intervenors call Jerry Punch.

MR. DE HUECK: Good afternoon, Mr. Punch. My name is Adam de Hueck. I am the Hearing Examiner in this matter. I'll be swearing you in today.

Are you ready?

THE WITNESS: I'm ready. Thank you.

(The oath is administered by Mr. de Hueck.)

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Why don't you introduce yourself to the Commission

and give a brief recap of your education and experience.
A. Well, I'm an audiologist. I have two higher degrees, a master's degree in hearing and speech science from Vanderbilt --

MR. DE HUECK: Can you slow down a little bit for the court reporter and identify yourself.

A. I'm Jerry Punch. I live in Okemos, Michigan where I'm seated right now. I appreciate the opportunity to not have to make the trip to South Dakota, by the way.

I have been an audiologist since 1967 so I have really about 50 years experience as an audiologist. My educational background is with a master's of science degree in hearing and speech sciences from Vanderbilt University and a Ph.D. in audiology from Northwestern University. I've been a teacher, a clinician, a researcher, an administrator in a number of settings, mostly academic settings.

The last 20 years, 21 years I've been at Michigan State University. I retired from that position, from the faculty there in 2011.

Would you like me to go into the issue of how I got involved with wind turbine noise at this point?

Q. Sure. Why don't you explain how you got involved.

MR. DE HUECK: Mr. Punch, this is the Hearing Examiner. I'm going to interrupt you for just a second.

When you look down we can't really see your lips so if you can either back up while you speak or, alternatively, if you can adjust your camera down.

(Discussion off the record.)

Q. First why don't you just -- what is an audiologist?

A. Well, audiology is the study of hearing and hearing disorders essentially, hearing loss. Much of my work has been involved -- particularly, my research has been involved with hearing aid research with diagnostic testing to quantify the amount of hearing loss in people.

As I say, I've been certified as an audiologist and still am since the 19 -- late 1960s. I've done a lot of clinical work with patients. As someone already mentioned in the previous testimony, I basically -- I'm losing my train of thought already. It's not that time of day for me.

Basically what I was saying is wind turbines is kind of a new area. I got involved in about -- excuse me. In 2008 or 2009 when, in fact, Rick James asked me to go to a wind project in lower Michigan. It was in the thumb area of Michigan where a family was abandoning their home or leaving their home at night to be able to sleep because of the turbine noise.

By the way, my affiliation with Rick has been over many years. When I was chair of the department for about

six years I actually hired Rick as an adjunct instructor to teach a couple of not courses but give a couple of lectures in a hearing conservation course, a graduate seminar in hearing conservation at Michigan State University.

And so Rick and I had known each other for sometime before 2008 or '9. So we basically -- I went there thinking I'm not sure what my role is here. I'm an audiologist. I understand sound. They were complaining of the noise. And I've had a lifelong interest or career-long interest in occupational hearing loss and in community noise so I thought it would be interesting. I was thinking about retiring in a few years, and I thought, well, this is something of interest to me. I could possibly become involved if it seems important to do so or interesting.

And the family, we just interviewed them more or less informally. Two daughters, two teenage daughters. Again, they were leaving their home at night to sleep in a hotel or motel. And I came away actually thinking honestly that what's the problem here?

I heard the turbines. They were moving somewhat during the afternoon that I was there. I felt a little bit of sensation. It didn't feel that strange at the time. I was only there, as I said, a couple hours or so,

three maybe. And I came away thinking, well, I need to understand -- I want to understand what's going on.

So I rented -- rented. I checked out a book from the library, Paul Gipe's book on wind energy, Wind Energy Comes Of Age. And it was fairly favorable toward wind energy. It did not -- it barely mentioned noise, though, as an issue, and the book was based a lot on the information that was available from the wind turbines that had been installed in European and I think Scandinavian countries and so forth and California at that time -- by the time had become involved with wind energy.

So not getting a whole lot from the book in terms of an explanation of what the family was complaining about, I began to search the literature, first the internet and then some other sources of, let's say, journal articles and so on, and I ended up writing an article. Rick was a co-author on the article along with a student we involved in our measurements and writing the report.

The study was published in Audiology Today, which is basically a monthly magazine of the American Speech Language Hearing Association in the summer of 2010, I believe. And so as a result of that, I was asked to chair a group in Michigan, which now the Department of Energy essentially in the state to develop --

My audio died. Are you hearing me?
Q. Yes.
MS. SMITH: I'm sorry. I'm kind of wondering what the question is because I don't think it's quite -- I'm sorry. I don't know where this started.
Q. I think we were just kind of rambling a bit about your background there, Dr. Punch. So let me try to hone you in here.
Did you file -- or did you prepare prefiled testimony in this matter?
A. I did.
Q. And is that what has been marked as Exhibit I-2?
A. I'm looking at my list here. I'm sorry I didn't become acquainted with this earlier.
Q. I-2.
A. Yes.
Q. And do you have any changes or corrections you want to make to that testimony?
A. No, I don't.
Q. And along with that testimony did you include two exhibits which were your CV and then an article written by you and Mr. James?
A. I did, yes.
Q. And you also provided some responses to some questions asked by PUC Staff; is that correct?

A. I did, yes.
Q. And I'll represent to you that those are on Exhibit I-34, specifically Intervenors' Responses to Staff's Second Set of Data Requests to Intervenors.
If I were to ask you those same questions that are asked in your prefiled testimony as well as the questions asked by PUC Staff in Intervenors' Responses to Staff's Second Set of Data Requests to Intervenors, would you provide the same answers here today?
A. I would, yes.
MR. ALMOND: At this time I would move for the admission of Exhibit I-2, as well as Exhibits I-2a and I-2b.
MR. DE HUECK: Do you have an objection?
MS. SMITH: Can we revisit this after cross?
MR. DE HUECK: Certainly.
MR. ALMOND: I think the process we used previously was to admit it and have her move to strike it.
MS. SMITH: If you would like to do it that way, that's fine by me.
MR. DE HUECK: You're right. Yes.
Okay. So, Staff, do you have anything to add?
MS. EDWARDS: I have no objection.
MR. DE HUECK: So we're going to go ahead and

admit the exhibits and testimony.

(A short recess is taken.)

MR. DE HUECK: Okay. We're back in session. The court reporter is all squared away so we can continue.

Q. (BY MR. ALMOND) Dr. Punch, did you have the opportunity to review Dr. Roberts's prefiled testimony in this matter?

A. Yes, I did.

Q. And do you recall in Mr. -- Dr. Roberts's prefiled testimony him stating that he's not aware of any reliable evidence providing any link between infrasound and adverse health effects?

A. I did. Yeah. I do.

Q. Do you have any response to that claim?

A. Well, I heard him say I'm not aware at least three times with respect to that question. Or I read that.

There's, I think, mountains of evidence as we provided in our article, the 2016 article, that included as exhibit -- I've lost the numbers here, but my second exhibit.

You've heard testimony, and I would agree with it, that from Rick especially that there's lots of field evidence. There's lots of anecdotal evidence. There is some evidence in the literature -- like Dr. Roberts made

the point that only epidemiological evidence is useful in drawing conclusions about causation between wind turbine noise and adverse health effects.

He also said paradoxically that -- when asked how likely is it that -- and I'm paraphrasing. How likely is it that such epidemiological studies will be done in the future. And he said not very likely.

And I think I agree with this in the sense that they're expensive, they require a lot of preparation, government funding, and Mr. James has already responded to that issue of there's just not government funding available for that kind of research.

So my point is we have to take what we have. Just like the Bradford Hill criteria doctor that is -- Sir Austin Bradford Hill who addressed the medical society in Britain in 1965 listing nine criteria, which include experimentation, but there are eight other criteria that he talked about that have become sort of the, if you will, the Bible of epidemiology, as I understand that. As I understand it. Indicating that we don't need just epidemiological research to answer questions about causations -- causation of disease processes and/or disorders and external patients.

He went through those criteria, but he didn't -- he just named them. He didn't talk about what they are

about. And I think he basically ignored the message that I would read into -- or read from Bradford -- Bradford Hill's address, and that is, again, we use what we can to draw inferences. We use what is available.

Not that we shouldn't do more research. Some of it might be clinical research design. Some of it might be epidemiological. But these studies that will really address the question definitely about infrasound or just even audible sound and things like dose response, how much sound does it take before people really do come down with the various complaints and problems that they complain about.

That was one of my major takeaways from his -- his comments there. He also did talk about -- he basically uses government studies to rely on for his inference or conclusion that there is no causative relationship between adverse health effects and wind turbines. Yet he uses -- he talked about peer-reviewed studies. But these government studies he relies on don't seem to be peer reviewed, per se, in the way that he defines peer reviewed. So I found that rather unacceptable.

He holds folks like me and Mr. James and others to a standard of peer-reviewed epidemiological research to establish those relationships. Yet he does not really have -- he can't point to specific studies other than the

Health Canada study perhaps as others have also done to support his view that there are no relationships, no causative relationships here.

Q. And just I want to jump to kind of your overall opinions and conclusions in your prefiled testimony.

You recommended two separate alternative noise limitations; is that correct?

A. I did, yes.

Q. One was a 40 dBA Leq night outside, the other 40 dBA LAmax; is that correct?

A. That's correct.

Q. Can you just explain the rationale for those two recommendations?

A. Well, the 40 dB Leq comes from mostly -- emanates really with the 2009 World Health Organization document on night noise guidelines. And that's the point at which it was said -- it was said -- it was decided and used by the World Health Organization to be a threshold at which there are substantial and nontrivial numbers of people who are affected by low frequency noise.

They did not study in the 2009 document really wind turbine noise. That needs to be understood. Wind turbine noise has its own specific characteristics. But if 40 dB Leq is needed for protection against things like road traffic noise and airport noise -- or airport noises

and other kinds of noises, then because infrasound is a component of wind turbine noise, the 40 dB actually seems to be a conservative threshold to me.

45 I know is the design goal for this particular project, but 40 is really a very conservative goal. It should be lower. And I know Rick James talks about, recommends, 35 dB Leq but I realize the stress that puts on wind companies to build the projects and I'm not really trying to stop them from building the projects. I just want to protect people as much as possible.

Let me point out the 40 dB Leq is the level that -- I was about to get into this earlier, that the task force that I chaired in the state of Michigan some years ago was about to recommend -- that task force was shut down. I won't go into that unless you want me to. But there was some lobbying, I think, about shutting us down because --

Q. I don't need you to go into that.

A. Okay.

Q. But --

A. All right. So 40 dB is the level that's certainly recommended by the World Health Organization. It is very close to the levels that the -- that Dr. Schomer, Dr. Paul Schomer, has come up with recently based on four different sources of information, data. They recommend

36 to 38 dB Leq.

And he recommends it to be measured over a 24-hour period basically. That is a little different from the World Health Organization 40 dB level because they recommended that as an annual average, which I think it impractical -- implying by annual that you actually leave the sound level meter out for a year. We don't do that, of course. You take samples over a year.

If I can get down into the 40 dB LAmax is an attempt -- and I made this attempt in another case earlier in New York to try to look at the WHO documents, both the 1999 and the 2009 documents.

Q. Can you back up just a little bit from the camera?

A. Sure. I was actually taking a couple notes and trying to read my notes that I just wrote down just a minute ago. Anyway --

Q. Let's not take any notes. Okay?

A. Okay. All right.

Okay. Can I go ahead with my --

Q. Yeah. The 40 dB LAmax.

A. 40 dB LAmax. If you review the -- even the 1999 WHO standards I think they talk about the 45 dB LAmax inside. And, again, the 40 dB LAmax, one, is an attempt to account for all the peaks and valleys that occur in wind turbine noise. Much of it is infrasound. Some of it, of

course, is also audible sound.

I think an even more conservative number might be in order because we're talking about -- when we talk about infrasound we're talking about sound that does not attenuate very well and certainly not very rapidly, and as you've heard many times already in this hearing, it dissipates over very long distances.

There's almost no barriers that can stop it. So even if you have your windows closed, it could be as bad inside as outside. And because the World Health Organization dealt with low frequency noises that did not include infrasound, I think an even lower number like 40 instead of 45 dB LAmax would be appropriate to account for the peaks and valleys that do cause the annoyance in real time for people.

And my concern -- and particularly in the 2009 WHO document, the concern there is with sleep. Sleep disturbance.

Q. In addition to noise limitations, you also recommended a 1.25-mile setback. Why is it necessary to have both a noise limitation and a distance setback?

A. Well, a distance setback would be ideal if we could show a really close correlation with the noise levels that people are exposed to at those distances. But because there are differences in terrain, even changes in

the weather patterns, differences in noise turbine arrays, the way they're arrayed with respect to one another, each other, you can't predict exactly what the noise levels are going to be from knowing the distance.

But I think the 1.25 miles or 2 kilometers that's been recommended many times in the literature starting with Pierpont in 2009 would be sort of a minimum distance. 1.5 probably better, obviously. Again, trying to give fairness as much as I can be fair to the wind companies, 1.25 seems a rather respectable conservative number.

But because the distance does not correlate very well with the noise levels at those distances, both would be my recommendation. It's not that hard to set the distance as a limiting factor or a minimum distance along with a maximum noise level. But certainly noise level always has to stay in the equation.

MR. ALMOND: Thank you. I don't have any further questions for you at this time, and I'll tender you for cross.

MR. DE HUECK: Mr. Punch, we're now going to subject you to cross-examination, starting with the Applicant, Prevailing Winds.

MS. SMITH: Dr. Punch, I'm just waiting so they can shift the camera over so that you can see me as

opposed to others that are watching.

(The camera is adjusted.)

CROSS-EXAMINATION

BY MS. SMITH:

Q. Dr. Punch, do you have anyone with you in the room?

A. I don't.

Q. And other than the documents that were filed in this matter, including your testimony, do you have any other documents in front of you?

A. I had taken some handwritten notes. I'm putting those aside. I'm not using them. I don't have any other notes. I have a laptop to my right with some files I thought I might need, but I think everything is on the exhibit list that we might need.

Q. Okay. Thank you.

You mentioned -- you indicated you're an audiologist; correct?

A. Correct.

Q. And you're not an engineer, not a professional engineer; is that also true?

A. True. True.

Q. And you're not an acoustician, as Mr. James is; correct?

A. Not as he is, no.

Q. You don't perform modeling analyses for wind

projects, for instance, to determine sound levels?
A. I've never done that.
Q. And you're not qualified to do that; is that correct?
A. I don't really know, to be honest, in terms of acoustical standards. Probably not. I have certainly done measurements in communities about community noise, racetracks, for example, and public events like concert halls and so forth. I have made noise measurements. Part of my training as an audiologist was how to make noise measurements.
Q. Okay. Are you a licensed audiologist?
A. I am not. Because I am a retired audiologist, I didn't want to pay the $350 a year when I knew I wouldn't be practicing clinical work. Licensing only applies to clinical work, working with patients who have hearing problems.
Q. Certainly. And so have you ever been licensed?
A. I have been licensed the whole time with my career that I was involved in clinical work, yes.
Q. Okay.
A. In a couple states.
Q. Are you licensed to practice medicine?
A. Of course not.
Q. Based on your testimony earlier, I understand that

an audiologist deals with hearing-related diagnoses or treatment. So, for instance, hearing loss treatment. Is that true?

A. That's true.

Q. And so an audiologist can determine if somebody has hearing loss, but they cannot necessarily determine or diagnose diseases, for instance, from the ear. Is that true?

A. Well, I think a medical doctor would say we can't diagnose in the sense that we can tell where the lesion -- the site of the lesion is by audiometric testing battery that we can perform, some of which is electrophysiologic, some of which is audiological through earphones and so forth. But we can't determine what the actual cause of, say, sensory neuro hearing loss really is.

Many times in reports we put in audiometric results are highly consistent with presbyacoustic hearing loss or noise-induced hearing loss, for example, and that is helpful to physicians in making their diagnosis. But they have additional tests they can perform, including their own physical exam.

Q. So if you -- as I understand your testimony, if you identified an issue, that may be referred to a physician in order to make a further testing diagnosis to determine

the actual cause?
A. Yes. We work closely with otolaryngologists, ENT specialists, in that we get referrals from them, and we refer to them with respect to diagnostic and sometimes treatment issues. If medical or surgical treatments seem applicable, then certainly we refer to a medical specialist.
Q. And as an audiologist, you don't have any expertise to diagnose nonhearing-related maladies like heart disease or diabetes; is that true?
A. That's true. True.
Q. In your testimony you state that you're testifying as an expert witness regarding the potential health effects posed by noise from the project; is that correct?
A. True.
Q. I believe if you want to turn to pages 3 and 4 of your testimony, do you have that in front of you?
A. What exhibit is that? I do not have it -- I have it on the computer.
Q. Certainly. I believe it is Exhibit 2. I-2. Sorry.
A. I-2?
Q. I-2.
A. I-2a? I'm sorry. Prefiled testimony?
Q. Yes.
A. Okay. Okay. I have it.

Q. And if you look at page 3. 3 and 4.
A. Okay.
Q. I'm looking at lines 58 and 59. Do you see those?
A. 59 ends the question, and 60 starts an answer.
Q. Yes.
A. On my -- okay.
Q. That's correct.
And, as I understand that portion of your testimony, starting at line 60 through 81 you're identifying your qualifications to testify as a health expert regarding wind turbine noise; is that true?
A. Well, the question was what experiences do I have to qualify me as a health expert, yes. In that sense, it's true.
Q. And as I'm looking at your testimony, you indicate that you coauthored an article on wind turbine noise in Audiology Today.
Is that the article you were referencing with Mr. James that you --
A. That was the first article. That's not the same article as I included as my Exhibit 2.
Q. Certainly. You talk about chairing a technical work group; is that true?
A. Yes.
Q. Testifying before zoning boards and commissions; is

that also correct?
A. I have, yes.
Q. Coauthoring a blog on a website; is that also true?
A. The article, wind turbine -- well, Exhibit 2 is an article that is published on a website. I called it a blog. I'm not sure it's really a blog. It's really a -- it's like a journal of the hearing health -- technology and health matters. Okay.
Q. Okay. And then testifying in other matters; is that true?
A. Yes.
Q. And interviewing individuals?
A. I have interviewed individuals, yes.
Q. And then the article that you've coauthored with Mr. James that you do have is Exhibit 2-2; is that correct?
A. Sure. Yes.
Q. So other than your interviews with people where you were interviewing them and asking them about their complaints as you described earlier in your testimony, you're relying primarily on other people's information to have your opinions; is that true?
A. Well, to a large extent I have my own experiences visiting and talking with people and doing some more formal interviewing than I had mentioned earlier.

Q. Okay. As far as -- as far as the people that you interviewed, did you perform medical examinations of those people?
A. No.
Q. And you have identified a number of maladies that you think can occur due to wind turbines; is that true?
A. Yes. Most of which are documented -- all of which are documented in the literature.
Q. And that's your -- you reference those on page 5 of your testimony; correct?
A. Are you talking about the symptoms or the complaints or the health problems?
Q. Yes.
A. Okay.
Q. So, for instance, you note sleep disturbance, annoyance, headaches, dizziness, vertigo, nausea, those types of symptoms?
A. Absolutely, yes.
Q. People that don't live near wind turbines also can experience those same health effects; is that true?
A. Admittedly, yes. Of course.
Q. And there's multiple reasons why someone might suffer a headache, for instance. Is that also true?
A. Many reasons I understand, yes.
Q. So if someone is seeking treatment for certain

symptoms, part of the process, as we discussed earlier, would be to diagnose potential causes of that particularly symptom; is that true?
A. True.
Q. And you would also rule out other potential causes so that you can identify hopefully the true cause; is that correct?
A. Yes. And you're talking about individuals. I don't diagnose individuals. I talk -- my work is involved with what I call causation assessment or risk assessment, not individual diagnosis.
Q. No. That would be what a physician would do; is that correct?
A. Individual diagnosis, yes.
Q. And an audiologist does not have the training to rule out nonhearing-related symptoms as you've stated earlier; correct?
A. Nonhearing-related symptoms? Rule out?
We can take the patient's -- or client's or patient's word for it, like the physicians have to do, that they have a headache, for example, but we can't officially diagnose it.
Q. On page 5 of your testimony you indicate that landowners who participate in a wind project or sign waiver agreements with a wind company are less likely to

experience or report negative effects from turbines; is that correct?
A. I believe it is.
Q. So a person's perception of a wind project can influence their reaction to the wind project; is that true?
A. Of course.
Q. On page 6 of your testimony you state that you estimate around 15 to 20 percent of exposed residents will experience extreme annoyance and sleep disturbance; is that true?
A. Right.
Q. You don't cite a source for that statement in your testimony, do you?
A. There is no source that says the range is 15 to 25 percent. I was offering an opinion and also an estimate, and that is my estimate.
Q. In your testimony you indicate that you have been retained as an expert witness in the past; is that true?
A. Yes.
Q. Are you familiar with the case of Williams v. Invenergy, LLC?
A. Yes.
Q. And do you have in front of you what's been marked as I -- oh, A36?

A. I have it on the list. I'll have to find it. I'm sorry. I --
Q. I apologize. It's A36. It would have been sent to you by e-mail.
A. Oh, I think that was sent to Mr. James's e-mail address because I'm in his study in his home. I don't know --
Q. I apologize. So do we need to send it to your e-mail now?
A. I have my computer available to do that, if you will.
Q. Okay. We will send it to you.
A. I need to log in --
Q. Okay.
A. -- again.
I think I have it now.
Q. Okay. If you have it up, just let us know when you're ready.
A. It's open. I'll need to be leaning to the right to access it. Okay?
Q. Okay.
A. Okay.
Q. Were you retained by the plaintiff in this action to provide expert testimony on health effects of wind turbines?

A. Yes, I was.
Q. And was your testimony excluded by the court?
A. As I recall, it was. I heard -- I should say I was present to hear Mr. James's testimony, and I think we were -- I know we were involved in the same case, and for the same reasons my testimony was excluded, because of the Daubert hearing issue that we discussed.
Q. Okay. So if you'll look on page 14 of the -- and so the -- as I understand it, the page numbers are on the lower right-hand side.
A. Yeah. I'm almost there.
Q. Okay.
A. Okay. I have page 14.
Q. So if we look under A, Qualifications, do you see that subsection?
A. I do. Yes, I do.
Q. And I'll just warn you Cheri's looking at me so we have to be careful not to talk over each other. Cheri is our court reporter.
I see a line that says, "Punch's qualifications are impressive, to be sure." Is Punch you, Dr. Punch?
A. I would assume.
Q. And if you look down at the bottom of the page, it says, "However," and then up at the top of 14, "Punch is neither a medical doctor nor an epidemiologist who could

opine on the cause of Williams's symptoms solely on the basis of these qualifications. Therefore, for Punch's causation testimony to be admissible, he must support his causation opinion with reference to foundational literature which establishes the causal relationship through the Application of scientific knowledge."

Have I read that accurately?

A. You have.

Q. So if we turn then to page 15 --

A. Okay.

Q. And were you -- before I get there, were you present for the discussion of the reason -- I believe you said you heard Mr. James's testimony?

A. From another room. I was listening on another computer, yes, on the website.

Q. Did you hear the discussion and us read through the reasons why the Cape Bridgewater study was found by the Court to not support an opinion of causation?

A. I have to say I only caught part of that. I'm not fully aware of what was said in total.

Q. If I indicate that Mr. James agreed that I read the portions that were referencing the Cape Bridgewater study and the Dr. Kelly article and Paul Schomer's articles as not being sufficient to form a basis for causation, would you accept that based on what's in the document?

A. I would accept that you --
Q. Read it correctly.
A. I'm accepting that you read it correctly, yes.
Q. I won't repeat those then.
A. Okay.
Q. If we look at then on page 15 at the bottom on the left-hand column, it says --
And are you there? I should ask before I start.
A. Am I here? Yes.
Q. It says here, "Neither the Pierpont nor Schomer information constitutes an epidemiological study or shows a significant statistical relationship between turbine-generated infrasound and adverse health effects. The third article by Salt and Hullar supports its theory of causation by demonstrating that some low frequency sounds stimulate hair cells in the cochleas of guinea pigs. However, the Salt and Hullar article, like Punch's other exhibits, fail to demonstrate the statistical relationship between low frequency wind turbine infrasound and human health effects."
Did I read that accurately?
A. I wasn't actually reading with you. I have no reason to doubt that you read it accurately. Is that acceptable?
Q. That's acceptable.

And the Pierpont study is the book by Neenah Pierpont called Wind Turbine Syndrome? Is that true, that they're referencing?
A. True.
Q. And there's testimony in your -- in your Direct Testimony you have certain references to Mr. Howell's study on -- the acoustical study that was performed by Mr. Howell. Is that accurate?
A. I did make some comments on that, yes.
Q. Okay. And you made recommendations of certain distances and certain sound levels that you believe are appropriate; is that true?
A. I don't recall whether that was in -- with respect to Mr. Howell's testimony or someone else's, but I think that's -- that makes sense, yes.
Q. And I should --
A. I'll take it as true.
Q. I should restate that you did make those opinions not necessarily in response always to Mr. Howell but of your own determination?
A. That's right.
Q. And as I understood your testimony earlier, you indicated that you had offered a distance of -- a mile distance in addition to a dBA level because you didn't know how you would determine sound at a specific level.

Is that true -- or a specific distance. Is that accurate?

A. Yes. I said basically that the two don't correlate always because of differences like terrain and weather conditions and times of year. All kinds of things, variations, factors, can influence the noise levels that are picked up or expose people to certain noise levels at that particular distance.

In other words, different people at 1.25 may not experience the same noise levels. I didn't quite make that clear earlier, I think.

Q. Are you aware that -- as Mr. Howell did in this case, that it's possible to model in advance the estimated sound levels at specific distances from wind turbines?

A. As I said earlier, I don't do the model but I understand what modeling is about and I understand from other acousticians in addition to Mr. James that modeling is not always accurate.

MS. SMITH: I have no further questions at this time. I would move to strike all of Dr. Punch's testimony.

He does not have the qualifications to opine regarding health effects. Nor does he have the qualifications to opine regarding acoustical analyses of

wind project and appropriate wind turbine levels.

MR. DE HUECK: So from my perspective I'm going to stand by my prior ruling and apply it to Mr. Punch in that he may not testify as to health-related effects. However, I think he is allowed to testify as an expert to infrasonic sounds and inaudible noises from his experience and his training and research.

MR. ALMOND: May I have the opportunity to voir dire the witness specifically related to this court case that she was just referring to, as there's a pretty significant paragraph in there where the Court says -- "Dr. Punch is provided to give an opinion on causation that wind turbines produce audible noise which may disturb individuals and interfere with sleep," which is on page 16 of this court case we're going over that has not been discussed yet.

MR. DE HUECK: Can you point me to where you're --

MR. ALMOND: Page 16 of the Williams v. Invenergy.

MR. DE HUECK: Where is it?

MR. ALMOND: C, Admissible Subjects of Testimony. Just read that section.

MR. DE HUECK: Yeah. The first sentence, that's what I was trying to say. We're not going to talk about

adverse health effects.

MR. ALMOND: Of infrasound and not audible -- or low frequency sound pulses.

That paragraph goes on to say that, "Given his expertise as an audiologist, he is qualified to give opinions that wind turbines produce audible noise which may disturb individuals and interfere with sleep."

MS. SMITH: May I respond?

Because nothing that we've discussed here so far indicates that an audiologist tests for infrasound. They test for hearing loss. Hearing has to be audible. Therefore, I do not believe that he is qualified to speak regarding infrasound.

MS. EDWARDS: I'd just like to weigh in that, if permissible, I would like to further voir dire the witness on the same issue.

MR. DE HUECK: Go ahead.

MS. EDWARDS: Thank you. Mr. -- rather, Dr. Punch, are you familiar with the case out of -- or, rather, docket out of New York involving the Cassadaga Wind Farm permit?

THE WITNESS: I am.

MS. EDWARDS: Did you offer testimony in that case?

THE WITNESS: I did, yes.

MS. EDWARDS: Was your status as an expert challenged?

THE WITNESS: I don't think my credentials per se were challenged. I don't recall that they were.

MS. EDWARDS: Was there a motion to have your testimony excluded?

THE WITNESS: Well, if you have evidence that's true, your documentation would be better than my recollection. I don't recall it. No. I don't recall it.

MS. EDWARDS: Would it be accurate to state that the Public Service Commission found that it went to weight and persuasiveness rather than admissibility and allowed your testimony in?

THE WITNESS: That sounds consistent with what I recall. But I'm not -- I'm not a lawyer either, and I don't really fully understand the weight of those -- you know, the substance of those labels.

MS. SMITH: I would say that this -- we're really just doing legal argument through the witness because that particular case had a standard where they allowed -- they decided they didn't -- were not going to apply the traditional standards of admissibility and they allowed the witness in and it went to weight.

Here we have been applying the rules of

admissibility. They need to be an expert witness in order to testify. Otherwise, anyone could come up and give their opinions regarding articles on the internet, and we've been attempting to differentiate between the two.

MR. DE HUECK: Okay. So still applying a legal standard, here is my ruling. And it's similar to what we did earlier.

He may not talk about adverse health effects as, say, a doctor or another medical professional because clearly he is not. But he has clearly stated that he has been studying audiology for a long, long time, and he's got a background and a resume to support that.

On that note, I believe infrasound and other inaudible noises go hand in hand with his study, and he's clearly very fluent in that matter, which is beyond someone just someone talking about what they've read on the internet. So I believe his background will allow him to testify in terms of infrasound.

Additionally, I see what Reece has pointed out, and if you read the whole paragraph it makes sense to me. They're not saying that he can medically go on to expound about sleep-related health effects, but that if he has, such as the WHO, literature that talks about health effects, he's qualified to tell us about those reports

and what they said.

MS. SMITH: And just to be clear, as I understand -- I understand with the reading here that noise can cause sleep disturbance -- the relationship between noise and sleep disturbance was allowed by the court in this particular case.

So is your ruling that that's allowable? That's the extent of what's allowable?

MR. DE HUECK: That would be the extent.

MS. SMITH: Okay. Just wanted a clarification. Thank you.

MR. DE HUECK: So I'm considering it pretty limited testimony, avoiding anything that is assessing the risk of health problems.

MS. SMITH: All right. As long as we're stopped, I will offer that we'll do the same approach that we did before.

We will provide our proposed striking redaction of the testimony that's been submitted, and we'll look at the transcript as well.

MR. DE HUECK: Yes.

MS. SMITH: Thank you. I have no further questions then.

MR. DE HUECK: Okay.

Moving on for cross-examination to Mr. Fuerniss.

CROSS-EXAMINATION

BY MR. FUERNISS:

Q. Hello, Dr. Punch. You have referenced the World Health Organization. Is it true that they're currently reviewing their noise standards and looking in particular at noises from wind turbines?

A. That's true. I learned that yesterday.

MR. FUERNISS: Thank you. I have no further questions.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: No questions.

MR. DE HUECK: Ms. Pazour.

MS. PAZOUR: No questions.

MR. DE HUECK: Staff.

MS. EDWARDS: No questions.

MR. DE HUECK: Okay. Dr. Punch -- or, Mr. Punch, now we're going to subject you to Commissioner cross-examination. We're going to get you over to Kristie Fiegen.

Before she begins, I just have one question.

That Pierpont lady, she came up with infrasound and studied it and published some things. Would it surprise you to know that she had changed her position and determined that wind turbines do not carry infrasound? In other words, she backed off of her former

position that you would have relied on in that court case?

THE WITNESS: Well, I relied on a number of things. But it would surprise me, yes. It would surprise me.

MR. DE HUECK: So you have not heard that?

THE WITNESS: I have not.

MR. DE HUECK: Okay.

CHAIRWOMAN FIEGEN: I have none.

MR. DE HUECK: Vice Chairman Hanson.

No questions.

Commissioner Nelson.

COMMISSIONER NELSON: Dr. Punch, your Exhibit 2, which I think has been labeled as Intervenor-2b, the wind Turbine Noise and Human Health paper, on the bottom of page 2 --

THE WITNESS: I'm sorry. Is that Exhibit 2?

COMMISSIONER NELSON: It was Exhibit 2 on your testimony.

THE WITNESS: Right.

COMMISSIONER NELSON: It's been labeled as 2b.

THE WITNESS: Well, they're numbered by letters and then a number.

COMMISSIONER NELSON: Yep. I-2b. And if you go to the second page.

THE WITNESS: Okay.

COMMISSIONER NELSON: Bottom of the second page, probably second to the last sentence that starts, "In fact."

THE WITNESS: Just getting to the second page. Okay. Yes. Okay.

COMMISSIONER NELSON: "In fact, much research and some already rendered legal decisions so convincingly that some segments of the population suffer damaging effects from exposure to wind turbine noise."

Can you cite for me the legal decisions that you're referring to there?

THE WITNESS: I don't think they're necessarily the legal decisions that were made in cases I've been involved with. They're cases that I've discussed with Rick James, and he's discussed some cases of others who he knows -- other acousticians who have been involved in these cases.

I cannot cite at this point -- I was basing that on information I had then, but I don't recall what I was basing it on at this point.

I think probably I was thinking for sure about the Wisconsin case. We mentioned the Shirley Wind case in this article, in fact. This was written in 2015 or '16. And that case was ongoing since, I don't know, 2012

at least, if not earlier.

So the fact that it had been ruled a human health hazard was a legal decision in a court case essentially, in a hearing at least.

There are other cases in Europe. There are cases now that I didn't know about then in Canada, particularly Ontario, Australia, I think, Ireland where there are real community pushback -- there's real community pushback to install turbine operations.

And even in Canada I think -- my understanding is that in the province of Ontario the new Premier, Doug Jones -- excuse me. Doug Ford was elected in large part because of the community's complaints and upset with respect to all the turbines that are going up in that area of the country.

COMMISSIONER NELSON: Yeah. But that has nothing to do with a convincing legal decision.

So I want to go back to your reference to the Shirley Wind Farm issue where that area was declared to be a public health area.

THE WITNESS: Human health hazard, yes.

COMMISSIONER NELSON: Okay. And that decision was made by a court of law; is that correct?

THE WITNESS: Well, it was made by the Public Service Commission, I think, based on evidence from the

Department of Health. I was not involved in that case. Let me make that clear.

COMMISSIONER NELSON: But that's the one that you're referring to in this paper; correct?

THE WITNESS: Okay. Correct. I believe so. I believe so.

COMMISSIONER NELSON: No further questions.

THE WITNESS: Again -- okay.

MR. DE HUECK: With that, Mr. Almond, do you have any redirect?

MR. ALMOND: No.

MR. DE HUECK: Prevailing Winds, do you have any recross based solely on Commissioner Nelson's question?

MS. SMITH: No.

MR. DE HUECK: Staff.

MS. EDWARDS: No.

MR. DE HUECK: Okay. Mr. Punch, thank you for your testimony today. You may be dismissed.

(The witness is excused.)

MR. DE HUECK: And moving on, Mr. Almond, you may call your next witness.

MS. AGRIMONTI: Mr. de Hueck, I'm sorry. I just realized the time. We're hitting 5:30, and I know we'll go until 7:00. I didn't know if this was the right time to break, or if you had a different time in mind.

(Discussion off the record.)

MR. DE HUECK: Reece, why don't you go ahead. Call your next witness. We'll at least get your portion done and then think about a break before cross-examination.

MR. ALMOND: Intervenors call Paul Schoenfelder.

Paul Schoenfelder,

called as a witness, being first duly sworn in the above cause, testified under oath as follows:

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Why don't you introduce yourself to the Commission.

A. My name is Paul Schoenfelder. I live at 40228 296th Street, Wagner, South Dakota.

Q. And do you own land in or around the project footprint?

A. I do.

Q. How long -- sorry.

A. Sorry. Own a farm together with my wife. I in 2000 received a deed to a portion of what's my wife's family farm.

Q. How many acres do you own?

A. 160.

Q. And how long did you say you've lived there?

A. My wife grew up on the family farm. We moved to

A. Well, I have -- yeah. I think I have about 1,120 acres, and my brother has about 840 acres, I think. There's about 1,900. And we own that one piece together. So roughly the two of us -- but we each own our own land, but together we own about 1,985 acres.

Q. Okay. And at some point were you asked to sign up to participate in the project?

A. Yes. I was asked to sign up for the Prevailing Winds project in the spring of 2015.

Q. And how were you asked to sign up?

A. Well, I was called by Ron Hornstra, and he wanted to make an appointment, which they did. And so him and Roland Jurgens came to our house. I think it was in -- I think it was in March of '15.

Q. And if you'd take a look at Exhibit I-16 for me.

A. Okay. Yes. I've got that.

Q. And tell me what Exhibit I-16 is.

A. Well, they brought this document with them the day they were at my house, and this was their, shall you call it, addendum or estimate or projection of what my payment would be and how it would work out. And for some reason they put my brother's land and my land together because I think someplace on here it says 1,985 acres.

But anyway -- yeah. Right here on the bottom, long table on top. It says 1,985 acres. And they did all the

did the draft -- or excuse me. The Article 17. And so this was kind of leading up to that and advocating for setbacks through that Article 17 process. That's what happened in 2015.

Q. And during the Article 17 process was a state standard utilized during these meetings?

A. Yeah. It was -- at all of our meetings we were talking a two-mile setback. And I've, you know, written some stuff in my prefiled stuff that would explain why we thought we wanted two miles. And, you know, it's very similar to what Paul testified to just a little while ago.

You know, the first meeting it sounded like they were listening. But the second meeting not so much. And by the third meeting it's like they didn't even hear what we said.

I mean, we took them volumes and volumes of stuff to read, and, I mean, it just -- they were being highly persuaded, highly influenced by, in my opinion, Prevailing Winds, District III. And they had their mind set up on this state standard, 1.1 times, 1,000 feet from the house, and there was nothing you could say, nothing you could do, nothing you could show them to make any difference.

And going through the process, the hearing process

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

Transcript of Hearing
October 12, 2018
8:30 a.m.
Volume IV, Pages 989-1183

BEFORE THE PUBLIC UTILITIES COMMISSION,
KRISTIE FIEGEN, CHAIRWOMAN
GARY HANSON, VICE CHAIRMAN
CHRIS NELSON, COMMISSIONER

COMMISSION STAFF
Adam de Hueck
Karen Cremer
Greg Rislov

A P P E A R A N C E S

Mollie Smith and Lisa Agrimonti,
appearing on behalf of Prevailing Wind Park;

Reece Almond,
appearing on behalf of Intervenors Gregg Hubner, Marsha Hubner, Paul Schoenfelder, and Lisa Schoenfelder;

Sherman Fuerniss,
appearing pro se;

Karen Jenkins,
appearing pro se;

Kelli Pazour,
appearing pro se;

Kristen Edwards and Amanda Reiss,
appearing on behalf of Staff.

Reported By Cheri McComsey Wittler, RPR, CRR
Precision Reporting, 213 S. Main, Onida, South Dakota

Mr. Almond, when everyone settles in, you'll begin your direct examination.

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Scott, can you introduce yourself to the Commission.

A. Yeah. My name is Scott Rueter, and I'm from Lake Park, Iowa. I live at 905 Lakeside Avenue.

Q. And Lake Park, Iowa, where is that at in relation to Sioux Falls?

A. About 70 miles east.

Q. And how long have you been residing at your current residence?

A. Nine years.

Q. And before you lived at your current residence where did you live?

A. I lived at 1341 U Avenue. That was in -- not in town but a rural address. It's Harris, Iowa.

MR. DE HUECK: Before we go any farther, I think the witness needs to be sworn in.

THE WITNESS: We did that already.

MR. DE HUECK: Did we? Apologies.

Q. Do you have Exhibit I-8 open in front of you?

A. Yeah.

Q. And is that a Google Maps view of your former residence of 1341 U Avenue?

A. Yes, it is.
Q. And are there wind turbines located around your former residence?
A. To the south there's six of them in about a mile-and-a-half stretch.
Q. When were those turbines built?
A. 2008, I believe.
Q. And that 1341 U Avenue property, how long did you live there?
A. How long have I lived there?
Q. How long did you live there?
A. About 45 years except for a couple years where I was gone to college and -- yeah. About 45 years approximately.
Q. How long has that property been in your family?
A. Oh. Before I was alive. I'm not sure. I suppose -- my dad farmed it forever. I'm going to say at least 60 years.
Q. And do you still own the property?
A. I do now, yes.
Q. And does anyone reside at that house located on the property?
A. No. Not currently.
Q. Approximately how far is the closest turbine to that residence of the 1341 U Avenue?

A. 987 feet.

MS. AGRIMONTI: Mr. de Hueck, I'm going to interpose an objection to the continued testimony of this witness.

He's established that he is talking about a wind farm in Iowa and property in Iowa, which is not relevant to the proceeding. Therefore, I would move to not allow any additional testimony.

MR. DE HUECK: I will overrule your objection and allow Mr. Almond to continue.

Q. How tall are the turbines that are close to your property?

A. Approximately 462 feet to the tallest part of the blade, I believe.

Q. And do you own property that has turbines on it?

A. Yes, I do.

Q. And what wind project is that?

A. Osceola Wind Power it's called right now. It's owned by NextEra. When it was originally built it was built by Clipper and then they went bankrupt and now it's owned by NextEra is the name of it.

Q. And how many turbines are on property that you own?

A. Two.

Q. And when were those put on your property?

A. 2008.

Q. Is that the same wind development that's associated with the towers here south of your former residence?
A. Yes.
Q. Why did you move from your former residence?
A. Why?
Q. Yeah.
A. Well, after they put the turbine up I couldn't sleep anymore, and I didn't have any choice. I slept for probably an hour and a half a night for almost a year, and my body was shutting down. I could feel it. I lost 35 pounds. Life's too short to live by a wind turbine that close.
Q. So how long did you live at this residence that you lived at for 46 years with a wind turbine before you decided to move?
A. I would have moved the next day, but it takes a while for all of that to happen. I lived there for about a year and three months before I actually got a house bought.
Q. In that year and a few months did you notice any of your sleep disruption or symptoms decline at any point in time?
A. Did it decline?
Q. Yeah.
A. My sleeping?

Q. No. Did your sleep disruption decline? Were you able to sleep better as the time progressed?
A. The only time I slept good is if the wind turbines didn't turn at night. I mean, if there's no wind.
Q. And under what conditions were the turbines the loudest?
A. Always in the wintertime is a lot worse. I'd describe it as a lake effect. If there's ice on a lake and somebody's talking or you're out fishing and someone's talking, it travels.

In the wintertime it has the same effect. If there's ice on the ground or there's snow on the ground, there's nothing to stop that noise. It's a lot worse. That and high humidity days.
Q. And have you gotten used -- first, what kind of sound do these turbines make?
A. Oh, you hear a whooshing noise all the time. At the worst part of it, it sounds like a jet airplane ready to take off and it never leaves. That's probably at the worst. It doesn't always sound the same.

It's constant. That's the problem. It never goes away. It's 24/7 if that turbine is going. Some days it can be better. Some days it can be worse. I would say the -- the worst is actually when it's about a 10- to a 15-mile-an-hour wind. You wouldn't think so. You'd

think at a 40-mile-an-hour wind it would be worse. But you hear all the other noises at that time, trees, everything else.

I'd say probably maybe two-thirds of the year is the 10- to 15-mile-an-hour winds.

Q. And did you live with anyone else in the house during that little over a year period?

A. My wife and two kids.

Q. And did they have any difficulties sleeping?

A. My wife did. Not to the extent that I did.

Q. Was she --

How did the disruption of sleep affect your quality of life?

A. Well, if you don't have your health, you don't have anything. And my health was declining so fast within a year. I went to a doctor and I went there and he says --

Q. Well, you can't talk about what your doctor said.

A. Okay. Well, I mean, I went there. It's hard to describe. You don't have your health, you have nothing. And if you can't sleep -- I can say it's kind of like going to a prom without the dancing and stuff. You're up all night and you can handle that for a night or two but after that it really wears on you.

And I slept for about an hour and a half for almost a year unless that turbine was shut off or I was gone. I

went camping a lot that year just to get away from it.
Q. And once you moved to your current residence did your sleep get better?
A. Yes.
Q. And how do you sleep now?
A. Like a baby.
Q. Has your health improved?
A. Yes.
Q. Significantly?
A. What's that?
Q. Significantly?
A. Oh, yeah. Yeah.
Q. Do you -- I mean, you testified earlier that you still own that property. Do you still go back there?
A. Yeah. That's where I farm. I'm a farmer, and that's where my machine shed is so I have to.
Q. And when you go back there do you notice any physical symptoms that come up?
A. Oh, yeah. You get -- I get a headache if you're there long enough for the day. Actually from my house where I live now I can see the turbines, which is about six miles away as the crow flies, and I can tell if they're turning or not.
I watch the weather to see if they're turning. And I get all my equipment ready pretty much in August for

the next year because that's usually when the winds are the lowest in the summertime.

I get everything ready a lot faster now than I used to because once they turn on -- I can't be there all day when they're on. It's too close. It's too loud. There's too many of them.

Q. So you take precautionary steps so you don't have to be at your farmhouse as long as you otherwise would be?

A. Oh, yeah. Absolutely.

Q. And you say you signed up for this project?

A. Yes, I did.

Q. And how many turbines did you say you have on your land?

A. Two.

Q. Are they both functioning?

A. No. Last June -- June of 2017 one of them caught on fire and burned down to the ground.

Q. And I'm going to show you --

A. Or not to the ground. The tower is still standing there, but the blades burned down.

Q. I'm going to show you what has been marked as Exhibit I-10.

MS. AGRIMONTI: And I will object to the introduction of I-10 in advance. It's an instance of an event in another state with a turbine that's different

than what's being proposed here.

MR. DE HUECK: And I will overrule your objection again and just point out that I believe the probative value of this evidence outweighs any prejudicial effect that it may have.

(The video is played.)

Q. And is this the turbine that's on your property?

A. Yes, it is.

Q. And when was this occurring?

A. June 4 or 5 of 2017. I can't remember what day.

(The video is concluded.)

Q. So that happened last summer. Has that turbine been fixed yet?

A. No.

Q. And if you turn to Exhibit I-12 in front of you, is Exhibit I-12 a photo of what the turbine on your property currently looks like?

A. Yes.

MR. ALMOND: No further questions. Thank you, Scott.

THE WITNESS: Yes.

MR. DE HUECK: Cross-examination.

Prevailing Winds.

MS. AGRIMONTI: Yes. Thank you.

CROSS-EXAMINATION

BY MS. AGRIMONTI:

Q. Good morning.

A. Morning.

Q. What model turbines were placed on your land on your property in Iowa that you were just showing in the video that was put out?

A. They were made by Clipper, I believe.

Q. Do you know the size of those turbines?

A. 2.5 megawatts.

Q. And who is the developer who was operating those turbines most recently?

A. NextEra.

Q. How far away from your home is the nearest turbine?

A. Where I used to live?

Q. Where these two turbines are located and the residence -- let me just make sure I understand.

There are two turbines on property where you used to live; is that correct?

A. No. I never lived there.

Q. Okay. You never lived on the property with the two turbines?

A. No.

Q. All right. The house that you moved from, how close was the nearest turbine?

A. 983 feet. Or 85. Whatever. I'm not sure.
Q. And is that part of the same project operated by Clipper at that time?
A. Yes. But that's -- they're not on my ground.
Q. They're not on your ground; they're near your ground?
A. Correct.
Q. Do you know what the decibel level was at your house the night the project first went into operation?
A. About 18. Before the turbines?
Q. Yeah. I've asked a bad question. Let me try again.
You mentioned that you would have left your home the first night if you were able to. Do you remember that?
A. Yes.
Q. What was the sound level if you had measured -- did you measure the sound level that first night from the operating wind farm?
A. No. I didn't measure it that night.
Q. And you haven't provided any medical records in this proceeding regarding the ailments that you talked about; is that right?
A. No.
Q. You commenced a lawsuit against the owner of the wind farm in 2010 claiming a nuisance; is that right?
A. Correct.

Q. Did you also assert that the wind farm had caused the medical issues that you've identified here today?
A. What was the question?
Q. In that lawsuit did you make claims about adverse health effects due to the wind farm?
A. Yes.
Q. I'm going to hand you a document that's been identified as A41.
Mr. Rueter, did you bring that lawsuit along with your wife, Tricia Rueter?
A. Yes.
Q. And is this a document you have seen before?
A. I didn't read through it all.
Q. Please take your time.
Yeah. Is this the Order from the Court of Appeals of Iowa affirming the dismissal of your case?
A. Yes.
MS. AGRIMONTI: I have no further questions. I would move admission of A41.
MR. ALMOND: No objection.
MR. DE HUECK: It will be admitted. Thank you.
And I'm sorry. Did you say no further questions?
With that, Mr. Fuerniss, questions.
MR. FUERNISS: No questions.

MR. DE HUECK: Ms. Jenkins.
MS. JENKINS: No questions.
MR. DE HUECK: Ms. Pazour.
MS. PAZOUR: No questions.
MR. DE HUECK: Staff.
MS. REISS: Yes. Thank you.

CROSS-EXAMINATION

BY MS. REISS:

Q. I'd like to bring your attention back to the video we watched with the malfunction of the turbine. Do you recall that video?
A. Yes.
Q. Were you present when that incident occurred?
A. No, I wasn't.
Q. Do you know how far the turbine fell -- or the turbine blade fell from the base of the turbine in that incident?
A. How far it fell from where?
Q. From the base of the turbine.
A. Well, it fell from the top of the tower to the bottom. It hit at the bottom. I don't know how far, no.
Q. You don't know the distance that it rested after it fell?
A. No. I mean, it fell towards the bottom of the turbine, but it scattered stuff all over my field.

Q. Okay. Did the blade fall into your field?
A. Yes.
Q. Did it damage any crops?
A. Yes.
Q. Do you have any knowledge of whether the local fire department responded to this incident?
A. They were called, but they were told that they could not come out there because it was too dangerous.
MS. AGRIMONTI: Objection. The witness is testifying to what the fire department may have been told. So, you know, probably the better way to do this is to strike and I'll maybe do that next time but the witnesses aren't trained to know that they shouldn't be talking about what other people say so I object.
MS. REISS: Can I just interject that this is extremely relevant as a safety concern?
MR. DE HUECK: Yeah. But I think you can couch it in terms of questions that don't ask him to -- just more or less his present sense impression as to did the fire department show up? Yes. How long did they respond? What did they do when they got there type of thing.
MS. AGRIMONTI: Mr. de Hueck, I believe the witness said he wasn't there, and he didn't take this video.

MR. DE HUECK: Right. So his question should answer in the negative.

MS. AGRIMONTI: Thank you.

Q. Can I just ask again, are you aware of whether the fire department, the local fire department, responded to this incident?

A. I did not see them there. I got a call in the morning from one of -- Clipper Wind Power people told me that my turbine was on fire. I did not actually see the fire department there.

Q. Okay.

A. If that's what you want to know.

Q. Okay. And I believe you may have answered this already, but how close is the nearest turbine to your current residence?

A. To where I live now?

Q. Yes.

A. Probably 4 miles as the crow flies.

Q. Okay. And are you still experiencing symptoms at your current residence?

A. As far as sleep?

Q. Yes.

A. No.

MS. REISS: No further questions.

MR. DE HUECK: That brings us to Commission

questions.

Commissioner Nelson.

COMMISSIONER NELSON: Thank you. You've talked about at your former residence -- and I'm looking at Exhibit I-8.

I see the six turbines that you referenced. You've indicated the distance to the nearest one. Can you tell us the distances to the other five turbines?

THE WITNESS: It's not on there, is it?

COMMISSIONER NELSON: No.

THE WITNESS: The closest one is like 980 some feet. I think the next one is between 12 and 1,400. There's another one around 1,700. They're all within probably three-fourths of a mile of my house. I don't know the exact distance. I mean, I could get that. I don't have it with me today.

COMMISSIONER NELSON: And the two turbines that are on your property are not shown on I-8; is that correct?

THE WITNESS: That's correct.

COMMISSIONER NELSON: The turbine that was disabled by the fire that we just saw, are you still receiving easement payments for that?

THE WITNESS: No. I haven't got anything.

COMMISSIONER NELSON: And per your easement

contract should you still be receiving payments?

THE WITNESS: They say you get a minimum of $1,000 until they take the whole thing down. But they don't -- they don't put anything on the thing so you can't really tell if you're getting that or not.

I have not got the revenue. I've gotten half the revenue of what I used to, put it that way, so I'm assuming I'm not getting anything.

COMMISSIONER NELSON: Okay. I'm confused by your response. So let me ask it again.

THE WITNESS: Okay.

COMMISSIONER NELSON: The easement agreement that you have with what is now NextEra.

THE WITNESS: Right.

COMMISSIONER NELSON: I'm assuming that requires them to make annual payments; is that correct?

THE WITNESS: Quarterly.

COMMISSIONER NELSON: Quarterly payments.

THE WITNESS: Yes.

COMMISSIONER NELSON: Are you still receiving quarterly payments for the turbine that burned?

THE WITNESS: No. There's no revenue. It's not turning so there's no revenue.

COMMISSIONER NELSON: So the easement agreement you signed was based entirely upon revenue; is that

correct?

THE WITNESS: Yes. Except for the $1,000 minimum per turbine. If the turbine was put up and never turned for a whole year, I get $1,000. But, otherwise, when it does not turn, I do not get the revenue.

COMMISSIONER NELSON: Does your -- does the easement agreement that you signed have provisions for removal of turbines?

THE WITNESS: It does not say that in the thing but -- in the easement. They say they're going to take care of it, but nothing's happened.

COMMISSIONER NELSON: When you say the easement agreement says that they will take care of it, what do you mean by that?

THE WITNESS: The easement doesn't say that. The wind company says -- when they originally came in, said if something happens we'll take the turbines down. Nothing was ever done. The county let it slide, and I've heard that it could take up to $250,000 per turbine to remove them.

COMMISSIONER NELSON: So the easement agreement that you signed does not have any provision for removal of the turbines.

THE WITNESS: Correct.

COMMISSIONER NELSON: No further questions.

MR. DE HUECK: Chairman Fiegen.

CHAIRWOMAN FIEGEN: No questions.

MR. DE HUECK: Commissioner Hanson.

COMMISSIONER HANSON: Good morning --

THE WITNESS: Good morning.

COMMISSIONER HANSON: -- Mr. Rueter. Thank you for making the voyage up to Pierre.

THE WITNESS: Yeah.

COMMISSIONER HANSON: A little bit of rain here.

Can you tell us -- you spoke of sleep deprivation, considerable. What other symptoms did you experience, or were there other?

I should ask, were there other symptoms that you experienced, and, if so, what are they? Or were they?

THE WITNESS: You feel anxiety. There's conflict between you and -- I wouldn't say me and my kids. Me and my wife. My wife did not want to move at all. She cried the whole day we moved. I almost got divorced over it.

Physical symptoms, I would say it's mostly sleep for me. The little lights on top don't bother me at all. Some people it does. Everybody -- it bothers people differently.

I would say beings these turbines are so close it's the shadows is what really bothers you during the

day. Because there's a line of them to the south of me, and certain times of the year where the sun is, them shadows will go for almost a mile, depending on where the sun's at.

And you see them, and they just -- you see them in your house. It's like you're turning the light switch off and on continuously for probably about 15, 20 minutes in the morning, 15, 20 minutes in the afternoon.

And then if you're outside, it goes on forever. When you're driving a combine you see those shadows and it -- people that do tiling are in the ground. I've seen a guy jump out of a hole because he thought the hole was going to cave in because that shadow goes by so quick and he thought -- you know, he was scared for his life.

You don't ever get used to that. You don't ever get used to the noise.

I was fortunate enough I had enough money that I could build another house -- or I didn't build it. I bought it. But, you know, like I said, I went -- I had the symptoms, and you don't have nothing unless you have your health. And it's not --

You asked me what symptoms I had. It's not really -- it's noise and it's the shadows but it's a low frequency noise. It's a -- I don't know how to explain it. It kind of gets into your body. I think the only

way you could get away from that is if you lived underground, if you had your house -- like you lived -- in fact, if I go down in my basement, sometimes you could not hear it as much.

But at the farm I didn't have a finished basement so I didn't want to sleep down there. But that's really the only way I think you could get away from this infra raised -- or I don't know what they call it. Low frequency noise. That's the part that really pulls your body down.

COMMISSIONER HANSON: Thank you for sharing that.

Do you know how many hours the flicker -- how many -- would you hazard a guess as to how many, excuse me, hours during the year that you actually experienced the shadow flicker on your property?

THE WITNESS: In the house or where?

COMMISSIONER HANSON: Yes. Affecting the residence, yes.

THE WITNESS: Affecting the residence. In the house I would say is probably 20 minutes in the morning every day, 20 minutes every night when the sun's out. I mean, it's cloudy you don't get it as much.

COMMISSIONER HANSON: Sure.

THE WITNESS: Outside on my residence walking

around the farm I'd say up to an hour and a half every day.

COMMISSIONER HANSON: Okay. Thank you.

Ms. Reiss was asking you some questions pertaining to the distance the blade fell. Via the video, we saw that the blade hit the ground and then it fell away from the tower itself.

And we understand that this was not the same operator as the Applicant is and it's in a different state and there's some different laws pertaining to it and different agreements and things of that nature.

But from my own curiosity and future reference in dealing with wind farms and different applicants, could you tell me -- I'll guess that you possibly know the length of the blades on that turbine. If not, just say so.

THE WITNESS: I could get it. I don't know it offhand.

COMMISSIONER HANSON: Okay. And when it fell it fell away from the base so that it extended almost the length of the blade. The blade was damaged so it fell away from the tower a certain distance.

And since you don't know the length of the blade, are you aware of how far away from the base the end of the blade was?

THE WITNESS: No, I don't. But I know there was stuff that was in my field, remnants from it over a quarter of a mile away.

COMMISSIONER HANSON: Okay. That was going to be my last question as to the debris that fell from that blade and possibly debris that came from the fire itself and lofted.

THE WITNESS: Right.

COMMISSIONER HANSON: Fiberglass or whatever to -- and your testimony is that debris was a quarter-mile away?

THE WITNESS: Yeah. There was some a quarter-mile away.

COMMISSIONER HANSON: Okay. And from the blade itself, what had shattered, and how far was that debris away?

THE WITNESS: That's what I was talking about.

COMMISSIONER HANSON: That's the quarter-mile?

THE WITNESS: What were you talking about?

COMMISSIONER HANSON: Well, I'm assuming and I may be wrong --

THE WITNESS: The tower never fell. Yeah. Okay.

COMMISSIONER HANSON: But as a kid I burned plastic, and there were pieces of plastic that would --

you know, you're working with your models and such and some of that plastic floats around and then your mother gets on your case for it.

So I'm wondering from a larger fire, Fiberglass, if that's carried for a distance. But you're not aware of that.

THE WITNESS: I don't know. All I know is if it would have been a 30-mile-an-hour wind day out of the south or the north or the east or the west, it would have burned thousands of acres.

COMMISSIONER HANSON: Okay. That's interesting. And perhaps not for this particular case directly, but I appreciate the information.

Thank you very much, sir.

THE WITNESS: Yes.

COMMISSIONER NELSON: I want to -- just so that I understand your testimony about the shadow -- shadows on your former home, 15 to 20 minutes a day, morning and evening year-round?

THE WITNESS: It depends on if the sun's out. I mean, it's --

COMMISSIONER NELSON: All right. If the sun was out 15 in the morning, 15 in the evening, year-round; is that correct?

THE WITNESS: It all depends on -- I can't

remember. It's more in the winter, I think. It depends on where the sun's at according to where they place these wind turbines on your ground.

If these wind turbines were on the north side of my house, I probably would never get them in my house. But they're all to the south and there's six of them there so as the sun comes up, and it has to get up quite a ways before it quits, and then it comes down again at night.

So I would say, no, it's not every day, but when it's there it's very noticeable.

COMMISSIONER NELSON: Thank you.

MR. DE HUECK: Any redirect, Mr. Almond?

MR. ALMOND: No.

MR. DE HUECK: Cross based on Commission questions?

MS. AGRIMONTI: No, thank you, Mr. de Hueck.

MR. FUERNISS: No.

MS. JENKINS: No.

MR. DE HUECK: Ms. Pazour.

RECROSS-EXAMINATION

BY MS. PAZOUR:

Q. You have farm ground; right?

A. Yes.

Q. You combined it, or is it like hay ground?

A. I combine it.
Q. I guess my question is when you're combining it could some of the debris go along with the feed?
A. Yes. It has. I farm about 1,100 acres, and I pick up more stuff around those two turbines than I do on the rest of my 1,100 acres.
Q. So it could get into like livestock, be consumed.
A. Yeah. It would have to go into the grain tank and not get thrown out the back of the combine. But it's possible, yes.

MS. PAZOUR: Thank you.

MR. DE HUECK: Staff.

MS. REISS: No questions.

MR. DE HUECK: Thank you for your testimony today. You may step down.

(The witness is excused.)

MR. DE HUECK: Mr. Almond, you may call your next witness.

MR. ALMOND: Vicki May.

Vicki May,

called as a witness, being first duly sworn in the above cause, testified under oath as follows:

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Vicki, can you introduce yourself to the Commission.

A. Yes. My name is Vicki May. I live at 88737 500th Avenue, Lynch, Nebraska, which is approximately 50 miles south of Wagner.
Q. And do you live near a wind farm?
A. Yes. I've lived next to the Grand Prairie Wind Farm, which is a 200-turbine, 400-megawatt wind farm.
Q. And how tall are the turbines in that wind farm?
A. When the blade is at the 12 o'clock position they're 443 foot tall.
Q. And how close do you live to the nearest turbine?
A. The nearest turbine from our home is one and three-eighths miles.
Q. And if you could flip to Exhibit I-4 for me. Is that a Google Maps view of your residence?
A. Yes.
Q. Is your residence where the red pin is at at the top of that map?
A. Yes.
Q. And where are the turbines at in relation to that red dot?
A. They're located to the south, the southeast, and the southwest of our home.
Q. And can you count the number of turbines there on that map?
A. Oh, gosh. I believe I can see 12 on this particular

picture.
Q. And are you able to see the turbines from your residence?
A. Yes. Out my south great room windows.
Q. And did you --
A. From my porch.
Q. Did you and your husband prepare some videos to show what that looks like?
A. Yes.
Q. I'm going to show you what has been marked as Exhibit I-6.
MS. AGRIMONTI: Mr. de Hueck, I believe there are several exhibits. Mr. Almond may be able to help me here on the numbers. It's I -- can read behind me. I-6a through E and No. 7.
MR. ALMOND: I-6a through E is what I intend to show.
MS. AGRIMONTI: Not 7. Okay.
So to extent those are video clips about property in another state, we would object as being not relevant.
MR. DE HUECK: Again, I'll stick to my same ruling on the prior video, but your objection is noted.
Q. As I open up the video, can you just explain to the Commission what it is we're looking at?

(The video is played.)

A. This is the view from the corner of our screen porch, which sits on the east side of our residence. So this is my view to the south and the southeast.

Q. And that was Exhibit I-6a. I'm going to open up Exhibit I-6b. Can you explain to the Commission what this video is?

(The video is played.)

A. This is up at the barn, which is north of our house but gives you an idea of what we see.

Q. And now Exhibit I-6c.

A. This is up on our alfalfa field which sits north of our place. Our place is down in those trees that you see there. But it gives a broader range from that particular field. If you pan from west to east, we have a view of 65 of the 200 turbines.

Q. And you said your house is located within a band of trees. When that comes up can you kind of identify where in the video it is that your house is located at?

A. Sure.

It would be in that group of trees there that you just panned by.

Q. And Exhibit I-6d.

(The video is played.)

A. Okay. This is just another view. This is from the

backside. We have a 10-acre pond on our property, and, there again, those trees that you see there are where our home is located, in those trees.
Q. We don't --
A. This is -- I didn't realize I took that many videos.
Q. When did the project that we just looked at get built and become operational?
A. It became -- it started in the late fall of 2014 where they put in a few of the bases. The main project was built throughout 2015 and became fully operational in the third week of October in 2016.
Q. And prior to it getting built, were you opposed to the project?
A. No. We were not. In fact, my husband is on the planning and zoning for our local county. We had no animus against the project. We knew our view shed would possibly be changed forever, our night sky would be changed, but what we had no idea was the sound.
Q. You said your husband was on the Planning Commission. Did that Commission consider the project?
A. Yes, they did. And it passed unanimous and was then presented to our Board of Supervisors, which moved the project forward.
Q. So your husband voted in favor of the project?
A. He had some concerns. He knew the project was going

to come in close to our place. We weren't -- let me just say the information that was provided when they needed to issue -- when they came before them for the CUP was not final. There were no final site layouts so --

Q. Let me stop you there.

A. Okay.

Q. Let's not get into the Application process of that.

A. All right.

Q. But your husband did vote in favor of this project?

A. Yes, he did. After asking quite a few questions because he knew it would impact us.

Q. And at one and a third mile are you able to hear the turbines at your residence?

A. When the wind is out of the south or the southeast, yes.

Q. What about when it's out of the north?

A. No. You can hear them slightly, maybe a slight whoosh, whoosh, but nothing like when it's out of the south or the southeast.

I'm sorry.

Q. That's fine. Take a moment.

A. I'm fine.

Q. And when the wind's blowing out of the south or southeast are you able to hear the turbines inside your home?

A. Yes.
Q. When did you first notice that sound?
A. I can tell you the exact time and date. It was October 29. It was a Sunday night at 7:36 in the evening. We were watching Madam President on TV, and we looked at each other and said What is that sound? We had never heard that sound before.

I looked at my husband, and I said, It's not those turbines, is it? And we went out on our front porch, and it was the turbines.
Q. And does that same sound persist every time there's a south or southeast wind?
A. Yes. Depending on the wind speed.
Q. And describe -- describe the sound for the Commission.
A. At our home the sound -- the most often sound we hear is like a jet plane revving up to take off, but that plane never leaves. And if it roars long enough, then we get what I'll call a pulsating sound.

To me if you've ever washed any of your kids' tennis shoes and then had to dry them in the dryer so they can get to a sporting event, you get that thump, thump noise after a certain wind speed.
Q. And has the noise from the wind turbines affected your ability to sleep in your home?

A. Yes.
Q. Tell us about that.
A. If you can get to sleep, it's very limited sleep. Our bedroom is on the south end of our house, along with our great room so those are the rooms we spend our most time.

It's not uncommon in the summer especially when we have the most south and southeast wind that I will go eight, nine nights in a row without sleep.

I've had to find different places in my house now that I can sleep. But, there again, it's not a full night's sleep. It's not a restful sleep.
Q. And then when the wind does change directions are you able to get better sleep?
A. Much better. And I thank God for those days.
Q. How has your inability to sleep affected you?
A. I've learned that if I have an appointment or somewhere I need to be after a stretch of when I don't sleep, I reschedule those appointments because it's become dangerous for me.

Twice I have fallen asleep while driving after a stretch of not sleeping, and I fear for my life and for somebody else's. So it's drastically changed my life.

I take alternate routes because we have some turbines that are very close to the road, 183 foot, and

that shadow flicker, when it's going across there, it's like the road is waving like this (indicating). So changed that.

I own a -- it used to be a very successful home-based business. My home-based business has suffered because of the turbines.

Q. You say "because of the turbines." You mean because of the lack of sleep or --

A. Correct. But I don't need to be a doctor to know that the reason I'm not sleeping is because of the turbines.

Q. And how has that affected you physically? Have you experienced any symptoms just aside from not sleeping?

A. That's a loaded question to answer. When you don't sleep for eight or nine nights in a row it messes with you in ways that, you know --

Have I been to the doctor to explain, you know, why I'm feeling that? No. I'm not going to spend more of my good, hard-earned money to know why I'm not sleeping. And I don't mean to be rude or coy about it, but I know why I'm not sleeping.

We don't plan on staying there long enough for there to be permanent health effects, I feel.

Q. Are you -- do you leave your property at times and go elsewhere and sleep?

A. There's many nights we've considered going to a motel. We have not done that. We have children that don't live close to us or don't live close to a wind turbine. When I visit them I get good sleep. When I go stay with my mom I get good sleep.

When the wind's not out of the south or the southeast I'm able to sleep in my room. So it's not an everyday thing. If it was an everyday thing, we would have been gone by now.

Q. And how has that affected your relationship with your family?

A. Well, I'll probably get yelled at here. I told -- you know, I can't say that, but my children say I'm not as happy as I used to be.

Q. Do you feel like it's put a strain on your relationship with your children?

A. No. Not necessarily. They don't live there so do they understand to the fullest potential what their dad and I go through? No.

Q. What about your leisurely time? Has the activities you enjoyed changed since this project was built?

A. Yes. We have a screened porch on the front of our house and during the weather when it's capable our favorite thing was to have morning coffee there, our morning devotions, and talk about our day before we went

about our business. Now we have to plan that around which direction the wind's blowing if we get to enjoy that or not.

I don't -- I love to fish. I don't go down to the pond and fish as often as I used to because during the time of year when you can do that is when we have the south and southeast wind, and for some reason down by that water the sound is amplified and even worse. I don't go out and help my husband on the property as much as I used to.

Q. Have you gotten used to the noise at all?

A. No.

Q. Aside from just a wind out of the south or southeast, what are the conditions that cause the noise to be the worst?

A. Atmospheric conditions. When we have high humidity, which in Nebraska we have a lot of high humidity. Cloudy days. When we have a south or southeast wind in the winter is really, really the worst when there's no other ambient sounds.

I'm in a very rural area. I have no close neighbors. My closest neighbor is a mile and a half away in one direction, four miles to the south in another direction. So there's not a lot of traffic. There's no tractors in the field during that time of year. There's

no crickets. There's no birds. There's no leaves on the trees to mute it. So winter is absolutely the worst.
Q. And before the project was built did you have any issues sleeping?
A. Not at all.
Q. And before the project was built was there a sound study performed that provided modeled noise levels at your residence?
A. Yes.
Q. And what were the modeled or predicted levels at your residence?
MS. AGRIMONTI: Objection. Hearsay.
MR. DE HUECK: I will allow her to tell us what the predicted sound levels were.
A. With five closer turbines that were not built, for whatever reason -- and I thank God for that -- it was 33 to 35 dBA.
Q. And the ambient noise level at your house prior to the project being built --
A. Was --
MS. AGRIMONTI: Objection. Lack of foundation.
MR. DE HUECK: You want to lay some foundation, Reece.
Q. Did you have an opportunity to review the sound study that was performed?

Well, let me ask you this: Did you have an opportunity to see what the ambient sound levels of your property were?
A. Yes.
Q. And what were those?
MS. AGRIMONTI: Same objection as to hearsay. We're talking about a report that's not before us today, and we have no ability to cross-examine the preparer.
MR. ALMOND: I'll lay more foundation.
MR. DE HUECK: Even so, if you're going to try to tell us what that report says, you should have maybe got your hands on it and brought it in.
Q. How did you learn of the ambient measurement of your house?
A. Beings my husband was on the planning --
Q. Well, let me stop you there. Have you taken ambient measurements of your property when the wind turbines are not operational?
A. Yes.
Q. And what is the measurements that you've taken and the ambient levels?
MS. AGRIMONTI: Objection. Foundation. She's not an acoustician. She's not trying to take --
MR. ALMOND: May I respond?
MR. DE HUECK: Let's see if she had an iPhone

with an app that measures, as we've heard in this hearing.

Get her to explain what went down.

Q. How did you measure the ambient noise?

A. I'm scared to answer here.

My husband and I invested in a decibel meter. I did not -- we downloaded the app on our iPhones. We didn't feel that it was accurate. We thought those readings had to surely be too high because there was no filter on your iPhone or anything.

So we spent several hundred dollars and invested in a Sper Scientific, is the brand name, decibel reader that reads on an A and C level because our readings were so much higher than what our predicted noise level was supposed to be. And we needed to see for ourself and that -- what we were experiencing or what we were hearing was not just some abnormal reaction to the wind turbines being there, but we needed --

I like to research. I want to see. I want to see what it is. And so we took the steps to invest in a decibel reader.

Q. And did you measure the ambient noise level using that decibel reader?

A. Yes.

Q. And what's the ambient noise level or the noise

level when the turbines are not operating at your property?

A. 20 to 25.

Q. What are your plans for the future in terms of how to deal with this problem?

A. My husband becomes eligible for full retirement in four years, and at that time we will sell the property that we've lived on and improved for 20 years and we had at the request of our children and grandchildren put in a trust and we can't say that we'll stay there.

MR. ALMOND: Thank you, Vicki. No further questions.

MS. AGRIMONTI: If the witness needs a few moments to compose, maybe this is a good time for a short break.

THE WITNESS: I'm fine.

(Discussion off the record.)

MR. DE HUECK: I'm going to tender you for cross-examination. Prevailing Winds will ask you some questions if they have any.

CROSS-EXAMINATION

BY MS. AGRIMONTI:

Q. Thank you, Ms. May. I'm Lisa Agrimonti. I represent the Applicant in this proceeding.

You were discussing the ambient sound at your home.

ATTACHMENT 5

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

ORIGINAL

= =

Transcript of Hearing
November 20, 2018
1:30 p.m.

= =

BEFORE THE PUBLIC UTILITIES COMMISSION,
KRISTIE FIEGEN, CHAIRWOMAN
GARY HANSON, VICE CHAIRMAN
CHRIS NELSON, COMMISSIONER

COMMISSION STAFF
Adam de Hueck
Karen Cremer
Greg Rislov

A P P E A R A N C E S

Lisa Agrimonti (teleconference),
appearing on behalf of Prevailing Wind Park;

Reece Almond (teleconference),
appearing on behalf of Intervenors Gregg Hubner, Marsha Hubner, Paul Schoenfelder, and Lisa Schoenfelder;

Kelli Pazour,
appearing pro se;

Kristen Edwards and Amanda Reiss,
appearing on behalf of Staff.

Reported By Cheri McComsey Wittler, RPR, CRR
Precision Reporting, 213 S. Main, Onida, South Dakota

The following transcript of proceedings was held in the above-entitled matter at the South Dakota State Capitol Building, 500 East Capitol Avenue, Pierre, South Dakota, on the 20th day of November, 2018, commencing at 1:30 p.m.

CHAIRWOMAN FIEGEN: The South Dakota Public Utilities Commission meeting is called to order. It is November 20, 2018. It is 1:30 p.m. Central Standard Time. We are in Room 413 of the Capitol Building in Pierre, South Dakota.

This is Commissioner Kristie Fiegen, and with me is Commissioner Hanson and Commissioner Nelson.

Today the agenda for the Ad Hoc Commission Meeting is Electric Docket EL18-026, 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.

The question before the Commission is shall the Commission grant, deny, or grant with conditions a permit for the construction of a wind energy facility to Prevailing Winds Park, LLC pursuant to South Dakota Codified Law 49-41B-25? Or how shall the Commission proceed?

The Order of the Ad Hoc Meeting was sent out and signed by the three Commissioners that all parties in the docket will get five minutes. Correct, administrative --

MR. DE HUECK: Yes. That's correct.

I did speak with Mr. Almond. I'm not sure of his intentions. He may have the Hubners address the

Commission.

Yeah. It's looking like that. So yes. And Schoenfelders. Schoenfelders address them too. So they will each be given five minutes.

CHAIRWOMAN FIEGEN: Okay. Thank you.

The Applicant gets the choice of going first or last. So I will ask the Applicant first if you'd like to go first or last.

Prevailing Winds.

MS. AGRIMONTI: Thank you, Chair. Lisa Agrimonti on behalf of the Applicant. We would like to reserve until the end of other parties' comments.

CHAIRWOMAN FIEGEN: Okay. Thank you. So we will start with the Intervenors. And I don't know how many people are -- how many Intervenors are speaking today.

Okay. So I don't care who goes first. Whoever wants to go up first. If you could state your name for the record slowly, realize you have five minutes.

Okay. Go ahead and state your name.

MS. SCHOENFELDER: My name is Lisa Schoenfelder. I reside at 40226 296th Street in Wagner, South Dakota.

Good afternoon, Commissioners and Staff. Thank you for the opportunity to speak to you. All the Intervenors that you have met during the process have had

the courage to stand before you and their peers to testify to protect their way of life, to protect their families, and even their own health. We ask you to have the courage and integrity to acknowledge that the Applicant has failed to meet the burden of proof that this wind farm siting amongst so many residents will not have severe impacts to their health and welfare.

My husband, Paul, and I are asking that you deny this project. With regards to this Application, the burden of proof the project will not have a negative impact on the people living in the area lives with the Applicant.

Based on the information and testimony provided through this process, we assert the burden has not been met. A witness for the Applicant, Mr. Anderson, explained the process of modeling shadow flicker, but he also testified there hadn't been any postconstruction testing to determine if those models are accurate. Where is the proof?

And who says 30 hours is safe? We are not convinced that Prevailing Winds Park will appropriately monitor shadow flicker or dBA sound levels to keep us safe. We fear that burden once again will be put on residents to monitor and protect themselves.

Their property expert, Mr. MaRous, states that a

longitudinal study might show different results. Where is the burden of proof? It lies with them.

Dr. Roberts admits that more research is needed on epidemiological studies once done -- since none have been done and they are difficult to perform. Where is the proof they are safe?

Mr. Pawlowski, the project manager, shared his opinion that their sound model was accurate and conservative, yet he would be unwilling to have the project held to those levels. When the project manager is unwilling to stand before his own data, this should be cause for concern. Where is the proof?

The construction manager for the project, Mr. Creech, sorry, was asked if the ice detection system that was planned has ever failed. He responds any system can fail. He also added that people should not be in the area during startup, and he couldn't say how quickly the system could shut down if there was a problem.

When the issue is public safety this is not very convincing and does not constitute proof where there could not be a negative impact. We saw and heard testimony from Scott Rueter that confirms these events do happen and that debris can travel up to a quarter mile. Safety of the inhabitants, where is the proof?

The staff's witness Mr. Hessler stated he

believed the Cooper Study to be very convincing and that some people have a sensitivity. These were his words. Doesn't this indicate there is a problem?

Mr. Hessler also stated that most people are not that bothered. Most people are not all people. The clear implication from his testimony and the Cooper Study he referenced is that some percentage of people will be bothered and when bothered equates to not being able to sleep in their own homes then honesty, common sense, preponderance of the evidence clearly shows that this project could substantially impair the health and welfare of the area's inhabitants.

You've heard several credible witnesses testify under oath that their health and livelihoods are being significantly impacted by the wind turbines near their homes. What I think we all learned is that those witnesses and the Intervenors are not scared of technology or progress. They are highly educated individuals who have done research outside of what the Applicant provides. Those that testified are real people who are not willing to be victims. They have no reason to lie and nothing to gain by abandoning their homes.

They also do not have the responsibility of proving they have been negatively impacted. The burden of proof is with the Applicant, and they have not met

that burden.

Commissioners, have the courage to deny this Application. Your hands are not tied. The authority has been given to you to protect the well-being of the citizens of South Dakota and all of us who are going to be impacted in this area. We plead to you, consider farther setbacks.

Hessler himself said he would advocate for two miles. But he didn't want to feel that that would set a precedent. You can set a precedence.

Thank you.

CHAIRWOMAN FIEGEN: Thank you.

(Discussion off the record.)

MS. PAZOUR: My name is Kelli Pazour. I reside at 29668 402nd Avenue, Wagner, South Dakota.

Thank you, Commissioners, for the final opportunity to plead our final source to protect our South Dakota way of life and our health and the well-being of our negative impact on the wind turbines.

I ask that you deny this Application. I keep asking the question whether the wind turbines would impact my daughter's -- Tessa, since she has a hearing aid and now concern that my other children and others who live near the wind turbine.

After listening to Vicki May's testimony on how

the wind turbines have changed her life and her health and listening to my neighbors Sherman and Lori Fuerniss, Jerome Powers, Kevin Andersch, Jim and Julie Kaufman that have had lived close to the wind projects and have had a negative affect on them, I feel greater concerns should be met.

My questions have been answered. I do -- they do impact people. I believe that Prevailing Wind has not taken the burden of proof that their project will not harm residents and the proposed area. The burden of proof was not shown by the Applicant or any of their expert witnesses.

I am deeply concerned at the fact that Mr. Pawlowski would not stand behind the sound study results that they state are the worst-case scenarios. Mr. Pawlowski dismissed my concerns about setbacks, shadow flicker, and requested that -- to use their models as a base of concern sound levels.

He said that the Charles Mix County setback of 43 would be more than enough. I don't believe him. I don't believe that Mr. Edward's [sic] testimony was convincing enough to prove that the sound from wind turbines don't impact the health of wind on us residents that would be living near these turbines.

The statement that the children with autism are

not impacted by the sound comes from fact knowledge and, while published, concerns me. The Applicant expert witnesses are which we are supposed to believe his statements.

The experts who study the extreme limit numbers of individuals impacted by the wind turbines was more concerning at diagnosing them with obese and drunk and acknowledged that the turbines could not impact the health of the individuals. This is testimony that Applicants and you, Commissioners, will be using to accept the Applicant to meet the burden of proof.

In addition, the fact that Mr. Howell stated that they do not do post testing on various -- varieties [sic] their results, if they are not willing to guarantee that the doubt that the wind would never exceed over the dBAs of the models, do I -- how do I trust that they will do this?

And any of my concerns of future when the sound levels go above 40 dBA, that might impact my family. I don't want my family to be the next victim.

The developers and owners of Vicki May and Scott Rueter's project did not help them. They did not trust -- and I do not trust Prevailing Winds that they will help us after these turbines are placed.

Because of my concerns and listening to Vicki

May's actions and learning more about the sound levels, as well as Mr. Pawlowski's demonstration on how easy it is to use the measuring of the dBA sound levels, I've invested into software and have been testing the current Beethoven Wind Farm. I want to confirm that -- confirm if they could meet the state regulation of the dBA numbers.

The results that I got were truly alarming. Readings from anywhere from 45 to 63 dBA. And those towers are only 450 feet tall, and the Applicant is proposing a 590-feet tall turbine, generating more sound and travels even farther.

I'm very concerned on how sPowers and the PWP representatives will keep their promise and make the state PUC and acknowledge any complaints that may have been valid about the dBA shall --

CHAIRWOMAN FIEGEN: One minute.

MS. PAZOUR: -- and only setbacks that will be willing to keep.

They have not proven enough evidence to prove that the wind turbines don't cause health hazards for the future residents. Because of all of this, I truly believe our best defense is for the PUC to deny this Application.

If you, the Commissioners, and the PUC do

approve it, I beg of a two-mile setback from nonparticipating residents to be a condition of the Application.

CHAIRWOMAN FIEGEN: Thank you.

(Discussion off the record.)

CHAIRWOMAN FIEGEN: If for some reason you do not want me to interrupt you and tell you that you have one minute remaining, just let me know. Because you might have your own timer next to you.

Was it helpful? Okay.

All right. The next Intervenor that would like to go forward.

MS. JENKINS: Commissioners, as you are the jury in this case --

CHAIRWOMAN FIEGEN: And you can state your name and your --

MS. JENKINS: Yes. I'm Karen Jenkins. I reside at 2891 410th Avenue, Hutchinson County.

CHAIRWOMAN FIEGEN: Thank you.

MS. JENKINS: Commissioners, as you are the jury on this case, I ask that you use all of your common sense and your good judgment in filtering the testimony you have been offered.

Consider, please, the Applicant and its witnesses and what is the interest they have in the

outcome of this case. I would offer you, it is money. Carefully consider the credibility of the Applicant's witnesses and the Applicant, please.

As Intervenors, we are simply, and yet more desperately, asking you to protect us, our families, and our way of life.

Consider carefully, please, the witnesses that appeared on behalf of the Intervenors. Also consider the Intervenors that testified before you. Consider the credibility you observed through the Intervenors and their witnesses.

Would you agree the interest of the Intervenors -- they have in the outcome of this case is protection for ourselves, as well as for those in the footprint of the proposed project.

The weight of the evidence and the credibility of the Intervenors and their witnesses is clearly in favor of the Intervenors. Evidence of health and economic hardship does not require a person who holds a degree in a related field. Common sense and good judgment is enough for a jury with your experience to filter through the case.

The Intervenors' right to protection is a constitutional right. General welfare is the concern of the government, for the health, peace, morality, and

safety of its citizens. Providing the welfare of the general public is a basic goal of government.

The preamble to the Constitution cites promotion of the general welfare as a primary reason of the creation of the Constitution. To approve this Application would be a direct violation of the Intervenors' rights, as well as the general public's rights.

Please deny it. Thank you.

CHAIRWOMAN FIEGEN: Thank you.

Next.

MS. HUBNER: Please don't say one minute left. That spooks me, I'm sure.

CHAIRWOMAN FIEGEN: Okay. I won't.

MS. HUBNER: Thank you.

Good afternoon. I'm Marsha Hubner.

We have spent nearly four years learning about industrial wind projects and how to properly site them. It's been a good education but a very expensive one.

The question the Commission needs to decide is whether the Applicant met its burden of proving its proposed project will not substantially impair the health, safety, or welfare of those living in the project.

You are, no doubt, aware that studies are

primarily paid for by people who want a certain outcome. That is why there are often conflicting results.

You say your decision must be based on evidence. The Staff stated that if there were problems with infrasound, more people would complain, even though Staff is aware of the gag clause in easements, the good neighbor agreements, and buying out homes, all to shut people up who do have complaints.

I would think the very best evidence is from people who it actually affects. We gave you evidence during the hearing from people sitting in this chair: Sherm Fuerniss, Jerome Powers, Kevin Andersch, Scott Rueter, and Vicki May. No Harvard degrees. No $500-an-hour witness fees.

Where are the studies that prove that this -- that prove what is a safe distance to live from a 590-foot turbine and not have adverse health effects? There is not one study. None cited because there aren't any. Only real life experiences.

These people had the most powerful evidence because they have lived next to wind turbines. Scott and Vicki have absolutely nothing to gain or lose from this project, but they were still willing to travel hundreds of miles to come here and tell you what happened to them when turbines were placed too close to their homes.

They came and testified before the Commission so that the mistakes that were made in Iowa and Nebraska, mistakes that cost people their homes and their quality of life, are not repeated here in South Dakota.

The Applicant, on the other hand, paid thousands of dollars to Drs. Roberts and Ellenbogen who have zero experience living near a wind farm. In fact, not one of the Applicant's witnesses discussed their own experience trying to sleep in a wind farm. If you go to buy a new car, would you get your best information about that car from five people that owned one or from the salesman trying to sell it to you?

Has Vicki May's health and welfare been substantially impaired going eight or nine nights in a row without sleep? Moving from room to room to find peace or even having to close her business and now making plans to move away from the turbines as soon as her husband retires?

Has Scott Rueter's health and welfare been substantially impaired? Sleeping an hour and a half a night, losing 35 pounds, and eventually being forced to move from the family farm. If the proposed project is approved, we now know what we have to look forward to.

And what recourse will we have? According to staff, we'll have the ability to sue them. So we'll get

to spend tens, if not hundreds of thousands of dollars, and years of our lives litigating. That would impair our health and welfare.

In the end, the Applicant may have to pay us some money to make us go away. Then it would continue, business as usual. But money won't give us back the peace and enjoyment we get from our home. No amount of money would ever give us back that time if we lose it. And money is what it really boils down to.

The Applicant doesn't want longer setbacks or stricter noise limits because it would cost more money to develop its project. It didn't even try to plan its project with longer setbacks or lesser noise limits. And why would they? They don't have to live by it.

All we want is a safe and reasonable setback and safe and reasonable noise limits. Although the Commission seems uncomfortable straying from county ordinances, you should have realized from the testimony of Mike Soukup and Keith Mushitz that our county folks just aren't equipped to establish ordinances addressing those issues.

Are we going to wait another 20 or 40 years like the tobacco industry until enough studies have been done? How many Vicki Mays and Scott Reuters will be sacrificed during that time? Are we the guinea pigs? Will we be

forced to move from our home so that sPower can make more money?

As you drive by White Lake next time and see that big wind turbine that is much too close to the Interstate, I hope you will think about Lori and Sherm, Theresa Kaaz, Jerome Powers, Kevin Andersch, Kelli Pazour and her daughter. I hope you remember Vicki May.

You get to drive by. They don't. Will your decision force others to have to live, work, and sleep too close to these things the rest of their lives? I pray not.

Thank you.

MR. FUERNISS: You will need to cue me. I already warned Cheri I'm going to go fast. But, Commissioners, good afternoon.

It seems to me -- oh, I'm sorry.

Sherman Fuerniss 40263 293rd Street, Delmont, South Dakota.

It seems to me that we the ordinary people most affected by this project have been on the defensive throughout the process, having to produce evidence and witnesses in fields unfamiliar to us in a very short time. We came here not knowing the game, much less the rules.

But I have learned much in the past weeks and

months. I have learned what a terrible, horrible, awful person I am. I've been accused of having an agenda that is not in the community's best interest. If preserving our livelihood and way of life and protecting the well-being of my families and neighbors is an agenda, so be it.

I have been called uneducated, obese, and a liar. I've been confronted with the attitude of who do you think you are? After months of that green map with the red rectangles depicting opposition to the project hanging in a storefront window on Main Street, our family's decades-long patronage of some Avon businesses is no longer desirable and has come to an end.

To avoid confrontation with lifelong neighbors, we attend church some 25 miles from home. You cannot pretend to share the peace of God with someone on Sunday and be in conflict the rest of the week. This will remain a lifelong rift in the community.

Although our neighbors may not trespass on our property by driving on it or dumping stones or posts or used wire across the fence line or unloading manure on it, they can apparently trespass on it by dumping noise and shadows on it even if we are present at the boundary of our property at the time.

I have learned that the information addressing

our concerns provided by representatives of the project comes down to we would never remove a turbine from a participating landowner in order to appease a nonparticipant. Indeed, there has been no serious, credible attempt by the Applicant to revise the project in any way to address the concerns of nonparticipants.

The latest ploy of proposing possibly using a few smaller turbines in some locations, thereby supposed by demonstrating concessions to nonparticipants, will make no difference at all unless those turbines are smaller than 1.8 megawatts and further than one and a quarter miles away from our residence. They will have the same effect as the existing turbines.

Seemingly ignored in all of this is the testimony of both Mr. Hessler and James concerning low frequency sound below 20 hertz, which is not even measured using the A-weighted sale. Both testified that contrary to what is presented in the Application, the most problematic portion of the noise generated by the turbines comes from the blade passing the tower, compressing the air there and creating the pulsating sound unique to wind turbines.

The blade passing frequencies below 1 hertz, the frequency known to cause motion sickness and nausea. Mr. James testified that these inaudible sounds are

measurable using proper equipment and techniques and that setbacks at one and a quarter miles from property lines would drastically reduce complaints by residents.

Despite semantic games and mental gymnastics performed by experts about direct versus indirect effects and what is a health effect and what is not and what is adverse and what is not, it is common knowledge that annoying noise disrupts sleep. Sleep disruption leads to sleep deprivation, which is known to have all manner of physiological effects on the human body. Perhaps CIA, FBI, or military interrogators should have been called to testify on the effects of sleep deprivation.

Industry standards have been referenced throughout these proceedings. These standards include outdated sound models that are not validated for the height of these turbines nor the distances involved, requiring extrapolation of calculations to make projections that may need adjustment by up to 10 decibels. Industry standards for sound levels, shadow flicker, and setbacks seemingly have no basis other than precedent.

The Applicant seems more concerned with maintaining precedent than actually considering what may actually be best for the impacted residents in the light of most recent and ongoing research.

CHAIRWOMAN FIEGEN: One minute left.

MR. FUERNISS: They say, after we get the permit we will finish our studies. After we get the permit we will provide information just before we begin construction. And they use terms like "to the extent practicable" and "substantially" and "limited impact."

I would ask you to exercise the authority of the government which you possess with justice and compassion. If this project is permitted anything remotely as proposed without significant and substantial, honest revision, it may not be a death sentence, but to someone my age it will certainly be a life sentence.

Thank you.

CHAIRWOMAN FIEGEN: Thank you.

Are there other Intervenors that will be speaking today?

Okay. We will go to Staff next.

MS. EDWARDS: Thank you.

This is Kristen Edwards for Staff. And I shouldn't need the one-minute reminder. And I certainly hate to follow that.

I would, first of all, like to commend my fellow parties on the quality of the briefs submitted in this docket. These were some of the most thought out and thought provoking briefs I have seen, making it nearly

impossible to respond to them in five minutes.

This is a unique project in that as you can see in Exhibit I-29 it is a very checker-boarded project area. Staff spent an incredible amount of time trying to figure out how to protect the welfare of all of these folks that are surrounded on this map. I cannot tell you how many times I thought I had found the answer, only to realize I could not support it based solely upon what was in the record.

I desperately wanted to find a way, as all of staff -- did we desperately wanted to find a way to get Mr. Powers's hunting lodge not to be surrounded on all sides by turbines, not to have 12 turbines within 2 miles of his residence and hunting lodge. I know there are a lot of people very upset with the position we took, but we truly tried based upon what was in the record. We cannot go outside of the record for our recommendations.

So what does the record support? For starters, it demonstrates that without the appropriate conditions, this project should not be permitted. The appropriate conditions are essential in this and every project that comes before the PUC.

The record supports a condition of 40 dBA max Leq at nonparticipating residences. For as simple as this should be to accomplish and as easy of a gesture it

would, be Applicant vehemently resists.

As Ms. Schoenfelder pointed out what's more, their witnesses testified they are not willing to commit to the studies. So without the condition we cannot be sure that the noise levels at nonparticipating residences will be as shown in their sound studies.

Applicant is also absolutely incorrect in their assertion that Staff's sound expert changed his opinion. Mr. Hessler has consistently advocated for a 40 dBA design goal. He simply came to the conclusion after listening to the testimony and reading testimonies that this project should meet that design goal.

Applicant's criticism is simply inaccurate when they claim that Mr. Hessler's entire opinion was based upon reading of the comments and how long it took him to do so. Was that a factor? Yes. But that was certainly not the only factor.

Applicant sites to recent dockets but fails to acknowledge that the three-quarter-mile setback in Crocker rendered the 45 dBA essentially meaningless but for settlement purposes. 40 dBA is reasonable, supported by the record, and abundantly attainable and necessary for this project.

Intervenors offered up a number of conditions which I greatly appreciate. In the interest of time I

won't go through all of them but wanted to touch on a couple.

Mr. Almond recommended a 35 dBA nighttime limit measured at L10. I would note that 35 dBA nighttime essentially is a 24-hour dBA, as a nighttime limit is not -- in this type of project is applicable to the entire 24 hours.

We don't disagree with the first part of that, but the L10 we would disagree with. We advocate for the sound metric to be Leq, which measures a two-year average with times when the turbines are not running discounted.

I'm sorry. Thanks to my analyst. A two-week average. I misspoke.

Mr. Almond also recommended a 1,500-foot setback from nonparticipating property lines. Staff does not take a position on whether ice throw is a concern, but if it is, this condition seems reasonable to address such a concern.

And, with that, I was going to get into how the different sound metrics are accomplished but --

CHAIRWOMAN FIEGEN: You still have a minute and 15 seconds.

MS. EDWARDS: Oh, perfect.

In closing, we are bound by what's in the record and what's in the record is limited to what we could get

into the record in four months and that is how we formulated our position and our conditions. And we stand by for questions.

CHAIRWOMAN FIEGEN: Thank you.

And now we will go to Prevailing Winds.

MS. AGRIMONTI: Thank you, Commissioners. Again, Lisa Agrimonti on behalf of the Applicant, Prevailing Wind Park, LLC.

I agree with Ms. Edwards's comments regarding the quality of the record that you have before you. The parties were certainly robust in their positions, and I think you have a very full record upon which to make your decision today.

There are four factors that are applicable, as you all know, in terms of deciding whether to grant the facility permit. There is no dispute that the Applicant in the project will comply with applicable laws and rules. And there's also no challenge to factor number 4, that the facility would not unduly interfere with orderly development. Therefore, I'll limit my comments to factors 2 and 3.

First, with respect to the second factor, the Applicant must show that there is no threat of serious injury to the environment or social and economic condition of inhabitants or future inhabitants. This

factor has been met.

While there was testimony about disagreement in the community related to the project, as staff noted, there is no material evidence that that disagreement is going to persist into the future. Moreover, you heard from both sides of the argument, Dustin Brandt and Mr. Paul Schoenfelder, that in the end they're going to be neighbors.

More importantly, in analyzing this factor the Commission has in past dockets evaluated taxes, jobs, impacts on industry, and similar issues, and that's what Prevailing Wind Park laid out in its brief.

I'll direct you to Finding of Fact 51, The project will not pose a serious injury to the social and economic condition based on those factors.

Second, Prevailing Wind Park has fully demonstrated the facility will not substantially impair the health, safety, or welfare of inhabitants. The only health impacts expert testimony you have came from Dr. Mark Roberts and Dr. Jeff Ellenbogen.

The two medical doctors both testified that there is no evidence that wind turbine infrasound or shadow flicker or audible sound can cause adverse health effects. Therefore, there's no basis in this record to impose any conditions relating to infrasound or shadow

flicker or to limit sound to nonparticipants' homes below 45 dBA and 35 dBA that Prevailing Wind Park has agreed to.

Mr. Hessler's testimony regarding a 40 dBA limit is not, as staff asserts, the best evidence in the record to mitigate the chance of impact to human health. There are no shown human health impacts in this record.

I heard Intervenors this morning talk about testimony from various witnesses who asserted that they had health effects. There was no proof of those health effects. And there was definitely no proof that they were caused by wind turbines. Mr. Hessler has no qualifications to even opine on human health issues.

Moreover, the testimony of Dr. Ellenbogen and Dr. Roberts refutes this claim. Dr. Ellenbogen, a neurologist and sleep specialist, specifically addressed the claims of sleep disturbance and testified to the most authoritative evidence in this record in documentary form, which is the 2016 Health Canada Study.

That study looked at more than 1,200 men and women, and that study included, and I quote, that "levels up 46 dBA had no statistically significant effect on any measure of sleep quality."

Staff's recommended sound condition cannot be supported on this record, and our brief fully details why

imposing such a condition would be arbitrary. No matter how close the sound limits are, based on the measurements and predictions we've provided in the record, that's not a basis to impose that condition.

South Dakota strives on having consistent, reasonable, predictable regulation. Prevailing Wind Park and other developers have designed their projects to meet the standards as they've been set by this Commission, and they've done so in two dockets. And while there may have been a greater setback in the Crocker docket, that was not so in Dakota Range, and in both dockets Mr. Hessler recommended a 45 dBA limit for participating landowners.

Also Mr. Hessler himself agrees that 45 is an appropriate and reasonably fair regulatory noise limit for nonparticipating residents. Mr. Hessler's personal ideal design goal, and he says it's to avoid complaints, is not a basis for a regulatory standard, and it's also unachievable. Mr. Hessler himself admits that there is no limit at which you can set sound where you can be assured that there won't be complaints.

I'd like to take a couple minutes just to address some of the additional comments that were made this morning.

CHAIRWOMAN FIEGEN: You have about 30 seconds.

MS. AGRIMONTI: Then I will do it very fast.

It's not that we're not standing by our predicted sound measurements; it's that Mr. Pawlowski was not willing to say that that would be the limit of the project. There's still final design to do. And while we believe that the layout as proposed and the sound predictions we've provided are accurate and, indeed, overstate the sound, that doesn't mean that we should be limited to what those modeled measurements are.

We believe very strongly that the standards that have been used by this Commission, that are used by Bon Homme we've committed to and the ones that should be imposed.

And, lastly, to the extent you rely on Vicki May and Mr. Rueter, they're talking about different projects with different turbines, with different sound. And, again, they came here, and they gave you their opinion. And I do not dispute that that is what they believe, but they did not provide you any proof of health impacts.

Thank you. We ask that you approve the permit.

CHAIRWOMAN FIEGEN: Thank you.

I believe everyone has been able to speak. So I'm going to allow Commission questions before we close the question portion to discussion.

MS. AGRIMONTI: Chair, I apologize for interrupting.

My client has just advised I misspoke. I meant to say that the Applicant committed to 45 dBA and 43 dBA in Charles Mix County.

Thank you.

CHAIRWOMAN FIEGEN: Thank you.

I just have a quick question of Staff on ice throw.

So are we 650 feet or 649 feet away from roads and property lines of nonparticipating? Or are we still at that 500 feet?

I just can't remember. I know we've talked about it. I've kind of tried to look through. I just want to make sure I understand roads. Nonparticipating property lines from a wind turbine.

MS. EDWARDS: I'll speak slowly to give Mr. Kearney plenty of time to poke me as I talk. But state law would be 1.5 times -- see. 1.1 times from property lines and roads. Yes.

CHAIRWOMAN FIEGEN: So that's that 649 feet or whatever.

MS. EDWARDS: Yes.

CHAIRWOMAN FIEGEN: And residence. Is it all 1,000 feet away from residents or currently only nonparticipating residents? What would all residents be if you're participating or nonparticipating? Is it that

1?

MS. EDWARDS: We're looking. I really don't want to get this wrong. I know there's an exhibit out there.

CHAIRWOMAN FIEGEN: There's hundreds of exhibits out there.

MS. EDWARDS: That's true.

CHAIRWOMAN FIEGEN: I just wanted to make sure before we went to closed Commission discussion. If staff you would like to ask any other parties in the docket, you are more than welcome to.

MS. AGRIMONTI: Chair, I believe is your question about what is the current setback based on the layout?

CHAIRWOMAN FIEGEN: Yes. And also according to the conditions that are placed.

MS. AGRIMONTI: Okay. With respect to the facts of the layout, and you can look at A42, the closest home is 1,558 feet and that is a participant. And the closest nonparticipant is 1,822.

The setback differs by county. It's a minimum -- now I'm going to go look. It's 2,000 or three times -- three times turbine height in Charles Mix?

MR. PAWLOWSKI: Charles Mix is 2,000 feet.

MS. AGRIMONTI: Or --

MR. PAWLOWSKI: Sorry. Three times or 2,000 feet.

MS. AGRIMONTI: Whichever is greater.

Then there is also a setback in Bon Homme that was applied to others, and I can look at that in just a moment. I don't have that at my fingertips.

CHAIRWOMAN FIEGEN: That's good. You've answered my questions. Thank you.

Other Commission questions before we go to closed Commission discussion?

Okay. Commissioner Hanson.

COMMISSIONER HANSON: This is for Staff.

I'm just curious. As you were talking you intimated that you might not have had enough time. It sounded like you did have enough time, but was there something else that you wanted to say during that period of time?

You expressed your concern about sound and distance, and I'm wondering if there was anything else that you were working on. I know shadow flicker was in there but --

MS. EDWARDS: I hadn't written it down because when I was going through my closing I could not get it under six minutes so -- of course.

COMMISSIONER HANSON: Well, this is your

opportunity.

MS. EDWARDS: Thank you.

The Intervenors had proposed to use the L10 metric. And our witness had testified that he was okay with L90, but we were advocating for the Leq and the -- his testimony reflected that the problem with the L10 was that it couldn't discount for other noise in the atmosphere.

Thank you.

COMMISSIONER HANSON: Thank you, Madam Chair.

CHAIRWOMAN FIEGEN: Other Commission questions.

Okay. This is the time that the Commission actually gets to speak with each other about this docket.

So go ahead, Commissioner Nelson.

COMMISSIONER NELSON: I move in EL18-026 that the Commission grant the permit with the proposed conditions found in Attachment A to the Applicant's brief as amended by the November 19 update to Condition 29.

CHAIRWOMAN FIEGEN: Okay. You may speak on that motion.

COMMISSIONER NELSON: Thank you.

As I have said a number of times before in other proceedings, our decision whether to grant a permit or deny a permit has absolutely nothing to do with whether we like wind turbines or we dislike wind turbines. It is

entirely based upon the criteria that is provided to us in State Law 49-41B-22 and the record that has been established in this particular proceeding.

And as I've evaluated that record and those statutes, I've determined that the Applicant has met the burden of proof, assuming that we attach appropriate conditions to the permit.

In my motion I mention permit conditions that were found in Attachment A and as were updated yesterday. I do not believe that those conditions are all inclusive of what is necessary to protect the welfare of folks living in that area.

Therefore -- and particularly 49-41B-22 Sub 3 that talks about the fact that we have a duty to ensure the welfare. And Ms. Jenkins talked about welfare a number of times today, and I take that seriously.

By the same token, as we are working to make sure that the welfare of the citizens are protected, we also have a duty to make sure that others have the right to use their property for economic gain as they see fit. And that's the balance that we are working through here today.

Based on that, Madam Chair, I have four additional amendments to my motion. Because they are all covering very different topics, I'd like to try them one

at a time so that we all have an opportunity to determine whether or not they are appropriate.

CHAIRWOMAN FIEGEN: Okay. So I will let you go to your first amendment to the motion.

Good thing. Otherwise, I would have had amendments to the motion.

Go ahead.

COMMISSIONER NELSON: Well, you may anyway once we get done. We'll see.

I move to amend the main motion by changing Condition 28 and 29C by striking "30 hours" and inserting "15 hours."

CHAIRWOMAN FIEGEN: Just wait one second.

COMMISSIONER NELSON: 28 and 29C.

CHAIRWOMAN FIEGEN: All right. Thank you.

COMMISSIONER NELSON: Delete "30 hours" and insert "15 hours."

CHAIRWOMAN FIEGEN: Go ahead and speak on your amendment.

COMMISSIONER NELSON: Thank you.

Obviously, there was a lot of reference to the shadow flicker issue and the number of hours that shadow flicker could be cast upon residences. Repeatedly I asked the Applicant, what Is your justification for 30 hours? Give me something. And all I got back was it's

the industry standard. Well, that doesn't cut it for me.

By the same token, nonparticipants were asking for zero. And I understand -- I understand where zero's coming from. But in the interest of trying to be fair to both sides, I've split it in the middle, and I've come up with 15.

In looking at the attachment that -- or the study that shows where the shadow flicker will fall, I believe that changing from 30 to 15 will only impact four of the receptors. And one of those has an agreement -- a setback agreement already. And so it may only be three that are actually impacted.

And that impact would probably be resolved through a changing of the operation of the turbines near those three receptors or some type of an agreement between the Applicant and those residences.

Obviously -- and Mr. Fuerniss is sitting back there saying, well, what about my property line? And I wrestled with that, and I'm not willing to go that far today. And I'm not saying that he doesn't have a very valid concern about that, but I'm not willing to go that far today with this particular amendment.

CHAIRWOMAN FIEGEN: Other discussion on the first amendment.

Commissioner Hanson.

COMMISSIONER HANSON: Thank you, Madam Chair.

I have a question of the sponsor. On 28 there are two spots for the 30 hours changing to 15. And then on 29C there's 30 hours. There's one spot. However, those also refer to and/or 30 minutes.

And I appreciate your motion. I, frankly, would not want to have a turbine close to me and having the shadow flicker, sound noise, and things of that nature. And when I look at this and have an empathy with the citizens that are faced with that situation or especially those who are not participating, I like your motion.

I would like it much better if there was something on the 30 minutes per day as well. And just your thoughts on that.

COMMISSIONER NELSON: Yeah. My thoughts on that were trying to give the Applicant, the operator, kind of the maximum flexibility to meet the 15 hours. I was more concerned with what's the total amount of shadow flicker over a year as opposed to how much might be on in a particular day.

I'm open to an amendment, but I was looking to give them some flexibility to actually meet the 15.

COMMISSIONER HANSON: Thank you.

And then I would have a question of one of our counselors at law. Can you tell me, when we look at

and/or 30 minutes, to me or 30 minutes means you can either do it 15 hours for the year or your maximum is 30 minutes per day. It seems like there's two different levels there, and one of them -- two different maximums so they can meet the 30 minutes a day, which is significantly more than 15 hours a year.

So I'm curious what your thoughts are. Does that "and/or" give us two different maximums?

MR. DE HUECK: My interpretation of that is we're going to have one maximum. We couldn't have -- have you done the math on that? How much more that would be?

COMMISSIONER HANSON: No, I didn't. But 365 --

MR. DE HUECK: I'm looking at Greg. You're good.

MR. RISLOV: It's going to be about -- it's going to be over -- if I understand what Gary's saying correctly, he would -- I'll try to interpret the way he worded it. He would have worded it 30 hours per year and 30 minutes per day, not to exceed a total of 30 hours per year.

The way he's suggesting, it would be over 4,300 hours a year because it would be a half-hour -- I shouldn't say that. That's all wrong.

It should be 182.5 hours a year the way Gary was

suggesting.

COMMISSIONER HANSON: Yeah. Correct.

MR. RISLOV: But if the phrase was added "no more than 30 minutes per day, not to exceed 30 hours per year," I think that's what you're getting at.

MR. DE HUECK: Correct.

COMMISSIONER HANSON: Right. And that's my concern is that when we say or 30 minutes per day, well, that's 365 divided by two, and that's the number of hours that could be for an entire year. So you've got to either this or you could do this.

And I like the way that -- just about called you Commissioner. That Mr. Rislov just articulated. Is that something that the sponsor could --

COMMISSIONER NELSON: My intention, and I think we're on the same page here, is that there be no more than 15 hours per year and that no single day could be more than 30 minutes.

COMMISSIONER HANSON: Okay. Saying it the same way, yes.

COMMISSIONER NELSON: Yes. And so if we need to adjust the language to mean that, I'm absolutely fine with that.

COMMISSIONER HANSON: Okay. So that with that understanding, I don't know that I need to make a motion

to change that, but I --

COMMISSIONER NELSON: If that's the understanding, I think we'll work that language out when they write the final condition.

COMMISSIONER HANSON: Okay. Is that under the with our --

MR. DE HUECK: Yeah.

COMMISSIONER HANSON: Okay. Great. Thank you.

CHAIRWOMAN FIEGEN: The other item I would like to discuss is participating landowners. And, if possible, can this not be part of participating landowners unless a signed waiver is obtained from the owner of the resident?

Because then you're protecting all South Dakotans. But the participants can have a waiver and sign that off.

Go ahead.

COMMISSIONER NELSON: Yeah. I wrestled with that for all of about two seconds. And the way I resolved that was if you have chosen to be a participant, if you have chosen to be part of this project, if you have chosen to receive easement payments in exchange for allowing these turbines on your land, are there going to be some things you're going to have to put up with?

Absolutely. And, therefore, I view that as an

issue between the landowner and the Applicant and not something that I'm willing to further restrict.

CHAIRWOMAN FIEGEN: Thank you. And I would agree with you to a point.

I do believe sometimes when participants sign up information may be very vague, information may be misleading, and as a Commissioner it's hard because, yes, they chose to sign up, but they may have signed up with misinformation.

And so that's why it would be nice to allow them at least to sign off on that. And if they're okay with that, that's fine.

Other discussion on the amendment. I will not make an amendment to the amendment but may make another amendment after this one is voted on.

Other discussion.

COMMISSIONER HANSON: Madam Chair, I would be interested in -- it's interesting, the three of us not being able to chat on these things until we get to this juncture. It's interesting hearing the flow of concerns.

I have marked several items that I have concerns with and Commissioner Nelson has touched on one just now and you just touched on one. And so I would be interested in that discussion later on.

Thank you.

CHAIRWOMAN FIEGEN: Thank you.

At this time is there anymore discussion on this amendment?

All in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

COMMISSIONER NELSON: Madam Chair.

CHAIRWOMAN FIEGEN: Go ahead.

COMMISSIONER NELSON: I move to amend the main motion by changing Proposed Condition 40A by striking "10" and inserting "30."

CHAIRWOMAN FIEGEN: Go ahead with your --

COMMISSIONER NELSON: Thank you.

This is the turbine decommissioning escrow account. The proposed condition that staff and the Applicant had agreed upon was that the annual payments into that decommissioning escrow account be made for a total of 10 years.

In Crocker we required those payments to be made for 30 years. I believe that the 10 years here probably

originates from some of the testimony that it may only take $50,000 to decommission a particular turbine. I will tell you I have serious doubts about whether 30 years down the road 50,000 is going to be enough to decommission a turbine. I would much prefer to make sure that there is sufficient cash in that escrow account to make sure that the decommissioning can, in fact, take place.

Understanding that per the other conditions at year 10 and every five years after that we will evaluate is there too much or not enough cash in the account and if we find that, in fact, we are overcollecting, as we frequently do in other dockets, we will change the amount that is being withheld or put into that account.

Additionally, if there's additional cash left at the end, that goes back to the Applicant, and so the Applicant is out nothing. But I want to make sure that at the end of the day there's enough cash in that account to pay for what needs to be done.

CHAIRWOMAN FIEGEN: Other discussion on this amendment.

All in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

COMMISSIONER NELSON: Madam Chair.

CHAIRWOMAN FIEGEN: Go ahead.

COMMISSIONER NELSON: I move to amend the main motion by adding staff's second Proposed Condition -- and just for reference, that's their sound condition -- but deleting "equivalent continuous sound level, Leq" and replacing it with "L10."

CHAIRWOMAN FIEGEN: Discussion on your motion.

COMMISSIONER NELSON: I think everybody understands, Applicant included, that there needs to be a sound limitation on this particular project. And I've wrestled with this provision probably as much as any of those that we've looked at, and I believe that, again, looking at the welfare of the individuals in that area, that 40 dBA is, in fact, the right number.

It is adequately supported by staff. It is adequately supported from several different perspectives in the Intervenors' brief.

The Applicant's posthearing brief did criticize Mr. Hessler for where he -- you know, for arriving at 40. I understood part of that, but at the end of the day I

still believe that it is adequately supported for the welfare of the inhabitants.

And understand this project will change the complexion of that area forever. At least for 30 years, if not forever. And we have to do what we can, understanding the change of that complexion, to maintain the welfare, and one of those things that we can do is set a reasonable noise limitation.

As Ms. Schoenfelder pointed out today, Mr. Pawlowski testified that the sound level model was conservative, the sound level model only showed that there were two nonparticipants that exceeded 40, and so for those two there will need to be some adjustment to their operation in order to meet this 40.

Let me speak about kind of a subpart to my motion to amend, and that is changing Leq to L10. This is an interesting subject.

And in one of Mr. James's exhibits, Exhibit I1-B, on page 2 he had a chart, a graph, that visually explained really the difference between L90, Leq, L10, and Lmax. I found it very, very revealing and instructive to me.

In addition, Mr. James in his testimony explained why L10 was a better measure for this than Leq. And I think the best way that I can explain it to my

fellow Commissioners as to why I've chosen to go L10 instead of Leq, Leq is an average. And so if we set an average of 40 and we understand that the ambient is 28, that means that there's a whole lot of time that this project is going to be emitting a lot more than 40.

And that's the time that it's going to be oppressive or bothersome or endangering the welfare and the well-being of the folks that are in that area.

L10 really is -- it's not a max, but it's close to a max with an allowance for 10 percent spikes. Okay. And, obviously, 10 percent spikes -- because there's going to be other things that are going to create noise that might create those spikes, the wind itself being one.

And so based on that thought process and really wanting to set a maximum that means something, I think L10 is appropriate. And understanding that in the sound model that was created assuming full operation of the turbines, and so L10 should not be an impediment to the operation based on the way the sound models were done, assuming the sound models were accurate.

I believe that is the sum of my comments.

CHAIRWOMAN FIEGEN: Okay. I do have a different amendment for this one. I will ask for a short recess, that I can visit with my advisor quick.

But, Commissioner Hanson, do you have any discussion before I ask for a short recess?

COMMISSIONER HANSON: Before voting on this, I would very much like to hear your -- I have my own thoughts on this and, like I was saying earlier, I wanted to change something too so I would like to hear what yours is prior to voting on it.

Thank you.

CHAIRWOMAN FIEGEN: Okay. I'm going to ask for a short recess. We'll be back probably within a few minutes.

(A short recess is taken.)

CHAIRWOMAN FIEGEN: Okay. We're going to come back into session. And I think I'll be supporting your motion. I will certainly have an amendment at the end to visit about participating landowners, but I will support your motion on nonparticipating -- or your amendment. I'm sorry.

Is there other discussion on the motion?

Go ahead.

COMMISSIONER HANSON: I'll just say that -- I guess you'll know that I'm supporting it when I vote that I'm supporting it.

But I feel it's moving the right direction, and that's why I will be supporting it. I can't make that

comment during the vote so I'll make it now.

Thank you.

CHAIRWOMAN FIEGEN: Other discussion on the amendment.

All in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

Commissioner Nelson.

COMMISSIONER NELSON: I further move to amend the main motion by adding a new condition requiring verification of compliance with the sound level requirement at the residences of the Intervenors within 60 days of commencement of full operation.

CHAIRWOMAN FIEGEN: Discussion on your motion.

COMMISSIONER NELSON: Obviously for anybody that was paying attention when the sound modeling was being talked about, I was certainly surprised, and I think were others, that there was not a verification of the accuracy of that modeling after construction.

And today, you know, Ms. Pazour asked repeatedly

about, you know, why that isn't done. And I agree with that, that there needs to be some verification that the sound level is what we have required.

Now having said that, I think requiring verification at every single one of the receptors is probably more than is necessary in order to ensure that the sound levels are being met, and so, hence, this condition would simply require that that initial measuring at the residences of the Intervenors and understanding that there is a provision in the last amendment that we passed that would allow others to request that testing if necessary. And so it's certainly not foreclosed on others to have that testing done.

CHAIRWOMAN FIEGEN: Could you read your amendment to the main motion one more time?

COMMISSIONER NELSON: Certainly.

Adding a new condition requiring verification of compliance with the sound level requirement at the residences of the Intervenors within 60 days of commencement of full operation.

CHAIRWOMAN FIEGEN: Thank you.

COMMISSIONER NELSON: And I will say there's probably no magic in this language. You know, I put 60 days in there so there's some deadline to get it done. Obviously, we want it after things are fully operating.

We don't want it done when there's turbines that aren't operating. But I'm open to any suggestions for improvement.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Thank you, Madam Chair.

A question for the sponsor. Did you -- I thought you just indicated, and I didn't hear it in the motion, that you would not preclude others from the opportunity.

Is that somewhere else in the document?

COMMISSIONER NELSON: I believe that is in Staff's second Proposed Condition that we just approved.

COMMISSIONER HANSON: Okay.

COMMISSIONER NELSON: Let me verify that.

Yeah. There's a provision in there that says, "Applicant shall, upon Commission formal request, conduct field surveys or provide postconstruction monitoring data verifying compliance with specific noise level limits using applicable ANSI methods. Sound monitoring will not be repeated in a representative area during any five-year period unless operational or maintenance changes result in a reasonable assumption of higher turbine levels."

And so the way I would anticipate that working is if one of the other nonparticipants down there had a complaint, they would come to us. We would determine

whether or not there needed to be that testing, and then per this condition, we could order it.

COMMISSIONER HANSON: So your new motion is perhaps slightly redundant, but at the same time it specifies what shall take place.

COMMISSIONER NELSON: Exactly. Yes.

COMMISSIONER HANSON: Okay. Thank you.

CHAIRWOMAN FIEGEN: Other discussion on the motion.

Seeing none, all in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

Commissioner Nelson, I just want to make sure. Let's see. Applicant and Staff were advised -- Condition 29 and then the revised new, that's all in there correcting your main motion? That final --

COMMISSIONER NELSON: Yes. 29 is what was submitted yesterday that I understood Staff and Applicant had agreed upon.

CHAIRWOMAN FIEGEN: Okay. That's what I heard

in your main motion.

Okay. Other amendments to the main -- and also the new item on the bottom; correct?

COMMISSIONER NELSON: No. No. I understand that yesterday there was another new condition proposed, and I have not moved that.

CHAIRWOMAN FIEGEN: Oh, okay. So you did not move this condition of -- at the bottom or all of 29?

COMMISSIONER NELSON: At the bottom.

CHAIRWOMAN FIEGEN: Okay.

COMMISSIONER NELSON: I think it says -- it says "new."

CHAIRWOMAN FIEGEN: Okay. And that's the one you did not propose.

COMMISSIONER NELSON: I did not propose that.

CHAIRWOMAN FIEGEN: Okay. All right.

We are ready for more amendments.

And I'm going to move in Condition 27 -- where Commissioner Nelson dealt with the sound, I'm going to move that the 45 L10 for participating landowners unless a signed waiver is obtained from the owner of their residence.

Discussion on the motion.

I just believe that as a Public Utilities Commission although there's waivers and contracts and

easements, this just gives a little bit of protection to participating landowners that don't necessarily have a turbine. And that they can certainly sign the waiver and this won't be an issue but just to ensure that participating landowners may also have some type of protection on sound.

I did move it up to 45 L10. Other discussion on the motion -- or amendment.

COMMISSIONER NELSON: Madam Chair, I would just reiterate what I stated before.

You know, we certainly have an obligation to ensure the welfare of folks that have not chosen to be part of this deal, but when somebody chooses to be part of it, chooses to take advantage of the economic opportunity when they are part of it, that with that may come some negatives that they have chosen to sign off on and I'm really not willing to get into the middle of that deal.

CHAIRWOMAN FIEGEN: Other discussion on the amendment to the main motion.

COMMISSIONER HANSON: Madam Chair.

CHAIRWOMAN FIEGEN: Go ahead.

COMMISSIONER HANSON: Madam Chair, I had the same thoughts as Commissioner Nelson as I went through this process. At the same time I thought of the

chronologic -- chronological order -- chronologically -- I can't get -- you understand what I mean.

COMMISSIONER NELSON: And Cheri has to spell it six different ways.

CHAIRWOMAN FIEGEN: Chronological.

COMMISSIONER HANSON: From the standpoint of the challenge if I were a property owner and signing an agreement and everything and the promises are made, I still don't know some of these things that are going to take place in the future.

And I think this protects that party, that citizen, from a situation where they've signed on to a deal and then there are future things that take place that may not be of their liking. And I know they're getting compensated for things of that nature. I just from that standpoint feel that it would be a good idea to allow them to do that.

Thank you, Madam Chair.

CHAIRWOMAN FIEGEN: Thank you.

And, you know, compensation -- we certainly didn't necessarily get to see the agreements on compensation when you don't necessarily have a turbine. And so a lot of times when participating landowners sign up a lot of times they sign up in the hopes that there will be a turbine, and that's not always the case.

And I understand there's lots of legal issues when you sign up, but this does provide protection. Signed waivers can be obtained from the owner of the resident.

Commissioner Nelson.

COMMISSIONER NELSON: Just scanning through the sound level modeling, it doesn't look like there are any model levels that are over 45, and so maybe it's more kind of a moot discussion.

I'm going to vote against it just on principal, but it looks to me like nobody's really going to be affected one way or the other.

CHAIRWOMAN FIEGEN: Thank you.

And just a reminder, that's L10 just like yours.

Okay. Other discussion on the motion.

All in favor say aye; all opposed say no.

Commissioner Nelson.

COMMISSIONER NELSON: Nay.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

That brings me to my next amendment to the main motion, which will be shadow flicker. I believe the

discussion is very similar to the discussion we just had. And so I'm going to add the same condition as was previously amended on shadow flicker with participants unless a signed waiver is obtained from the owner of the resident.

That's my amendment to now the main motion. And the same -- mine's the same argument. I'm sure Commissioner Nelson's is the same argument also.

Other discussion on that motion.

COMMISSIONER NELSON: You're right. Same argument. Just very quickly scanning through it looks like there's at least eight participants that would be affected by this.

Thank you.

CHAIRWOMAN FIEGEN: Other discussion on the motion.

All in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Nay.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

Are there other amendments to the main motion?

COMMISSIONER HANSON: I have a question if I may.

CHAIRWOMAN FIEGEN: Go ahead.

COMMISSIONER HANSON: Does the main motion include the -- the request by Applicant -- I believe it was by the Applicant on item 29E to change to "the Applicant decide at a later point to use a lower" -- a different lower megawatt turbine and also include "the Applicant shall also demonstrate that in," et cetera, et cetera.

COMMISSIONER NELSON: The answer is yes. That is the Proposed Joint Condition from both Applicant and Staff that came in yesterday. That was part of my initial motion.

COMMISSIONER HANSON: Okay. And I would have a further question then on that same issue.

Why not have that with larger megawatt turbines? Why do we need to specify just for -- why is this particular requirement condition just for lower megawatt and not for larger megawatt turbines?

Would it make sense to just strike lower megawatt?

COMMISSIONER NELSON: I'm not sure that I can answer that. As I said, this was proposed by Applicant and Staff. I didn't find it objectionable, but if you'd

like to know the ins and outs of that, you might want to ask Staff and Applicant.

COMMISSIONER HANSON: All right. Thank you.

And that question I'd put to Staff and Applicant.

MS. EDWARDS: I'd just start by saying we had come to this agreement about turbine flexibility using roughly the same language we had used in the previous two dockets. And it was an oversight on my part, and I feel bad about it.

In the brief I had advocating -- advocating for using the smaller turbines at places where they would minimize impacts. However, I failed to acknowledge that I had already agreed to a different condition and failed to contact the Applicant to warn them I was doing that. And I try to never do that to people.

So I'm terribly sorry for that oversight. They reached out to me to let me know that I had done that, and that's kind of how we came to this condition.

COMMISSIONER HANSON: Okay. Having said that, and I appreciate and understand it, why not apply this to all turbines as opposed to just lower megawatt turbines?

Do you wish the Applicant to give it a shot? It looks like they're anxious. I'll let Applicant go ahead, and then you can feed off that answer.

MS. AGRIMONTI: Thank you, Commissioner.

The testimony at hearing was that Prevailing Wind Park was looking for flexibility to use a smaller GE turbine to qualify for the production tax credit so that was the only flexibility that was requested.

So on the record, the only alternative turbine is the smaller turbine. So it's just an adjective not necessarily meant to be restrictive but to be reflective of the record.

COMMISSIONER HANSON: So I assume you'd be amenable to just stating at a later point to use a different turbine model?

MS. AGRIMONTI: No objection, sir.

COMMISSIONER HANSON: All right. Thank you.

Madam Chair, I'd make a motion that on item 29 on the -- make a motion to amend the main motion on page -- well, in this case we have different page numbers.

On item 29E, to read, "Should Applicant decide at a later point to use a different megawatt turbine model, it shall provide," et cetera. So the change being that "lower" would be removed.

And I believe any discussion on that is -- by myself has taken place at this time.

Thank you, Madam Chair.

CHAIRWOMAN FIEGEN: Commissioner Nelson.

COMMISSIONER NELSON: I don't think there's anything on the record that would indicate things might go this direction, but that leaves it open for a higher megawatt turbine model to be substituted.

I mean, I don't think that's being proposed. I don't think that will happen, but by taking "lower" out, that perhaps gives that opportunity.

COMMISSIONER HANSON: Madam Chair.

CHAIRWOMAN FIEGEN: Go ahead.

COMMISSIONER HANSON: I don't read it as saying that. It simply provides that if for some reason they do decide at a different megawatt, that -- and it is subsequently approved, that they have to demonstrate in selecting locations, et cetera.

And I see my motion also needs to include the word "small" because that was added as part of the Applicant's request.

So I would supplant the word "small" with the word "other." It's restrictive, regardless. And it provides a restriction in this case only -- the way it's presently written only to smaller turbines or lower megawatt turbines by removing those two words.

And it would apply to any turbines. It doesn't permit additional turbines. It just means that any

turbines that are provided.

CHAIRWOMAN FIEGEN: Other discussion on the amendment.

COMMISSIONER NELSON: Madam Chair, since this was a joint condition, may I ask Staff if they are okay with those changes?

MS. EDWARDS: My main concern was just having the Applicant at least consider if a turbine's going to have lower impacts, to put it where lower impacts would have the most benefit. And that would still do that.

And regardless of what turbine the Applicant ends up using, whether it's in the off chance bigger or smaller, there's a slough of other conditions they'd have to abide by, setbacks or sound requirements. So I think we're comfortable with that.

COMMISSIONER NELSON: Thank you.

CHAIRWOMAN FIEGEN: Other discussion on the amendment to the main motion.

All in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

I do have a question of the Applicant, and I don't know if this is in confidential session or not but the new item that was brought to us that was not agreed upon and is not currently in the main motion is, "Shall any installed wind turbine not be operating for a consecutive 12-month period, Applicant shall remove and decommission the nonoperating turbine within the subsequent 12-month period."

So are these landowners paid based on generation? Are they -- so would a landowner still be paid the same amount if it's not operational?

MS. AGRIMONTI: Chair, I consulted with Mr. Pawlowski of Prevailing Wind Park, and to answer that question he would ask that we go into confidential session for the proprietary nature of the agreements.

COMMISSIONER NELSON: If I might interject, Exhibit I-17, does that not -- which is a public document. Does that not answer the question?

MS. AGRIMONTI: I can tell you, as we stated at the hearing, that there's a representative lease in the record and I believe, Commissioner Nelson, you've just cited that.

COMMISSIONER NELSON: Yes.

MS. AGRIMONTI: But if there's a request for us

to state what our company policy is and what the rest of the leases say, we would prefer to do that in confidential session.

COMMISSIONER NELSON: Fair enough.

MS. AGRIMONTI: I've gotten further clarification that I can say in that document it advises that the payment is based on facility presence, not on production.

COMMISSIONER NELSON: Well, could I ask a question based off of that response?

CHAIRWOMAN FIEGEN: Yes. And then I'll be asking staff a question after you're done.

COMMISSIONER NELSON: So the actual leases, would the answer be different in any of those?

MS. AGRIMONTI: One moment, sir.

(Pause.)

MS. AGRIMONTI: No.

COMMISSIONER NELSON: Thank you.

CHAIRWOMAN FIEGEN: Now I have a question for Staff on the proposed new condition that was filed, although not agreed upon by both Applicant and Staff.

Do you still feel comfortable with this condition, realizing that a landowner would lose their --

So if the tower is taken down, is it your understanding the landowner would lose their payment?

And are you still comfortable with this condition that you ran up the flagpole yesterday when you filed?

And I'll give you a little bit of time to discuss that among the three of you, and then if you could decide who's going to speak.

MS. EDWARDS: That stemmed from both the testimony and the record from someone who did end up having one sitting resting or burnt out on his property and that concern and also our concern for the general public not wanting those around in their community.

So Staff does still feel comfortable that's a necessary question. Not having read each and every lease, I suppose one could obtain a waiver from the particular landowner to allow it to be left up, but that still leaves the general public with a burnt out potentially inoperable wind turbine.

CHAIRWOMAN FIEGEN: So did you hear the same thing I understood anyway? And maybe I understood the Applicant wrong, but it sounded like the Applicant responded that although a turbine is not running on a landowner's land and is not operating, they still get payment and they still get, I believe, the same payment?

MS. EDWARDS: Right. That would alleviate that portion of the concern.

So our only remaining concern would be a

community as a whole who are not and would not receive payment for that anyway would be left with that structure.

CHAIRWOMAN FIEGEN: And no sound or no shadow flicker.

Go ahead.

MS. AGRIMONTI: Commissioner Fiegen, thank you. I simply wanted to advise the Commission that as a practice the company would remove a turbine in disrepair. The company wouldn't want to leave one that wasn't operational on the premises.

And the time frame that we proposed in the Joint Condition was the time frame in which Mr. Pawlowski testified that that would occur.

CHAIRWOMAN FIEGEN: Thank you.

I would love to make this amendment to the motion, and that's all about setbacks. I believe our setbacks are outdated. So I believe they're outdated on a statewide level.

And what I have learned, especially through this evidentiary hearing, that the technical expertise for counties to decide on setbacks may be limited.

I would love to make the amendment of a three-quarters-of-a-mile setback for nonparticipating landowners. I wish the record would support that

amendment, and I wish the Applicant would have worked with participating and nonparticipating landowners to ensure the setbacks were more up to date.

But today I'm not going to make that amendment, but I so wish the record would reflect that.

Other amendments to the main motion.

COMMISSIONER HANSON: Madam Chair, I have some -- a few important and not so important amendments, a number of them.

However, having just heard your statement, I would -- one of the motions that I have I think I need to meet with counsel, legal counsel, first before I --

CHAIRWOMAN FIEGEN: Who knows. You might change my mind, and it might be on the record.

COMMISSIONER HANSON: Thank you.

CHAIRWOMAN FIEGEN: So we're going to go into recess. Commissioner Hanson is meeting with advisors, and we will be in recess.

(A short recess is taken.)

CHAIRWOMAN FIEGEN: We are going to come back from recess.

And, Commissioner Hanson, you do have the floor.

COMMISSIONER HANSON: Thank you, Madam Chair.

One of the challenges with this particular docket is the -- well, like all large dockets, there's so

much differing information, and it seems to change as we go through it. I want to be certain of a couple of things, and we were just talking out in the hall trying to figure out some of the particulars.

And before I make a motion, either Staff or -- I know we've gone over this before, but there's -- this is -- I don't know. Like mercury sometimes, slipping through the fingers trying to get ahold of it.

We have three different counties. We have one county that does not have setback regulations. The other two have different setback regulations. We have within our -- the Application and within the permit process conditions and testimony, some different distances. And I know that Staff and the Applicant perfectly understand exactly the distances for everything. I don't.

So I'm curious if someone would go over the distances for the three counties and for the participants and for the nonparticipants on requirements for setbacks as they presently stand in the conditions.

CHAIRWOMAN FIEGEN: So I believe that's in the Application or saw it in a brief. I saw it last night and the night before.

COMMISSIONER HANSON: I saw it as well.

CHAIRWOMAN FIEGEN: But I can't remember where it went, just like you. And so I'm going to allow a

little bit of time for people to find the county setback.

COMMISSIONER HANSON: I read it as recently as four days ago, I think.

CHAIRWOMAN FIEGEN: I believe it's in the Applicant's Application, but I can't remember if it was in your Application or your brief. But it's something the Applicant --

MS. AGRIMONTI: Thank you, Commissioners.

I can point you to Table 9-2 in the Application. It includes the setbacks for the counties as they exist. The Application does not reflect the commitments that Prevailing Wind Park made to Charles Mix County.

And just to sort of summarize, I know there was some testimony that was conflicting. Bon Homme has specific wind energy system requirements, which the project has met through an approval of the Wests in Bon Homme.

Charles Mix is not zoned, and that's where Mr. Pawlowski's Affidavit and commitments come in. And Hutchinson has a special exception permit process, which the project also went through and received approvals for.

So the Prevailing Wind Park commitments in Charles Mix would be in the Affidavit. And I've got to grab the exhibit number for that momentarily.

COMMISSIONER HANSON: So in Charles Mix can you tell me what the setbacks are, requirement?

MS. AGRIMONTI: That's what I'm going to look up right now. Give me just a moment, please.

COMMISSIONER HANSON: And same question for Bon Homme.

MS. AGRIMONTI: Bon Homme I can tell you, and that's in Table 9-2 of the Application. So the distance from occupied off-site residences is 1,000 feet. And then the distance from the residence of a landowner on whose property towers are erected is not less than 500 feet or 1.1 times the system height. Public roads is 500 feet or 1.1 times system height, whichever is greater.

COMMISSIONER HANSON: Just a minute. I didn't catch that.

The nonparticipant occupant is 1,000. The landowner participant is not less than 500.

MS. AGRIMONTI: Or 1.1 system height.

COMMISSIONER HANSON: Okay.

MS. AGRIMONTI: Then the distance from the public right-of-way roads is 500 feet or 1.1 times system height.

And then the property line requirement in Bon Homme is the same as the state requirement in

SDCL 43-13-24, and that's 500 feet or 1.1.

CHAIRWOMAN FIEGEN: And that's the tower height and not necessarily the system.

MS. AGRIMONTI: It's the system height. It's the tip height. So we talk about the tip height. It's with the blade up.

COMMISSIONER HANSON: And the Hutchinson one.

MS. AGRIMONTI: Hutchinson has no requirements.

COMMISSIONER HANSON: Right.

MS. AGRIMONTI: The project applied the Bon Homme requirements to Hutchinson, even though Hutchinson did not have those requirements.

COMMISSIONER HANSON: Thank you.

MS. AGRIMONTI: And I'm sorry, Chair. You're looking at me quizzically, and I want to make sure that I'm still tracking.

CHAIRWOMAN FIEGEN: So state regulation is 1.1 of the tower height without the blade; is that correct?

MS. AGRIMONTI: Oh, I'm sorry.

It's tower. I thought you were asking about Bon Homme. And you're right. That's the difference between those two.

Thank you. I apologize. Bon Homme is greater than the state requirement.

And if anybody knows Mr. Pawlowski's Affidavit

number -- exhibit number faster than I do.

MS. EDWARDS: Exhibit I-22. And you'll want to look at setbacks on page 304.

MS. AGRIMONTI: All right. Thank you.

MS. EDWARDS: Forgive me. I can read it into the record.

MS. AGRIMONTI: Go right ahead. That would be fine.

MS. EDWARDS: For Charles Mix County it would be the turbine distance from currently inhabited rural residences of a nonparticipating landowner is not less than 3.5 times the system height or 2,000 feet, whichever the greater. From the residence of a participating landowner, not less than 1,000 feet.

Rights of way and public roads is not less than 500 feet or 1.1 times the system height, whichever is greater.

COMMISSIONER HANSON: Thank you, Applicant and Staff. Appreciate that.

Madam Chair, I have some comments on that later. Right now I have some -- I have a motion on No. 41.

CHAIRWOMAN FIEGEN: And let us just get to that.

COMMISSIONER HANSON: Yes.

CHAIRWOMAN FIEGEN: Okay. Everybody at 41, Condition 41.

Go ahead.

COMMISSIONER HANSON: I move to insert the words "and operation" after the word "construction" so that in the first sentence it will read, "The terms and conditions of the permit shall be made a uniform condition of construction and operation subject only to an affirmative written request for an exemption addressed to the Commission."

It seems to be self-explanatory that this -- requirements would survive the construction of the project and require -- to be required during the remainder of the operation of the facility.

CHAIRWOMAN FIEGEN: Thank you.

Other comments on the motion.

All in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

COMMISSIONER HANSON: Madam Chair, I would have an additional -- some cleanup on No. 40.

CHAIRWOMAN FIEGEN: On No. 40, page 8 of the

conditions.

Go ahead.

COMMISSIONER HANSON: I'll run through a number of these. And if someone wants to take them individually, that's fine. I don't know that they'll be controversial in any fashion.

I appreciate the fact that these were sent I think it was -- the last discussion we had in the setup of the escrow account and how it would be facilitated.

Item 40B, the very last sentence towards the end, the Commission may -- I would like to change the verbiage so that it states in the last sentence, "Based on the verification of the information in the filing, the Commission may require additional funding to equal the estimated amount needed for decommissioning."

And in the second line to add the word "to" so that it states, "The turbine owner shall submit to the Commission an estimated decommissioning date." I believe "to" was just accidently left out.

If everybody's following that, on item C I wish to supplant the word "interest" with the word "revenues" earned by the account, state that earned by the account shall remain in the account.

The reason to change from interest to revenues is that many escrow accounts receive funds from other

areas besides just interest; capital gains, for instance, dividends, things of that nature. And I would think that we would want to make certain that all of those are included.

On item D, I would say -- wish to state, "An account statement shall be provided annually and become a public record" -- "to the Commission and become public record."

And in item E the last sentence state, "A sale of project assets shall include" instead of the words "would be expected." State "shall include the associated permit" and state "that requires Commission approval," instead of which would. Just to put them in the positive fashion. And I believe that's all --

MR. DE HUECK: Could you read the last one again, Gary. Sorry.

COMMISSIONER HANSON: The last one would be in Section E. The last sentence state, "A sale of project assets shall include the associated permit that requires Commission approval per," et cetera.

CHAIRWOMAN FIEGEN: Discussion on your motion.

COMMISSIONER HANSON: I think they're self-explanatory. It puts things in a stronger fashion. And, like I said, I appreciate this being added in the last meeting that we had.

I believe I was on the phone at the time trying to shuffle papers as I was -- I was not driving, but I was traveling at the time. And I think it's a well pushed suggestion that was incorporated in the last and hopefully in future dockets of this nature.

Thank you.

CHAIRWOMAN FIEGEN: Thank you.

Commissioner Hanson, I certainly do think you have cleaned it up. You've made it more direct, and I can certainly tell you are a former legislator using the words "shall is shall" and shall is shall is shall.

Commissioner Nelson.

COMMISSIONER NELSON: I'm good with all of that with the exception of maybe the change on C from "interest" to "revenues."

When you mention capital gains and dividends that would lend me to believe that some of this money would go into equities which may also have capital losses, and that is not my intention with an escrow account. And the escrow agreement that we are reviewing in the Crocker docket clearly specifies that this money isn't going to go into things that may have capital gains or capital losses but only in an interest-bearing type of account. And so --

Well, yeah. Revenues would certainly cover it.

I feel more comfortable with "interest" so that nobody thinks that we can go off on speculative ventures with this money.

COMMISSIONER HANSON: As long as the document itself states that it's not for that purpose, that it's for interest, that's fine.

If that's ever changed, though, then you have the challenge here that it only states for revenues. Revenues, like you say, includes interest, and so it doesn't affect that. It's only the document, the directing document itself, that we have to make certain directs that. And as long as it states that, there shouldn't be any interpretation challenges.

But I think it's fairly standard to always say that revenues that are earned, regardless of how they're earned, remain in the account. I feel more comfortable with revenues. That's why I suggested it.

COMMISSIONER NELSON: And I'm okay with that. I guess, just when the Applicant brings the actual agreement in, I anticipate that it will probably much more informal than what we're seeing in Crocker.

COMMISSIONER HANSON: Thank you, Madam Chair.

CHAIRWOMAN FIEGEN: Other discussion on the motion.

All in favor of amending 40 on page 8 of the

conditions say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

Commissioner Hanson.

COMMISSIONER HANSON: Madam Chair, I'm still debating on a setback item. However, I would -- I'm going to pursue another one while I'm -- where my subconscious continues to debate the other one.

I would turn to the other document that we have. I don't know -- I'm searching for a title to it. Before the Public Utilities Commission of the State of South Dakota, In the Matter of the Application of Prevailing Wind. Proposed Findings of Fact and Conclusions of Law.

Will there be a -- will there be a vote on that at all?

MR. DE HUECK: No.

COMMISSIONER HANSON: Will that in any way be an instructional document in the future?

MR. DE HUECK: No. Commissioner Hanson, you and I will visit about that in a different forum.

COMMISSIONER HANSON: Okay. So it will not need to come before us for approval.

MR. DE HUECK: Not at this time.

COMMISSIONER HANSON: Oh, in the future.

MR. DE HUECK: We will have our own Order.

COMMISSIONER HANSON: Thank you. My subconscious is not working as fast as it should.

CHAIRWOMAN FIEGEN: We have plenty of time. Take your time. I mean, this is an important docket.

COMMISSIONER HANSON: I'd like to explore item 34 for a moment. And I will -- I'll just say this will parallel some of my concerns that I was going to bring up in the amendment -- or the suggestions that I was going to make for the Findings of Fact.

On item 34, Applicant agrees to undertake two years of independently conducted postconstruction avian mortality monitoring for the project and provide a copy of the report to et cetera, et cetera.

Two years of independent postconstruction monitoring of mortality. Will we be able to define -- I know that's included in the other document I just referred to. However, once we agree to two years in this document, then we are, I would assume, constrained to two years in the next document; correct? I mean, we're not going to be able to have a different duration.

MR. DE HUECK: If you want a condition different than this, then 34 would be the place to --

MS. CREMER: Yep.

COMMISSIONER HANSON: Thank you.

And I'd like a little discussion on it. For me I look at it, and I think that it needs to be permanent. I recognize what that means from the standpoint of having an independently conducted postconstruction avian mortality. I just don't see how it works otherwise and how it's reported.

I know it has to be reported if an endangered species is killed. But if I could have some discussion on that to make me comfortable with two years because I'm totally uncomfortable right now. I believe it needs to be longer than that.

And I know that was part of the discussion that we had, but when I look at -- I looked at the record again today. I looked at the transcript. I've read the answers that were given, and I -- frankly, I'm just not comfortable with the two years at all. So I'd like the Applicant to respond to my concern.

The evidence that was presented in the transcript really doesn't provide much at all from the standpoint -- it just seems really lacking from the standpoint of giving me any feeling that -- you know,

it's ambiguous and it just doesn't give a lot of specifics. So perhaps you could --

MR. PAWLOWSKI: Sure. And thank you for giving me the opportunity to address the Commission.

We expect U.S. Fish & Wildlife requires two years of postconstruction mortality surveys and then a year every five years. So in practice every five years we'll do a year of surveying. That five years from the date of operation, right.

So two years of postconstruction monitoring. Then three years later we do another year of study, and then so on and so forth. So in reality -- and these are conditions we expect from U.S. Fish & Wildlife Service. So those are, I guess, customary in terms of monitoring.

COMMISSIONER HANSON: All right. As you're speaking, I'm thinking of a different verbiage that would make me feel comfortable. Thank you.

Go ahead if you have a question.

CHAIRWOMAN FIEGEN: No. I was just going to have discussion with you. So go ahead with your motion, and then we can discuss.

COMMISSIONER HANSON: I would like us to have the opportunity in our Order to have some leeway, and I think we're given that if we state -- if we make a change to item 34 that states, "Applicant agrees to undertake a

minimum of two years of independently conducted postconstruction." Then that gives me -- gives us the opportunity to discuss it on the Order and see what -- some specifics. We need specifics here more than what we've had and more than what has been discussed.

CHAIRWOMAN FIEGEN: Sorry. I wasn't listening well enough.

Was that a motion, or is that a discussionary item?

COMMISSIONER HANSON: Forgive me. I trespassed and spoke to the motion prior to, during, and after --

CHAIRWOMAN FIEGEN: Okay. So we're not going to have that as a motion right now.

And so I'm going to ask you a question about -- he stated that it sounds like the Federal Government asked you to -- maybe the Commission should also receive all Federal Government studies throughout the lifetime of the operation because right now the Commission is only given the first two years.

So along with your minimum of two years maybe we should also ask for all reports. And then you let me know when you're ready for your motion.

COMMISSIONER HANSON: I appreciate your suggestion on the motion, and I believe it might already state that. But I appreciate what you said there. I'll

make my motion.

I move that on item 34 to insert the words "a minimum of" so that it's after the word "undertake" so that it reads, "Applicant agrees to undertake a minimum of two years of independently conducted postconstruction avian mortality monitoring for the project." And to provide a copy of the report to the U.S. FWS, GFP, and the Commission.

CHAIRWOMAN FIEGEN: Comments on your motion.

COMMISSIONER HANSON: I believe I have probably discussed it beyond what it needed to be.

CHAIRWOMAN FIEGEN: I have a question of the sponsor of the amendment.

Do you believe that it requires that they are to submit all reports that they do at year five, at year 10, 15, 20, 25?

COMMISSIONER HANSON: No. And I was thinking that perhaps when you suggested that I didn't have the verbiage in my mind quite of how I would phrase that. So I thought I would do this one and then pursue what you had suggested.

CHAIRWOMAN FIEGEN: Okay. Commissioner Nelson.

COMMISSIONER NELSON: If I could just ask, so a minimum of two years and the company then, the Applicant, would decide if they want to do more than that? Is that

where we're going?

COMMISSIONER HANSON: Madam Chair. Thank you for the question.

No. I would look at it as at this juncture item 34 would require them to do a minimum of two years and that in the Order, when we put that together, we could then specify exactly what our -- what the three of us believe needs to be done.

COMMISSIONER NELSON: I'm going to have to oppose that. Our Order's got to match what we're putting in the conditions. And I guess I would say -- let me back up.

In one of our previous dockets they were proposing one year of monitoring and you had suggested two and I went with that. And now we've got an explanation that apparently the Feds require this every-five-year deal so there is some monitoring in perpetuity.

I don't know that I would support any more than that. At least at this point I don't know that I could. Without a -- if you can give me -- you know, give me a reason, what this would accomplish, then -- help me out with that.

COMMISSIONER HANSON: Madam Chair.

CHAIRWOMAN FIEGEN: Go ahead.

COMMISSIONER HANSON: Thank you.

We're dealing with an endangered species here. We're dealing with several endangered species. And when one considers that we here have the opportunity to provide some safeguard for those extremely rare animals that in 10, 20 years if they're killed because of the proliferation of wind turbines or there's a significant setback as a result of them, then it's too late.

And in your first concern that this has to mirror the Order, there are items that are in the Order already that are not by any means mirrored in this document. So I would -- and I recognize that when I said two years instead of one year. That particular, as I recall, was in northeastern South Dakota. It was not really close to the flyways. Significantly close to the flyways. So I felt that the two year with the follow-up from the federal agencies would suffice in that process.

Thank you.

COMMISSIONER NELSON: I appreciate that response. I just want to make very clear to everybody out there, the Order has not been written. Okay. Yeah. The Order has not been written.

You know, if the U.S. Fish & Wildlife Service -- and they're the ones whose job it is to protect the things that -- the animals that you're talking about. If

they're good with every five years, I guess I am.

CHAIRWOMAN FIEGEN: So, Commissioner Hanson, I'm going to ask you one more time. So I would support your motion if you will have another amendment that states that the reports will be submitted to the Commission at year -- it looks like it's going to be year five. And there are other reports. All reports. So let me know --

I mean, can you kind of discuss your other motion so I know?

COMMISSIONER HANSON: Madam Chair, I would like to make a substitute motion.

CHAIRWOMAN FIEGEN: I like substitute motions.

COMMISSIONER HANSON: I would -- on item -- I move in item 34 that item 4 shall read, "Applicant agrees to undertake a minimum of two years of independently conducted postconstruction avian mortality monitoring for the project and to provide a copy of this and all further reports to the" -- et cetera, et cetera, and the Commission.

CHAIRWOMAN FIEGEN: Comments on your motion. Substitute motion.

COMMISSIONER HANSON: Well, trying not to be my mother's fool, I understand fully that you will support the motion with those in it, and I do wish to have that as a part of the process that I include that in the

motion.

CHAIRWOMAN FIEGEN: And I will expect our attorneys to wordsmith that if it needs to be wordsmithed. Our intent, I believe, is --

COMMISSIONER HANSON: I would also like to --

CHAIRWOMAN FIEGEN: I'm just going to hold a second because I think we're in a little bit of a recess so just wait one second.

COMMISSIONER HANSON: And then I would like to speak to comments Commissioner Nelson made pertaining to the Findings of Fact.

CHAIRWOMAN FIEGEN: Okay. So my comment was if your motion may need to be wordsmithed a little bit to the intent. And I don't know. I'm not an attorney, so I don't know how it has to be wordsmithed. And then I will support your motion.

Go ahead, Commissioner Hanson.

COMMISSIONER HANSON: Thank you.

And I agree with Commissioner Nelson saying that a Findings of Fact has not been concluded at this juncture. That's why I've used the word Proposed Findings of Fact.

However, there is a Proposed Findings of Fact which is not confidential. And this was written by Prevailing Wind Park, and their own Proposed Findings of

Fact include a number of items pertaining to -- in item 39, page 12, and in item 40 they include items that are in addition to and certainly do not mirror the item 34 that I've presented here. So I would certainly hope that you can find that you can support the motion.

Thank you.

CHAIRWOMAN FIEGEN: Commissioner Nelson.

COMMISSIONER NELSON: I was good right up until the point, Madam Chair, that you talked about some wordsmithing.

I am good with the wording that Commissioner Hanson has proposed. I'm okay with that. I'm not okay with any further wordsmithing without it being on the table.

CHAIRWOMAN FIEGEN: Other discussion on the motion.

COMMISSIONER HANSON: Madam Chair.

CHAIRWOMAN FIEGEN: Substitute motion.

COMMISSIONER HANSON: Madam Chair, I made the motion and your concern was some wordsmithing so if there's something of that arena that you feel needs to be changed -- --

CHAIRWOMAN FIEGEN: All right. I'm going to support your motion.

All in favor say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

COMMISSIONER HANSON: Madam Chair, I strongly want to make another motion pertaining to setbacks, and I in discussions and research cannot find evidence that would support making a -- making a motion for setbacks farther than what are already part of the motion.

So I don't have any further motions at this time.

CHAIRWOMAN FIEGEN: I'm going to just look at everything one more time to see if I have any other amendments. Anybody else have any other amendments to now the motion that has been amended several times?

The question before the Commission -- we are now to the main motion that has been amended. All in favor say aye -- oops.

COMMISSIONER HANSON: Discussion on the final motion.

CHAIRWOMAN FIEGEN: Okay. So we are to the -- we voted on the substitute motion. We're back to the

main motion, on the main motion that has been amended several times.

Is there discussion on the main motion? That's what I meant to say. If I didn't say that, go ahead, Commissioner Hanson.

COMMISSIONER HANSON: Thank you, Madam Chair.

A lot of thoughts. First of all, I would thank the Applicant for using the previous decisions by the Commission. Using that as precedent and incorporating that through the Application has actually made this a smoother process. One may not who is observing one of these for the first time realize that, but it was smoother than could have been.

One thing that became clear through this process is that there's a challenge with property rights. We all three want to protect property rights and want to protect citizens of South Dakota. So let my remarks not be negative towards my fellow Commissioners in any way because it's not intended to be.

I don't know exactly what I'm going to say anyway so I'll just start by -- it depends a great deal on which side of the fence you're standing from a very literal standpoint on property rights. Property rights of the participant landowner versus the nonparticipant landowner.

The participant landowner wants to have the right to develop their property in a fashion. The nonparticipant owner does not want their property adversely affected and has -- should have that right. And that's where there's this huge challenge for us from the standpoint of looking at only evidence and being able only to make decisions based upon that evidence.

The nonparticipant landowners who have been both party and not necessarily party to this process have articulated excellent discussions and reasons why their property is being adversely affected. And I've always believed that if someone's property is being adversely affected, that's as far as the other property rights -- landowner's rights should go. Once that person starts affecting my right for quiet enjoyment to my property, then they don't get to do that.

And so it's very conflicting from my standpoint in looking at this, whether it's sound -- certainly that seems to be easy to ascertain. Hopefully we have resolved that through this process. Shadow flicker, hopefully there's some decent resolution to that process. Distant setbacks. I don't know how you get over the challenge of aesthetics from the standpoint of seeing those wind turbines so close to you.

And I believe it was -- well, Lisa

Schoenfelder -- well, all of them explained very well from the standpoint of distance and concern from that standpoint.

I enjoyed Marsha Hubner's presentation -- I enjoyed all of their presentations. The statement that struck me the strongest was the wind turbine much too close to the Interstate by White Lake that Mrs. Hubner touched upon. And that should give everyone pause from the standpoint of recognizing how something of this nature affects their property.

I had in discussion -- semi-purposely. I guess I didn't intend to discuss that and say I wouldn't want a wind turbine close to me. I wouldn't. I wouldn't want to have it within 2 or 3,000 feet of my property. And so that -- that makes it a challenge in looking at something of this nature.

The big problem that we have is that we have counties making decisions on setbacks. And we've always said that the closer government is to the people, the better that government will be. But for a county not to have any regulations and then to have --

There's the challenge for us from the standpoint of different counties having different setbacks. And, frankly, I don't think that the setbacks by the counties are sufficient. I think that they should be greater than

what they are. But that's not for me to decide. That's for the county commissioners to decide. Perhaps some day the legislature will make that decision.

We here have the responsibility to look at it from the standpoint of does it meet the criteria that is set forth in law.

And I know there's an argument to be made from the standpoint when we look at the different -- the Commission must find one, two, three, four, the proposed facility will comply with all the applicable laws, et cetera. And I wonder --

And I've been struggling with item 4. I was prepared to make a motion on providing for a greater setback because I felt that even though the setback laws are through the counties, I felt that in item 4 when it states that the facility will not unduly interfere with the orderly development of the region with due consideration having been given to the views of governing bodies of affected local units of government, that does not exclude the views of the citizens who are affected.

It specifically states that we must consider the views of the governing bodies, but it does not say that we cannot exclude the views of the citizens. And so when I look at that and -- item 2 and 3 I guess I would interpret the same way. I feel we could -- I would

certainly make the argument that we could provide for greater setbacks.

But, again, I met with legal counsel, and I reviewed what staff had provided us. I reviewed the hearing evidence. And I don't have that ability from the standpoint that would be -- that would hold up in Circuit Court.

I could try and stretch the envelope a little bit and add 100 feet here or there, but that wouldn't help. That wouldn't change anything. And so from that standpoint I feel, unfortunately, that I can't pursue that.

I think the Commission has done an admirable job. I don't mean to pat us on the back. I think this was a very difficult, very challenging, very personal type of situation, and I just think that we've done the very, very best we can to protect the citizens and at the same time to provide the Applicant the rights that the Applicant has under the state law of South Dakota based upon the evidence that's been presented to us.

Thank you, Madam Chair.

CHAIRWOMAN FIEGEN: Commissioner Nelson.

COMMISSIONER NELSON: Thank you. And, Commissioner Hanson, I appreciate your comments.

This is clearly a classic circumstance where we

have competing property interests. We have those property owners that wish to maximize the economic return opportunity that has been given them for their property. We have others, many of which are here today, that really don't want to be impacted by that particular economic development. And I understand both of those viewpoints.

As I began today saying however the criteria that we have to use is laid out in state law to make this judgment and the portion that talks about ensuring the welfare of the folks in that area, I think we have done what we can here today to balance those competing interests.

I want to spend just a little bit of time talking about the issue that I've not talked about today but that we've heard much about throughout this entire proceeding, and that is the issue of infrasound and health impacts, potential possible health impacts.

We had -- on the infrasound, I learned about this through this process. I came away understanding that there are two different methodologies for even measuring this, methodologies that give very different answers as to how much of this is out there and how far does it go.

I wish I could have pulled both of those experts back in to have them further discuss why their particular

methodology was right as opposed to the other so that we could have understood which, in fact, was the better methodology. That's an open question at this point.

The health impacts or the alleged health impacts. Let me be very clear. For any of those folks who have claimed that they are -- their health has been affected, I don't quibble or disagree that you may have some health impacts. What was completely lacking, however, in this proceeding was the nexus, the scientific medical nexus between what folks are experiencing and wind towers.

I was -- coming into this I was dearly hoping that this particular question would be fully fleshed out in this proceeding and that when we were done today I would have a very firm understanding of where the science is at on this.

Unfortunately, none of the Intervenors produced a doctor or a medical researcher on the stand who could talk to us about that. And I'm disappointed in that because that's who I wanted to hear from, somebody that could make that scientific nexus. And so, without that, we don't have on the record what we need to make any other conclusion other than what we have today.

That's all I'm going to say on that. Just we're not ending where I hoped to end on that with the

understanding that I hoped to have had, but we didn't have enough evidence to draw any other conclusion.

With that, though, Madam Chair, I think the rest of the work that we have done is where we need to be and certainly will support the motion.

CHAIRWOMAN FIEGEN: Thank you, fellow Commissioners. There's really not much to add.

I so wish I had more tools in the toolbox. I believe our statute is outdated on setbacks. I believe land values and land guarantees should have a comprehensive study so we can really understand that. I absolutely believe six months is too short a time frame to weigh such strong conditions and bring the evidence that my fellow Commissioners talked about that we need.

To strike a balance between affected landowners and the industry is not easy to do. And today I have to make my decision based on the tools that I have, and the legislature gives us that authority in statute.

Other discussion on the motion.

Commissioner Hanson.

COMMISSIONER HANSON: Thank you, Madam Chair.

Discussion is good. One of the arenas that I kept looking at was the health aspects. I appreciate Commissioner Nelson bringing up the health aspects again.

I don't know that it needs to be a doctor that makes a presentation. I was very moved by testimony from the folks from Nebraska and Iowa who had had to move, who were selling their properties, and who obviously were telling the truth on the effect that it was having on them.

And that was the -- that one little hole in everything that I felt that -- I had forgotten about as I was going through this and in all of my notes that I had included that from the standpoint of No. 3 that -- of the criteria in South Dakota Codified Law that provides that the facility will not substantially impair the health, safety, and welfare of the inhabitants. And that was the one area that I felt was strong that I had actually forgotten about as I was going through this process on looking at distance.

And since we're back to the main motion and I would have an opportunity to pursue a setback based upon distance, I would just need a couple minutes with counsel to see -- for a motion to amend to increase the setback distance. Because I believe that we have had testimony that provides us with support and evidence from a standpoint of being able to require further setbacks.

CHAIRWOMAN FIEGEN: Okay. We will go into recess.

(A short recess is taken.)

CHAIRWOMAN FIEGEN: We are back in from recess and, Commissioner Hanson, you have the floor.

COMMISSIONER HANSON: Madam Chair, after meeting with Commission advisors and with our counsel and going over the process, there just does not seem to be any way in the world that we could survive an objection in Circuit Court to this -- a challenge in Circuit Court on the motion that I -- the two motions -- actually three different motions that I explored with counsel just now. And for that reason just I can't make the motion.

Thank you.

CHAIRWOMAN FIEGEN: You know, thank you for your consideration. I know I too looked a lot at setbacks and spent a lot of time on that. And I do believe they're outdated. I do believe the legislature really needs to look at that. They're very technical. And I hope in 2019 that they will be proactive.

Other comments on the main motion that has been amended.

Seeing none, all in favor of the main motion for the permit of EL18-026, if I remember that right, say aye; opposed, nay.

Commissioner Nelson.

COMMISSIONER NELSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Hanson.

COMMISSIONER HANSON: Aye.

CHAIRWOMAN FIEGEN: Commissioner Fiegen votes aye.

Motion carries.

(The proceeding is concluded at 4:22 p.m.)

ATTACHMENT 6

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	**INTERVENORS' POST-HEARING BRIEF** **EL 18-026**

Intervenors, Gregg Hubner, Marsha Hubner, Paul Schoenfelder, and Lisa Schoenfelder, through counsel, hereby submit this post-hearing brief requesting the Commission deny Prevailing Wind Park, LLC's ("PWP") Application for a Permit of a Wind Energy Facility in Bon Homme County, Charles Mix County, and Hutchinson County, South Dakota, or alternatively, approve the Application with the below-referenced conditions.

INTRODUCTION

PWP is seeking a permit from the Commission to build a wind farm in Bon Homme County, Charles Mix County, and Hutchinson County. As the applicant, PWP shoulders the burden of proof to establish its proposed project satisfies the provisions of SDCL 49-41B-22. Intervenors shoulder no burden. Therefore, if there remains a question as to whether the proposed project complies with SDCL 49-41B-22, the permit application must be denied. As shown below, PWP has not satisfied its burden. Therefore, Intervenors respectfully request the Commission deny PWP's permit application.

Alternatively, Intervenors encourage the Commission to impose the following conditions in the event the permit application is approved:

- 35 dBA nighttime noise limit when averaged over a ten minute period for non-participating residences;
- 2 mile setback from non-participating residences;
- 1,500 foot setback from property lines and rights-of-way;
- No shadow flicker be permitted on non-participating residences; and
- These conditions/restrictions may be waived by any non-participating landowner.

ARGUMENT

PWP had the burden of proof to establish that the proposed project (1) will comply with all applicable laws and rules; (2) will not pose a threat of serious injury to the environment nor to the social and economic condition of inhabitants or expected inhabitants in the area; (3) will not substantially impair the health, safety or welfare of the inhabitants; and (4) will not unduly interfere with the orderly development of the region with due consideration having been given to the views of governing bodies of affected local units of government. SDCL 49-41B-22. PWP failed to satisfy its burden that the proposed project will not substantially impair the health, safety or welfare of the inhabitants.

I. PWP Failed to Prove that the Sound Generated by the Proposed Project Will Not Substantially Impair the Health and Welfare of the Inhabitants

PWP shouldered the burden of proving the sound (or more aptly put, noise) generated by the proposed project will not substantially impair the health and welfare of the inhabitants. PWP fell short in meeting its burden.

Wind turbines create different types of sound. The most obvious and readily perceivable type of sound is audible sound. Audible sound generated from turbines—like any audible sound—has the ability to both annoy inhabitants as well as disrupt their sleep if not adequately regulated. (Ex. I-32 p. xii ("Measureable effects of noise on sleep begin at LAeq levels of about

30 dB. However, the more intense the background noise, the more disturbing is its effect on sleep."); Transcript 739: 3-6; Ex. I-1 at Lines 58-85; Ex. I-2 at Lines 398-399.) In addition to audible sound, wind turbines produce infrasound and low-frequency noise ("ILFN"). ILFN has the ability to affect people as well. (Ex. I-32 p. xii ("It should be noted that low-frequency noise . . . can disturb rest and sleep even at low sound pressure levels."); Transcript 715:22 – 716:8.) Because both audible sound and ILFN generated from wind turbines can negatively affect people,[1] it is necessary to ensure such sound does not substantially impair the health and welfare of the inhabitants. SDCL 49-41B-22.

Audible Sound – dBA Metric

Audible sound generated from wind turbines can both annoy and disrupt the sleep of inhabitants if allowed to reach certain levels. (Transcript 739: 3-6; Ex. I-1 at Lines 58-85; Ex. I-2 at Lines 398-399; Transcript 1048: 7-12; 1076:24 – 1077:15 .) The question, then, is at what level does the audible sound generated by wind turbines become so problematic that it impairs the health or welfare of inhabitants. SDCL 49-41B-22. Because audible sound is most often measured using the A-weighted scale expressed as dBA, limits placed on audible sound are normally expressed using the dBA metric. (Ex. A10-2 p. 10.)

Acousticians like George and David Hessler and Richard James who have been studying wind turbine noise for years recognize that "[a]dverse impact in the form of annoyance and complaints can occur if facility noise emissions significantly exceed the prevailing environmental background sound level[.]" (Ex. I-37 p. 95.) When a wind farm is introduced to

[1] "[D]isturbed sleep (either from internal factors or from external factors) leads to or is at least associated with fatigue, lower cognitive performance, depression, viral illness, accidents, diabetes, obesity and cardiovascular diseases." (Ex. I-31 p. 42.)

a relatively quiet rural area, higher community annoyance is expected.[2] This concept is reflected in industry standards, namely 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.

(Ex. I-1 Lines 69-82.)

Applying this industry-standard concept to the project here raises serious red flags about the project's effect on the community. The project area is certainly a quiet rural setting. Indeed, the sound study performed by PWP noted that the average background noise (or "ambient sound level" measured as L90) for the project area is 28.8979 dBA. (Ex. A10-2 p.15.) Examining only the nighttime measurements taken at midnight, the average ambient sound level is 27.2875 dBA. (*Id.*) PWP's predicted[3] noise levels of the turbines anticipates 52 residences will experience

[2] This is especially true given the characteristics of wind turbine noise---e.g., fluctuating, pulsating, tonal infra and low frequency sound—which make wind turbines more likely to cause "adverse effects than other common rural noise sources." (Ex. I-1 lines 63-65.)

[3] Of course, these predicted levels "represent only the noise emitted by the wind turbines and do not include any extraneous noises" that already exist in the project area. PWP recognizes that when the extraneous sounds are added to the wind-turbine noise, the "overall sound level" may be higher than 45 dBA. (Ex. A10-2 p. 19.)

noise levels of 35 dBA or more.[4] (Ex. A42.) Applying ANSI's guidance reveals that those 52 residences may have the same annoyance level as though the sound levels were 50 dBA or more. High levels of annoyance can be expected at these levels, especially when the inhabitants are used to nighttime sound levels of 27 dBA. (Ex. I-1 Lines 126-136.) This is one of the reasons Richard James proposes a maximum sound level of 35 dBA (Leq) for nighttime wind turbine noise for new projects in addition to a 1.25 mile setback from property lines. (Ex. I-1 Lines 101-105, 158-168.)

A study conducted by Health Canada supports James's proposal. Health Canada looked at a sample of just under 2,000 people living within 3-5 km of six wind projects in Ontario. (Ex. I-1 Lines 126-136.) Less than 2 percent of individuals reported high annoyance at levels at 35 dBA Leq or less. That percentage jumps to over 10 percent for levels between 35 and 40 dBA Leq. Imagine the percentage of complaints that would exist if participating landowners were allowed to lodge complaints instead of being subject to strict confidentiality provisions. (Ex. I-17.) Interestingly, the limits for new wind projects in Canada are set at 40 dBA Leq, which is also a limit used in the United Kingdom, Australia, and New Zealand. (*Id.* at Lines 137-142.) Other counties, like Germany for example, have limits of 35 dBA Leq for quiet rural communities. (*Id.*; *see also* Ex. I-37 p.97.) Given wind development is newer to the United States than other countries like Canada, Germany, the UK, and New Zealand, (Ex. I-37 pp. 96-67), it makes sense to compare the noise standards those countries impose on new wind projects, as they have a longer history evaluating complaints of those persons living close to wind projects. And those countries have implemented noise limits between 35 and 40 dBA to help

[4] According to Richard James, PWP's predicted levels underestimate what the actual levels will be by at least 5 dBA. (Ex. I-1 Lines 343-377.)

protect the health and welfare of its citizenry. Even with those stricter noise regulations, wind development continues.[5] (I-1 Lines 139-140.)

Infrasound and Low Frequency Noise

Not only does the audible sound produced by wind turbines have the ability to disturb inhabitants, ILFN produced by wind turbines has the ability to do so also. (Ex. I-1 Lines 208-219 (noting ILFN from wind turbines is problematic because it "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" and that some people can also "feel" the ILFN even if they cannot hear it); Ex. I-32 p. xii ("It should be noted that low-frequency noise . . . can disturb rest and sleep even at low sound pressure levels."); Transcript 715:22 – 716:8 (noting "people with certain sensitivities are affected by extremely low frequency pulsations from wind turbines"); *id*. at 730:1 – 732:5 (relying on the Cooper study where people who complained of ILFN were able to identify when they were being exposed to ILFN with 100 percent accuracy as "convincing" that certain people experience dizziness, vertigo, and nausea from the ILFN produced by wind turbines).) ILFN pulses in the 40 dB range generate complaints and when ILFN pulses get to the 60 dB range, people begin considering moving from

[5] Witnesses suggested that anything less than a 45 dBA noise limit would prevent wind development. This is a commonly-used tactic. Regardless of the specific regulation, developers claim that any stricter regulation will prevent development. The Commission saw it first hand in the Crocker proceedings. There, the developer represented to Clark County that any setbacks greater than 2,000 feet would prevent the project from being built. Clark County nevertheless required ¾ mile setbacks. Low and behold, the developer found a way to develop the project with the ¾ mile setbacks. Here, PWP made no efforts to develop this project with stricter noise limitations, because it was focused solely on compliance with Bon Homme County's 45 dBA regulation. (Transcript 486:3-24, 509:10-19.) So any claim that this project cannot be built with a 35 or 40 dBA limitation has no basis in the evidence.

their homes. (Transcript 855: 2-25.) In other words, ILFN works alongside audible sound to add to the annoyance factor created by wind turbines.

ILFN, however, is typically unregulated when it comes to wind farms. That is because noise regulations use the dBA scale, and the "A-weighting scale . . . de-emphasizes sounds in the low and high frequencies." (Ex. A10-2 at p.10.) Thus, regulating for ILFN is most easily accomplished using a distance setback, which is discussed further below.

Annoyance from Noise—Whether Audible or ILFN—Is a Serious Issue

During the hearing, PWP's witnesses downplayed the seriousness of those studies showing wind turbine noise causes high levels of "annoyance," seemingly equating annoyance and NIMBYism. Annoyance generated by a consistent noise, however, is a very real and serious issue. That is because "it may be assumed that much of the annoyance associated with noise from neighbors relates to the influence of such noise on sleep." (Ex. I-31 at 60.) Everyone knows sleep is critical to a person's health and welfare. Further, studies have recognized that reports of annoyance from turbine sound are associated with sleep disturbance, negative emotions, or other health-related effects. (A4-5 p. 17.) Because complaints of noise annoyance are so closely associated with sleep disruption and other health-related effects, Health Canada defines high annoyance to noise as an adverse health effect in accordance with the World Health Organization ("WHO").[6] (Ex. I-1 Lines 131-133.)

The Commission heard testimony as to what happens when inhabitants experience "annoyance" from wind turbine noise. They cannot sleep. They experience headaches and

[6] Recognizing noise annoyance relates to sleep disruption, the WHO publishes noise recommendations to protect sleep. The WHO Guidelines for Community Noise "recommend that, for continuous noise, an indoor sound level of 30 dBA should not be exceeded during the sleep period time to avoid sleep disturbance." (Ex. A39 p. 97.) As for outdoor sound levels, the WHO's Night Noise Guidelines for Europe suggest an annual average of 40 dBA "to reduce negative health outcomes from sleep disturbance." (*Id.*)

fatigue. Loss of concentration. Their quality of life substantially decreases. They no longer enjoy being at home. And in some cases, they abandon their homes. Put simply, their lives are turned upside down.

Vicki May is a prime example. (Transcript 1070: 25 – 1084:10.) Initially, her and her husband were not opposed to the wind project that was built one and three-eighths miles from their home. In fact, her husband was on the planning commission and voted in favor of the project. That project predicted the sound levels at their home would be between 33 and 35 dBA on average, which was a significant increase above the ambient levels of 20 to 25 dBA they were used to. (*Id.* at 1081:17, 1084: 3.) Once the project became operational, she experienced substantial impairments to her welfare, namely her ability to sleep. She testified as follows:

> Q: And has the noise from the wind turbines affected your ability to sleep in your home?
>
> A: Yes.
>
> Q: Tell us about that.
>
> A: If you can get to sleep, it's very limited sleep. Our bedroom is on the south end of our house, along with our great room so those are the rooms we spend our most time.
>
> It's not uncommon in the summer especially when we have the most south and southeast wind that I will go eight, nine nights in a row without sleep.
>
> I've had to find different places in my house now that I can sleep. But, there again, it's not a full night's sleep. It's not a restful sleep.

(*Id.* at 1076:24 – 1077:12.) As a result of her sleep disruption, she has fallen asleep twice while driving and been forced to reduce her in-home quilting business. She no longer enjoys her property like she once could due to the noise from the turbines and now looks forward to the day she can move away from her home of twenty years.

Scott Rueter is another example. (Transcript 1045:5 – 1053: 18.) Just like Vicki May, Scott was not opposed to the project that was built close to his home. In fact, he was a participating landowner in the project. After the project became operational, however, he was forced to abandon his family farmhouse where he had lived for approximately 45 years due to sleep disruption and annoyance from the noise. He explained his problems with sleep disruption as follows: "Well, after they put the turbine up I couldn't sleep anymore, and I didn't have any choice. I slept for probably an hour and half a night for almost a year, and my body was shutting down. I could feel it. I lost 35 pounds." (*Id.* at 1048: 7-11.) Once he moved away from the turbines, he began sleeping better and his health returned. However, when he returns to his property to farm, he gets headaches when the turbines are operating. He actually has to plan his farming process around whether the turbines are operating.

Jerome Powers, Kevin Andersh, and Sherman Fuerness are three South Dakota residents who live in or around the proposed project area and who already experience noise-related annoyance, including sleep disruption, from the Beethoven Wind Farm. Jerome Powers testified:

> Q: Since [the Beethoven] project became operational have you noticed any symptoms or experienced any symptoms that you weren't experiencing before the project?
>
> A: Yes.
>
> Q: And what are those?
>
> A: The main problem was disrupted sleep. The next problem I noticed was an increase in migraine headaches, a more sense of an agitated mood, infinite mood swings.
>
> . . .
>
> A: I feel my quality of life in the last two years has decreased immensely. Obviously, if you have disrupted sleep, you do not sleep well. Your cognitive

> thinking just isn't the name (sic). You're mentally fatigued. And to concentrate on things that you really need to concentrate on becomes really difficult at times.

(Transcript 1010: 6-13, 1011: 17-22.) Kevin Andersh also has difficulties sleeping at night and describes his home as an echo chamber where he constantly hears noise from the wind turbines. (Transcript 1034: 9 – 1035:7.) He no longer sleeps with his windows open. (*Id.* at 1041: 18-19.) Lastly, Sherman Fuerniss testified to his difficulties sleeping and feeling fatigued, and that has caused him to be "regretfully" short with his children and crabby. (Transcript 575: 5-10, 587: 7-20.)

Put simply, brushing aside the multiple studies showing wind turbine noise causes high levels of annoyance as well as the complaints of those people like Vicki May, Scott Rueter, Jerome Powers, Kevin Andersh, and Sherman Fuerness ignores a very real and serious issue for inhabitants exposed to wind turbine noise. Yet, that is exactly what PWP wants the Commission to do here. In fact, PWP failed to even consider whether the community would respond to this project with high levels of annoyance. PWP failed to consider how the community would respond to this project whatsoever, because, it claimed, doing so "is not required." (Ex. A10 Lines 64-81.) That simply is not accurate, as SDCL 49-41B-22 requires PWP to prove the project will not substantially impair the health or welfare of the inhabitants. If the community is expected to respond to the project with high levels of annoyance, the project would substantially impair the health and welfare of the inhabitants of the community. As noted above, Health Canada defines high annoyance to noise as an adverse health effect in accordance with WHO. (Ex. I-1 Lines 131-133.) More obviously, if inhabitants of a community consistently experience high levels of annoyance, their welfare is substantially impaired. PWP's sound study, which focused "entirely on whether the Project complies with the Bon Homme County noise limit of 45 dBA at occupied residences rather than assessing or addressing in any way the potential for an

adverse community reaction to project noise," is therefore lacking and inadequate. (Ex. S3 Lines 17-22.) Stated differently, PWP failed to meet its burden of proving the noise generated by the project will not substantially impair the health and welfare of the inhabitants. As such, the permit application should be denied.

Adequate Noise Restrictions and Standards

Given the complaints consistently made by people like Vicki May, Scott Rueter, Sherman Fuerniss, Kevin Andersh, and Jerome Powers, the question becomes what limitations or restrictions are needed for this project to ensure the health and welfare of the inhabitants are not substantially impaired.

As a starting point, there is no state law or regulation addressing noise from wind turbines. Further, Hutchinson County and Charles Mix County have not adopted any zoning ordinances addressing noise from wind turbines.

Bon Homme County adopted zoning ordinances that provide: "Noise level produced by the LWES shall not exceed forty five (45) dBA, average A-weighted sound pressure at the perimeter of occupied residences existing at the time the permit application is filed[.]" (Ex. I-14 § 1741.) It is unclear over what period of time the average is taken. For instance, is the average to be taken over one minute? One hour? A 24-hour period? A week? A year? It is not clear. Moreover, no deference should be given to Bon Homme County's noise restrictions. Commissioner Soukup, who was serving on both the Bon Homme County Commission and Zoning Board when the wind-specific ordinances were adopted, readily admitted that the noise restrictions contained in the Bon Homme County Ordinances were over his head. (Transcript 686: 5 – 687:4 ("This is over my intelligence.").) And that is not intended to demean Commissioner Soukup, it is merely a recognition of the complexity of the issue. Some issues,

like noise generated by wind turbines, are so complex local government officials may not fully understand them. When that occurs, like it did here, it makes little sense to totally defer to the local regulation. Moreover, the Commission is charged with ensuring the proposed project will not substantially impair the health and welfare of inhabitants. SDCL 49-41B-22. This means that when local regulations fail to protect the health and welfare of inhabitants, the Commission is not bound by them.

So what noise restriction should the Commission adopt here to ensure the health and welfare of the inhabitants are sufficiently protected? Two acousticians, who are trained in how to measure sound and relate those measurements to human and community responses, (Ex. I-1 Lines 400-401), provided testimony in this matter—David Hessler and Richard James. Hessler recognized that a 40 dBA noise limit "would serve to much better protect the community against complaints and annoyance." (Transcript 721: 17-18.) He further recognized that a 35 dBA limit would protect everyone. (*Id.* at 722: 8-14.) Separately, James testified that the maximum sound level for audible sounds should be 35 dBA (Leq) and 50 dBC. (Ex. I-1 Lines 101-105.) James specifically noted that a 40 dBA limitation is not adequate protection, as proven in Ontario. "Ontario where there are many projects designed to meet a 40 dBA criteria now have abandoned homes all over the rural communities because people have just left them." (Transcript 812: 15-17.) Other respected acousticians, including Dr. Paul Schomer, the Emeritus Director of the Acoustical Society of America's Standards Committee, propose noise standards ranging from 36 to 38 dBA Leq. (*Id.* at Lines 115-125.)

PWP's own evidence actually favors a sound restriction less than 45 dBA. PWP's two medical experts, Drs. Ellenbogen and Roberts, each relied heavily on the Massachusetts Study (Dr. Ellenbogen actually participated in the study). (Ex. A4-7.) The Massachusetts Study was

intended to be a comprehensive study commissioned by the Massachusetts state government to identify concerns (e.g., noise) related to wind development and to identify best practices that could reduce potential human health impacts. (*Id.* at p. 7.) The end goal was to "inform public policy decisions by state, local, or regional governments concerning the siting of turbines." (*Id.*) Naturally, then, it makes sense to look at what public policy decisions the Massachusetts government made in light of that study to protect the health and welfare of its citizens. David Hessler explained the noise regulations Massachusetts adopted in light of its study:

> Q: My question to you, because nobody else has been able to answer it, is what is Massachusetts's regulations as far as noise limits on wind farms?
>
> A: The Massachusetts noise—state noise limit is to measure the background L90 statistical. That's the near minimum background level. And then the project can be 10 above that.
>
> So it starts at a very low level, and then they have a big adder. It's unusual.
>
> Q: So whatever the L90 level is, the project can go 10 above that?
>
> A: That's right.

(Transcript 746: 5-20.). Here, PWP's sound study (ex. A10-2 p.15) shows the average L90 at midnight for the project area is 27.2875 and the average L90 when taking into account the 5pm and 10am measurements is 28.8979. Applying the Massachusetts's computation would yield noise restrictions of between 37.3 and 38.9 dBA. These noise restrictions fall in line with the restrictions suggested by acousticians who have spent years studying wind noise.

Given the above, and in the event this project is permitted, Intervenors request a condition be placed on the project imposing a nighttime noise limitation of 35 dBA when averaged over a ten minute period for non-participating residences. During compliance testing, turbines must be operating at 90 percent of full power or more as shown by SCADA data showing energy production, hub rpm, hub level wind speed and direction, blade angle and

nacelle yaw. Compliance testing must be conducted via an on/off compliance test in accordance with ANSI S12.9 Part 3 Sections 6 and 7. (Transcript 856:8 – 859:15.) According to David Hessler, this form of compliance testing is the "simpler, more unequivocal way of doing it." (Transcript 738: 3-4.)

Distance Setbacks to Account for Noise and ILFN

In addition to noise restrictions which are based on the dBA metric, restrictions must be put into place to account for ILFN. Again, the two acousticians who presented testimony in this proceeding recognize ILFN as a serious concern that has the ability to negatively affect inhabitants. (Transcript 715:22 – 716:8 (noting "people with certain sensitivities are affected by extremely low frequency pulsations from wind turbines"); *id.* at 730:1 – 732:5 (relying on the Cooper study where people who complained of ILFN were able to identify when they were being exposed to ILFN with 100 percent accuracy as "convincing" that certain people experience dizziness, vertigo, and nausea from the ILFN produced by wind turbines); *id.* at 855: 2-25 (recognizing some people abandon their homes when being exposed to certain levels of ILFN). The only restriction to account for ILFN addressed at the hearing was in terms of distance setbacks.

Bon Homme County's zoning ordinance imposes a 1,000 foot setback from non-participating residences.[7] (Ex. I-14 § 1723.) During the hearing, it was clear Bon Homme County adopted the "state standard" for setbacks from non-participating residences, which was merely the PUC Model Ordinance that was previously on the PUC's website. (Transcript 672: 14 – 673:13.) This is important because in a prior wind-siting docket that involved 1,000 foot setbacks from non-participating residences, Commissioners represented they believed the

[7] When Bon Homme County adopted its wind-specific ordinances in 2015, there were no turbines in South Dakota standing 590 feet tall like those being proposed here.

county's setbacks were outdated, but that they would defer to the county regarding appropriate setback distances. (*See* EL 18-003.) Here, Bon Homme County actually deferred to the Commission's "Model Ordinance" in establishing its setbacks. Given that, it makes little sense to defer to the Bon Homme County's setback for non-participating residences. Accordingly, the Commission should be empowered to update these self-described "outdated" setbacks.

So what setbacks reduce adverse exposure to ILFN? When questioned about distance setbacks, David Hessler candidly admitted that he considered advocating for a 2 mile setback in this case. (Transcript 743: 1-16.) Richard James, on the other hand, proposed a 1.25 mile setback from property lines, because people complain about ILFN as far out as 2 miles from a turbine. (Ex. I-1 Lines 101-105, 158-168; Transcript 859: 18 – 860: 8.) Therefore, in the event this project is permitted, Intervenors request a condition be placed on the project imposing a 2 mile setback from non-participating residences.

II. PWP Failed to Prove the Proposed Project Will Not Substantially Impair the Safety of Inhabitants Given the Proposed Setbacks from Property Lines and Rights-of-Way Are Only One Point One (1.1) Times the System Height

Setbacks from property lines and rights-of-way are intended to protect the safety of those persons and property around wind turbines. "From a safety point of view, the most serious failure is associated with splintering of rotor blades and detachment of debris, which could be thrown over long distances and damage people or property." (Ex. A28 p.16 (Analysis of throw distances of detached objects from horizontal-axis wind turbines, p. 151).) "Ice-throw from wind turbines installed in cold climate is also of high concern, especially for wind turbines erected near highways where the ice pieces thrown from a wind turbine may strike a passing car, which in the worst case may cause a fatal accident." (*Id.*) Moreover, the number of *reported* wind-

turbine accidents has steadily grown since 2000. (*Id.* at Figure 1.)[8] To prevent these accidents from causing personal or property damage, governments typically impose setbacks. (*Id.*) Some countries have imposed a "safety distance" which "is a distance within which it is not allowed to build human structures such as buildings and roads." (*Id.*) France and Germany, for example, have safety distances of wind turbines from human structures of 5,280 feet. (*Id.* at Table 1.) Manitoba, Canada, on the other hand is 6,500 feet. (*Id.*) Here, setbacks from non-participating residences are only 1,000 feet and setbacks from property lines and rights-of-way are only 1.1 times the system height, or 649.61 feet.

So the question is whether those setback distances risk causing a substantial impairment to the safety of inhabitants. The answer is yes, absolutely. During turbine malfunctions, at normal operating conditions pieces of blade weighing between 7-16 ton can be thrown 700 meters (2,297 feet), and when operating at extreme speeds (as might occur during a malfunction) pieces of blade can be thrown 2 kilometers (6,562 feet).[9] (*Id.*) Indeed, one witness testified he has found pieces of blade debris approximately a quarter mile from the turbine following a malfunction. (Transcript 1067: 1-13.) For ice throws, pieces of ice weighing between 0.4 to 6.5 kg can be thrown 600 meters (1,969 feet). (Ex. A28 p.16 (Analysis of throw distances of detached objects from horizontal-axis wind turbines, p. 151).)

In light of the above, and given the common use of the land adjoining where turbines are proposed, which includes farmers in fields, hunters walking fields and ditches, cars driving on roads, etc., Intervenors request a 1,500 feet setback from property lines and rights-of-way.

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[8] Presumably, many incidents go unreported for business and political reasons.

[9] Given a turbine malfunction could cause a 16 ton blade to be thrown 6,562 feet from the turbine, Intervenors believe 6,562 feet should be the *absolute* minimum setback distance between non-participating residences and turbines. Of course, when taking into account noise concerns, Intervenors continue to request a 2-mile setback from non-participating residences.

III. Shadow Flicker Should Not be Permitted on Any Non-Participating Residence

Bon Homme County's zoning ordinances seemingly limit ("when determined appropriate by the County") shadow flicker to no more than 30 minutes per day or 30 hours per year. (Ex. I-14 § 1741.) Intervenors contend no shadow flicker should be permitted on non-participating residences. Certainly non-participants are not permitted to operate a strobe light into the bedrooms of participants at nighttime provided they do so less than 30 minutes per night and 30 hours per year. Shadow flicker is simply the inverse situation. Such conduct should not be authorized by the Commission, as it creates a nuisance.

CONCLUSION

In sum, Intervenors request the Commission deny PWP's siting permit. There simply is too large of a risk that the inhabitants' health, safety, and welfare will be impaired by the proposed project. And for what? So the 29 landowners[10] who are getting turbines can reap the financial benefit? (Ex. I-38.) Denying this project would not be a condemnation of wind development in South Dakota. South Dakota has an abundance of land much more suitable (i.e., less densely populated) for wind development from a health, safety, and welfare perspective. PWP, and other developers, should be encouraged to develop in those locations.

Alternatively, Intervenors request that the following conditions be placed on the proposed project:

- 35 dBA nighttime noise limit when averaged over a ten minute period for non-participating residences;
- 2 mile setback from non-participating residences;
- 1,500 foot setback from property lines and rights-of-way;
- No shadow flicker be permitted on non-participating residences; and
- These conditions/restrictions may be waived by any non-participating landowner.

Imposing these conditions on the project will greatly minimize any risk that the project will substantially impair the health, safety, or welfare of inhabitants living in and around the project area. And there is no evidence in the record that shows these conditions would prevent the project from being built.

[10] There are 136 full-rights lease agreements, but only 29 landowners are receiving turbines. (Transcript 236: 10-22; Ex. I-38.) That begs the question of whether those participating landowners who anticipated receiving a turbine but are not receiving one are still supportive of this project. Of course, the lease agreements prevent those persons from raising any such issues to the Commission. (Ex. I-17 at §§ 9.4 and 13.2.)

Other siting dockets suggest Intervenors' proposed conditions are workable. In Crocker, for example, the applicant designed a project of 120 turbines on 29,331 acres *with ¾ mile setbacks*. PWP's proposed project has 50,364 acres and only needs to site 61 turbines.[11] In other words, PWP needs to site half the turbines and has 21,000 more acres to do so. Certainly greater setbacks and stricter noise conditions are workable if PWP were to try. But PWP has not even tried to design this project to provide greater protections for inhabitants, because it was concerned only with meeting Bon Homme County's ordinances. Accordingly, the Commission should force, through conditions, PWP to design the best project that has the smallest chance of impairing the health, safety, and welfare of inhabitants. Intervenors' proposed conditions do just that.

Dated this 13th day of November, 2018.

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[11] When Gregg Hubner was asked to sign up for this project, it was represented to him that twelve turbines could be sited on 1,985 acres. (Transcript 954:8 – 955:3.) Using those numbers, PWP needs only 10,090 acres to site 61 turbines; unless the number of turbines Hubner could receive was over-exaggerated to entice him to sign up his land for the project.

CERTIFICATE OF SERVICE

The undersigned, one of the attorneys for Intervenors Gregg C. Hubner, Marsha Hubner, Paul M. Schoenfelder and Lisa A. Schoenfelder, certifies that a true and correct copy of the above was served on November 13, 2018, via email upon the following persons listed on the South Dakota Public Utilities Commission's docket service list:

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ATTACHMENT 7

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

018018

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 at least 5 dBA less 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

ATTACHMENT 8

Bio Materials for: Richard R. James
Ver: Nov. 8, 2017

Mr. James is the Owner and Principal Consultant for E-Coustic Solutions, LLC, of Okemos, Michigan. He has been a practicing acoustical engineer for over 40 years. He started his career as an acoustical engineer working for the Chevrolet Division of General Motors Corporation in the early 1970s. His clients include many large manufacturing firms, such as, General Motors, Ford, Goodyear Tire & Rubber, and others who have manufacturing facilities where community noise and worker noise exposure occur. In addition, he has worked for many small companies and private individuals. He was actively involved with the Institute of Noise Control Engineers (INCE) since its formation in the early 1970's. He was a full Member from early in the 1990's through 2017.

His academic credentials include a degree in Mechanical Engineering (BME) from General Motors Institute, Flint Michigan (now Kettering Institute). He has been an adjunct Instructor to the Speech and Communication Science Department at Michigan State University from 1985 to 2013 and an adjunct Professor for the Department of Communication Disorders at Central Michigan University from 2012 through 2017. In addition, Mr. James served on the Applied Physics Advisory Board of Kettering Institute from 1997 to 2007.

Specific to wind turbine noise, he has worked for clients in over 60 different communities.

He has provided written and oral testimony in approximately 30 of those cases. He has also authored or co-authored four papers covering wind turbine noise topics including:

- Criteria for wind turbine projects necessary to protect public health (2008),
- Demonstrating that wind turbine sound immissions are predominantly comprised of infra and low frequency sound (2011), and
- A peer reviewed historical review of other types of low frequency noise sources with similar sound emission characteristics, such as large HVAC systems (fans) which caused noise induced Sick Building Syndrome and other noise sources that have known adverse health effects on people exposed to their sound. (2012).
- A peer reviewed literature review of research spanning 40 years showing wind turbines cause risks of adverse health effects from both audible and inaudible sound emissions (2016).

He has been qualified as an expert in acoustics for hearings and court proceedings in several countries. Examples of recent qualifications are:

Jurisdiction	Before	Qualified as:
Ontario, CA (January 2014)	Ministry of Environment (MOE) and Environmental Review Tribunal (ERT)	Qualified to provide evidence on matters related to acoustics and noise control engineering and wind turbines
Alberta, CA (Dec. 2013)	Alberta Utilities Commission (AUC)	An acoustical engineer and acoustician with expertise in the field of sound including noise, low frequency noise, sounds emitted from industrial wind turbines and human response to noise.
Michigan, US	Michigan Circuit Court	1. acoustician with expertise in measurement of wind turbine noise and its effects on people. (Dec. 2013) 2. acoustician qualified to opine that the plaintiff's symptoms were caused by the defendant's wind turbines. After special Daubert Hearing (Dec. 2013)

EXHIBIT Int. I-1(a)

ised: Nov. 8, 2017

Computers to quiet the factory

Ever since the Occupational Safety & Health Administration (OSHA) adopted industrial noise standards in 1971, plant engineers have been struggling to reduce the ear-piercing din in factories. But it is a tough job. The hundreds of machines inside a factory produce different sounds, each of which interacts differently with nearby equipment and partitions. Even skilled acoustical engineers often misjudge the effort needed to get down to the noise level the government permits. And because noise control is often expensive, mistakes can be costly.

Now, however, many corporations are turning to computer models to make sure their noise-control efforts will be cost-effective. Spurred by the falling cost of computer time and the high price of noise control, companies are using models to ensure that newly built plants will comply with OSHA noise rules. Managers are also using computers to test whether modifications of an existing plant will actually reduce noise. And executives are finding that models enable them to contest ineffective noise-control measures proposed by the government.

The computer's advantage. A noise model is based on equations that state in mathematical form the same laws of physics that consultants have traditionally used to forecast sound levels. These equations predict, for example, the effects of bouncing sound off a wall or absorbing it in acoustical tile. To apply a model to a particular plant, a consultant first measures the several different noises emitted by each machine, then records the size, nature, and placement of noise barriers such as walls and ceilings. When these data are fed into the noise model, engineers can get information about the noise level anywhere in the plant.

Without the computer, a noise consultant must calculate intuitively. The advantage of having a model is in being able to track interactions among a larger number of variables to predict the noise level at each station. A model developed by Total Environmental Systems Inc. in East Lansing, Mich., can cope with 3,500 noise sources and 250 partitions. "There are no more than 10 people in the country who can intuitively evaluate 100 variables," says Richard R. James, TES vice-president.

Many company officials are enthusiastic about the success of these models. Using a computer model developed by TES, General Motors Corp. found that it could slash by 25% its expected use of noise-reducing material in the body-fabricating area of its new Oklahoma City assembly plant. Tests made after the plant was built showed that the model had predicted the actual noise level in the plant to within 2 decibels, a high degree of accuracy. "We can't afford trial and error," notes Woodford L. Van Tifflin, the engineer who oversees GM's noise control system.



Engineers James and Van Tifflin: Using models to plan noise control.

Costs. The average machine shop could not afford the $50,000 it cost GM to have TES model a 750,000-sq.-ft. portion of its Oklahoma City plant. The TES prices for less complex jobs start at $18,000. But even clients paying the highest fees say that the savings from modeling more than cover the costs. "Modeling prices are not out of line," argues Robert F. Birdsall, a Ford Motor Co. environmental engineer. Ford recently completed noise modeling for its new Batavia (Ohio) transaxle plant, slated to be in production by the 1981 model year.

Most of the modeling of existing plants is aimed at preventing OSHA citations for excessive noise. But modeling also helps a company fight alleged violations of noise standards. Stanadyne Inc. in Windsor, Conn., recently used a model to show that the government overstated—by a factor of 20—the effectiveness and thus the feasibility of noise control measures that it claimed Stanadyne should have used at its Bellwood (Ill.) plant to keep workers from being exposed to more than 90 decibels. The model's results played a key role in a judge's Dec. 28 decision in favor of the company, claims Stanadyne's attorney, Columbus R. Gangemi Jr. Testimony based on a model "is easier for the court to understand and easier to defend" than traditional expert testimony based on engineering analysis alone, he says.

Saving time. In addition to eliminating the cost of unnecessary or ineffective noise-control measures, modeling husbands executive time. The model can generate a noise map of a new plant using colors and contour lines to indicate the sound level at each worker station. Additional maps then can display the impact of various noise-reduction strategies. So, rather than having to wade through statistical tables or try to follow complex oral explanations, managers can see at a glance what areas in the plant have noise problems and the effect of potential solutions. "It puts complex information into a meaningful summary," says Ford's Birdsall.

Although users of noise modeling are enthusiastic, there is still some skepticism in the acoustical consulting community. These doubts persist despite the widespread use of modeling to cope with other forms of industrial pollution (BW—Oct. 29). "It could be a gimmick," says Paul Jensen, manager of the industrial noise division at Bolt Beranek & Newman, an acoustical consulting firm in Cambridge, Mass. Jensen contends that it is more important to consider the worker. "The problem with the model is that it doesn't say a darn thing about the worker—where *he is, how he moves* in and out of noisy areas."

Many other consultants, though, contend that Jensen overstates the case against modeling. "We use it successfully for companies having 5 to 1,000 employees," counters Thomas D. Miller, vice-president of Donley, Miller & Nowikas Inc. in East Hanover, N. J. But he cautions that modeling, like any mathematical simulation, is only as valid as the data base and operating assumptions on which it is built. ■

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BIOGRAPHICAL SKETCH

NAME	POSITION TITLE	BIRTHDATE
Richard R. James	Principal Consultant, E-Coustic Solutions, LLC (2006-)	3/3/48

ACADEMIC CREDENTIALS

INSTITUTION	DEGREE/POSITION	YEAR	FIELD
General Motors Institute, Flint, MI	B. Mech. Eng.	1966-1971	Noise Control Engineering
Michigan State University, East Lansing, MI	Adjunct Instructor	1985-2013	Acoustics and Effects of Noise on People
Central Michigan University, Mount Pleasant, MI	Adjunct Professor	2012-2017	Wind Turbine Noise and its Impact on People

RESEARCH AND PROFESSIONAL EXPERIENCE:

Richard R. James has been actively involved in the field of noise control since 1969, participating in and supervising research and engineering projects related to control of occupational and community noise in industry. In addition to his technical responsibilities as principal consultant, he has developed noise control engineering and management programs for the automotive, tire manufacturing, and appliance industries. Has performed extensive acoustical testing and development work in a variety of complex environmental noise problems utilizing both classical and computer simulation techniques. In 1975 he co-directed (with Robert R. Anderson) the development of SOUND™, an interactive acoustical modeling computer software package based on the methods that would be later codified in ISO 9613-2 for pre and post-build noise control design and engineering studies of in-plant and community noise. The software was used on projects with General Motors, Ford Motor Company, The Goodyear Tire & Rubber Co., and a number of other companies for noise control engineering decision making during pre-build design of new facilities and complaint resolution at existing facilities. The SOUND™ computer model was used by Mr. James in numerous community noise projects involving new and existing manufacturing facilities to address questions of land-use compatibility and the effect of noise controls on industrial facility noise emissions. He is also the developer of ONE*dB(tm) software. He was also a co-developer (along with James H. Pyne, Staff Engineer GM AES) of the Organization Structured Sampling method and the Job Function Sound Exposure Profiling Procedure which in combination form the basis for a comprehensive employee risk assessment and sound exposure monitoring process suitable for use by employers regulated by OSHA and other governmental standards for occupational sound exposure. Principal in charge of JAA's partnership with UAW, NIOSH, Ford, and Hawkwa on the HearSaf 2000tm software development CRADA partnership for world-class hearing loss prevention tools.

1966-1970	Co-operative student: General Motors Institute and Chevrolet Flint Metal Fabricating Plant.
1970-1971	GMI thesis titled: "Sound Power Level Analysis, Procedure and Applications". This thesis presented a method for modeling the effects of noise controls in a stamping plant. This method was the basis for SOUNDTM.
1970-1972	Noise Control Engineer-Chevrolet Flint Metal Fabricating Plant. Responsible for developing and implementing a Noise Control and Hearing Conservation Program for the Flint Metal Fabricating Plant. Member of the GM Flint Noise Control Committee which drafted the first standards for community noise, GM's Uniform Sound Survey Procedure, "Buy Quiet" purchasing specification, and guidelines for implementing a Hearing Conservation Program.
1972-1983	Principal Consultant, Total Environmental Systems, Inc.; Lansing, MI. Together with Robert R. Anderson formed a consulting firm specializing in community and industrial noise control.
1973-1974	Consultant to the American Metal Stamping Association and member firms for in-plant and community noise.
1973	Published: "Computer Analysis and Graphic Display of Sound Pressure Level Data For Large Scale Industrial Noise Studies", Proceedings of Noise-Con '73, Washington, D.C.. This was the first paper on use of sound level contour 'maps' to represent sound levels from computer predictions and noise studies.

Nov. 1973	Published: "Isograms Show Sound Level Distribution in Industrial Noise Studies", Sound & Vibration Magazine
1975	Published: "Computer Assisted Acoustical Engineering Techniques", Noise-Expo 1975, Atlanta, GA which advanced the use of computer models and other computer-based tools for acoustical engineers.
1976	Expert Witness for GMC at OSHA Hearings in Washington D.C. regarding changes to the "feasible control" and cost-benefit elements of the OSHA Noise Standard. Feasibility of controls and cost-benefit were studied for the GMC, Fisher Body Stamping Plant, Kalamazoo MI.
1977-1980	Principal Consultant to GMC for the use of SOUND(tm) computer simulation techniques for analysis of design,layout, and acoustical treatment options for interior and exterior noise from a new generation of assembly plants. This study started with the GMAD Oklahoma City Assembly Plant. Results of the study were used to refine noise control design options for the Shreveport, Lake Orion, Bowling Green plants and many others.
1979-1983	Conducted an audit and follow-up for all Goodyear Tire & Rubber Company's European and U.K. facilities for community and in-plant noise.
1981-1985	Section Coordinator/Speaker, Michigan Department Of Public Health, "Health in the Work Place" Conference.
1981	Published: "A Practical Method for Cost-Benefit Analysis of Power Press Noise Control Options", Noise-Expo 1981, Chicago, Illinois
1981	Principal Investigator: Phase III of Organization Resources Counselors (ORC), Washington D.C., Power Press Task Force Study of Mechanical Press Working Operations. Resulted in publishing: "User's Guide for Noise Emission Event Analysis and Control", August 1981
1981-1991	Consultant to General Motors Corporation and Central Foundry Division, Danville Illinois in community noise citation initiated by Illinois EPA for cupola noise emissions. Resulted in a petition to the IEPA to change state-wide community noise standards to account for community response to noise by determining compliance using a one hour L_{eq} instead of a single not-to-exceed limit.
1983	Published: "Noise Emission Event Analysis-An Overview", Noise-Con 1983, Cambridge, MA
1983-2006	Principal Consultant, James, Anderson & Associates, Inc.; Lansing, MI. (JAA), Together with Robert R. Anderson formed a consulting firm specializing in Hearing Conservation, Noise Control Engineering, and Program Management.
1983-2006	Retained by GM Advanced Engineering Staff to assist in the design and management of GM's on-going community noise and in-plant noise programs.
1984-1985	Co-developed the 1985 GM Uniform Plant Sound Survey Procedure and Guidelines with James H. Pyne, Staff Engineer, GM AES.
1985-2013	Adjunct instructor in Michigan State University's Department of Communicative Sciences and Disorders from 1985-2013
1986-1987	Principal Consultant to Chrysler Motors Corporation, Plant Engineering and Environmental Planning Staff. Conducted Noise Control Engineering Audits of all manufacturing and research facilities to identify feasible engineering controls and development of a formal Noise Control Program.
1988-2006	Co-Instructor, General Motors Corporation Sound Survey Procedure (Course 0369)
1990	Developed One*dB(tm), JAA's Occupational Noise Exposure Database manager to support Organizational structured sampling strategy and Job Function Profile (work-task) approach for sound exposure assessment.
1990-1991	Co-developed the 1991 GM Uniform Plant Sound Survey Procedure and Guidelines with James H. Pyne, Staff Engineer, GM AES. Customized One*dB(tm) software to support GM's program.
1990-2006	Principal Consultant to Ford Motor Company to investigate and design documentation and computer data management systems for Hearing Conservation and Noise Control Engineering Programs. This included bi-annual audits of all facilities.
1993-2006	GM and Ford retain James and JAA as First-Tier Partners for all non-product related noise control services.
1993	Invited paper: "An Organization Structured Sound Exposure Risk Assessment Sampling Strategy" at the 1993 AIHCE

1993	Invited paper: "An Organization Structured Sound Exposure Risk Assessment Database" at the Conference on Occupational Exposure Databases, McLean, VA sponsored by ACGIH
1994-2001	Instructor for AIHA Professional Development Course, "Occupational Noise Exposure Assessment"
1996	Task Based Survey Procedure (used in One*dB(tm)) codified as part of ANSI S12.19 Occ. Noise Measurement
1995-2001	Coordinate JAA's role in HearSaf 2000tm CRADA with NIOSH, UAW, Ford, and HAWKWA
1997-2007	Board Member, Applied Physics Advisory Board, Kettering Institute, Flint, Michigan
2000	Use of structured, interactive interviews in retrospective noise exposure assessment in an occupational epidemiologic study, Prince, Waters, Anderson, and James, JASA,, April 2000
2002-2006	Member American National Standards Institute (ANSI) Accredited Standards Committee S12, Noise
2006	Closed James, Anderson and Associates, Inc. (JAA) and founded E-Coustic Solutions (E-CS)
2006-Present	Consultant to local communities and citizen's groups on proper siting of Industrial Wind Turbines. This includes presentations to local governmental bodies, assistance in writing noise standards, and formal testimony at zoning board hearings and litigation.
2008	Paper on "Simple guidelines for siting wind turbines to prevent health risks" for INCE Noise-Con 2008, co-authored with George Kamperman, INCE Bd. Cert. Emeritus, Kamperman Associates.
2008	Expanded manuscript supporting Noise-Con 2008 paper titled: "The "How To" Guide To Siting Wind Turbines To Prevent Health Risks From Sound"
2009	"Guidelines for Selecting Wind Turbine Sites," Kamperman and James, Published in the September 2009 issue of Sound and Vibration.
2010	Punch, J., James, R., Pabst, D., "Wind Turbine Noise, What Audiologists should know," Audiology Today, July-August 2010
2011	Jerry L. Punch, Jill L. Elfenbein, and Richard R. James, "Targeting Hearing Health Messages for Users of Personal Listening Devices," Am J Audiol 0: 1059-0889_2011_10-0039v1
2011	Bray, W., HEAD Acoustics, James, R., "Dynamic measurements of wind turbine acoustic signals, employing sound quality engineering methods considering the time and frequency sensitivities of human perception," invited paper for Noise-Con 2011, Portland OR
2012	James, R., "Wind Turbine Infra and Low Frequency Sound: Warning Signs that were not Heard," April 2012, Bulletin of Science, Technology and Society
2012	Appointed to position as Adjunct Professor in the Department of Communication Disorders at Central Michigan University.
2014	Negative Health Effects of Noise from Industrial Wind Turbines-Parts 1-3, Punch, J, James, R., Hearing Health Technology Matters, http://hearinghealthmatters.org/hearingviews/2014/wind-turbine-noise-evidence-health-problems/
2016	Punch, J. L., James, R.R., "Wind turbine noise and human health: a four-decade history of evidence that wind turbines pose risks," Journal of Hearing Health and Technology Matters, October 4, 2016, http://hearinghealthmatters.org/journalresearchposters/files/2016/09/Final-Final-16-09-30-Wind-Turbine-Noise-Final-Manuscript-HHTM-Punch-James.pdf.

Professional Affiliations/Memberships/Appointments

Research Fellow - Metrosonics, Inc.	American Industrial Hygiene Association (through 2006)
National Hearing Conservation Association (through 2006)	Institute of Noise Control Engineers (Member through 2017)
American National Standards Institute (ANSI) S12 Working Group (through 2006)	Founder and Board Member of the Society for Wind Vigilance, Inc.
Adjunct Professor, CMU 2012-2017	Adjunct Instructor, MSU 1985-2013

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List of Recent Publications

Sept. 5, 2017

2000 JASA, April 2000, Prince, Waters, Anderson, and James, Use of structured, interactive interviews in retrospective noise exposure assessment in an occupational epidemiologic study

2008 Paper on guidelines for siting wind turbines to prevent health risks for INCE Noise-Con 2008, co-authored with George Kamperman, Kamperman Associates.

2008 Expanded manuscript supporting Noise-Con 2008 paper titled: "The 'How To' Guide To Siting Wind Turbines To Prevent Health Risks From Sound"

2009 "Guidelines for Selecting Wind Turbine Sites," Kamperman and James, Published in the September 2009 issue of Sound and Vibration.

2010 Punch, J., James, R., Pabst, D., "Wind Turbine Noise, What Audiologists should know," Audiology Today, July-August 2010

2011 Jerry L. Punch, Jill L. Elfenbein, and Richard R. James , "Targeting Hearing Health Messages for Users of Personal Listening Devices," Am J Audiol 0: 1059-0889_2011_10-0039v1

2011 Bray, W., HEAD Acoustics, James, R., "Dynamic measurements of wind turbine acoustic signals, employing sound quality engineering methods considering the time and frequency sensitivities of human perception," invited paper for Noise-Con 2011, Portland OR

2012 James, R., "Wind Turbine Infra and Low Frequency Sound: Warning Signs that were not Heard," April 2012, Bulletin of Science, Technology and Society, http://bsts.sagepub.com, DOI:10.1177/0270467611421845

2014 Negative Health Effects of Noise from Industrial Wind Turbines-Parta 1-3, Punch, J, James, R., Hearing Health Technology Matters, http://hearinghealthmatters.org/hearingviews/2014/wind-turbine-noise-evidence-health-problems/

2016 Punch, J. L., James, R.R., "Wind turbine noise and human health: a four-decade history of evidence that wind turbines pose risks," Journal of Hearing Health and Technology Matters, October 4, 2016, http://hearinghealthmatters.org/journalresearchposters/files/2016/09/16-10-21-Wind-Turbine-Noise-Post-Publication-Manuscript-HHTM-Punch-James.pdf.

ATTACHMENT 9

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?

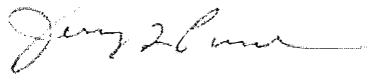
A: As a general rule, no wind turbine should be located closer than 1.25 miles from the property line of any residence. This distance should preferably be applied to all residences, both participating and non-participating. If placed closer to participating residences than 1.25 miles, those residents 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.



Jerry L. Punch

ATTACHMENT 10

Curriculum Vitae
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August 2018

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EDUCATIONAL BACKGROUND

A.A. – 1963 Gardner-Webb College (now Gardner-Webb University)
Boiling Springs, NC USA

B.A. – 1965 Wake Forest College (now Wake Forest University)
Winston-Salem, NC USA
Major: Psychology

M.S. – 1967 Vanderbilt University
Nashville, TN USA
Major: Audiology and Speech Pathology
Master's Thesis: An investigation of the speech discrimination ability of elderly adults
Thesis Advisor: Freeman McConnell, Ph.D.

Ph.D. – 1972 Northwestern University
Evanston, IL USA
Major: Audiology
Doctoral Dissertation: Forward masking under homophasic, antiphasic and other listening conditions
Advisor: Raymond Carhart, Ph.D.

PROFESSIONAL BACKGROUND

TRAINEE AND STUDENT POSITIONS

Audiology Trainee, Veterans Administration, Winston-Salem, NC, June-August 1965
Clinical Audiologist and Supervisor, Bill Wilkerson Hearing and Speech Center, Nashville, TN, February 1967-June 1968

Experience in salaried, part-time positions as ASHA-certified audiologist while a doctoral student/candidate; work settings included Chicago Hearing Society, Veterans

EXHIBIT
Int. I-2(a)

Administration Research Hospital, Schwab Rehabilitation Hospital, and ENT practice of Dr. George Sisson, Chicago, IL, Fall 1968-Summer 1971

PROFESSIONAL POSITIONS

Assistant Professor of Audiology, University of Mississippi, Oxford, MS, September 1971-July 1973
Assistant Professor, Memphis State University (now University of Memphis), Memphis, TN, August 1973-April 1975
Research Associate, Biocommunications Laboratory, Department of Hearing and Speech Sciences, University of Maryland, College Park, MD, May 1975-June 1980
Project Director, American Speech-Language-Hearing Association, Rockville, MD, July 1980-June 1981
Director, Research Division, American Speech-Language-Hearing Association, Rockville, MD, July 1980-July 1984
Associate Professor and Chief, Audiology Section, Department of Otolaryngology-Head and Neck Surgery, Indiana University School of Medicine, Indianapolis, IN, July 1984-October 1987
Senior Research Audiologist, Audio-Diagnostics Division, Nicolet Instrument Corporation, Madison, WI, October 1987-December 1989
Associate Professor (tenured), Department of Audiology and Speech Sciences, Michigan State University, East Lansing, MI, January 1990-August 1994
Professor, Chair, and Clinic Director, Department of Audiology and Speech Sciences, Michigan State University, East Lansing, MI, August 1994-May 2000
Professor, Department of Audiology and Speech Sciences (renamed Department of Communicative Sciences and Disorders), Michigan State University, East Lansing, MI, June 2000-May 2011
Professor Emeritus, Department of Communicative Sciences and Disorders), Michigan State University, East Lansing, MI, May 2011-present

ACADEMIC COURSES TAUGHT (in alphabetical order)

Anatomy and Physiology of Hearing
Anatomy and Physiology of Speech and Hearing Mechanisms
Audiological Assessment and Intervention/Rehabilitation
Aural Rehabilitation
Clinical Audiometry/Hearing Assessment/Evaluation Procedures in Audiology (course and lab instruction)
Differential Diagnostic Audiology
Evaluation Procedures in Audiology (also with associated lab)
Hearing Aids/Hearing Amplification and Rehabilitation/Hearing Amplification I & II
Hearing Disorders
Industrial Audiology/Hearing Conservation
Introduction to Audiology
Introduction to Speech and Hearing

Medical Aspects of Audiology
Microcomputer Applications in Audiology and Speech Sciences
Pediatric Audiology/Special Populations in Audiology
Professional Ethics in Communicative Sciences and Disorders
Psychoacoustics
Research Design and Analysis/Research Methods/Research Methods in Communicative Sciences and Disorders
Seminar for Honors Undergraduates: Investigating Hearing Health Risks in the MP3 Generation

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Punch, J.L., Robb, R., & Shovels, A.H. (1994). Aided listener preferences in laboratory versus real-world environments. *Ear and Hearing*, *15*, 50-61.

Punch, J.L, Shovels, A.H., Dickinson, W.W., Butcher, J., & Snead, C. (1995). Target-matched insertion gain derived from three different hearing aid selection procedures. *Journal of the American Academy of Audiology*, *6*, 425-432.

Punch, J.L., Robinson, D.O., & Katt, D.F. (1996). Development of a hearing performance standard for law enforcement officers. *Journal of the American Academy of Audiology*, *7*, 113-119.

Arsenault, M.D., & Punch, J.L. (1999). Nonsense-syllable recognition in noise using monaural and binaural listening strategies. *Journal of the Acoustical Society of America*, *105*, 1821-1830.

Rakerd, B., Punch, J., Hooks, W., Amlani, A., & VandeVelde, T.J. (1999). Loudness discrimination of speech signals spectrally shaped by a simulated hearing aid. *Journal of Speech, Language, and Hearing Research*, *42*, 1285-1294.

Punch, J.L., Rakerd, B., & Amlani, A. (2001). Paired-comparison hearing aid preferences: Evaluation of an unforced-choice paradigm. *Journal of the American Academy of Audiology*, *12*, 190-201.

Punch, J.L. (2001). Contemporary issues in hearing aid selection and fitting. *Speech and Hearing Review*, *2*, 21-50 (Chinese version); 166-191 (English version) (by invitation).

Punch, J. (2003). A universal hearing aid: Recommended technologic and functional features. *Iranian Audiology*, *2(1)*, 24-31. (Invited paper).

Punch, J., Joseph, A., & Rakerd, B. (2004). Most comfortable and uncomfortable loudness levels: Six decades of research. *American Journal of Audiology*, *13*, 144-157.

Punch, J., Rakerd, B., & Joseph, A. (2004). Effects of test order on most comfortable and uncomfortable loudness levels for speech. *American Journal of Audiology*, *13*, 158-163.

Holcomb, S.S., & Punch, J. L. (2006). Multimedia Hearing Handicap Inventory: Test-retest reliability and clinical utility. *American Journal of Audiology*, *15*, 3-13.

Amlani, A., Rakerd, B., & Punch, J. (2006). Speech-clarity judgments of hearing-aid-processed speech in noise: Differing polar patterns and acoustic environments, *International Journal of Audiology*, 45, 319-330.

Joseph, A., Punch, J., Stephenson, M., Paneth, N., Wolfe, E., & Murphy, W. (2007). The effects of training format on earplug performance. *International Journal of Audiology*, 46, 609-618.

Callaway, S.L., & Punch, J.L. (2008). An electroacoustic analysis of over-the-counter hearing aids, *American Journal of Audiology*, *17*, 14-24.

Punch, J., Elfenbein, J., & James, R. (2011). Targeting hearing health messages for users of personal listening devices. *American Journal of Audiology*, *20*, 69-82.

Punch, J. & James, R. R. (2016). Wind turbine noise and human health: a four-decade history of evidence that wind turbines pose risks. *Hearing Health & Technology Matters*, http://hearinghealthmatters.org/journalresearchposters/files/2016/09/16-10-21-Wind-Turbine-Noise-Post-Publication-Manuscript-HHTM-Punch-James.pdf.

NON-REFEREED ARTICLES

Causey, G.D., Punch, J.L., Schweitzer, H.C., & Beck, L.B. (Spring 1978). The clinical and acoustic parameters of hearing aid effectiveness. *Bulletin of Prosthetics Research.*

Causey, G.D., Punch, J.L., Schweitzer, H.C., & Beck, L.B. (Spring 1979). The clinical and acoustic parameters of hearing aid effectiveness. *Bulletin of Prosthetics Research.*

Causey, G.D., Punch, J.L., & Schweitzer, H.C. (Fall 1979). The development of improved techniques for the analysis of hearing aid performance. *Bulletin of Prosthetics Research.*

Causey, G.D., & Punch, J.L. (Spring 1980). The clinical and acoustic parameters of hearing aid effectiveness. *Bulletin of Prosthetics Research.*

Punch, J.L. (1980). Self-study of profession's service and training needs in the 1980's. *Asha*, 22, 849-850.

Punch, J.L. (1981). Subjective approaches to hearing aid evaluation. *Hearing Instruments*, *32*, 12-14, 65 (Invited paper).

Rees, N.S., Punch, J.L., & Snope, T.L. (1981). Report of Advisory Committee for the self-study project. *Asha*, *23*, 899-902.

Punch, J.L., & Gelatt, J.P. (1982). Federal funding agencies and speech-language-hearing. *Asha*, *24*, 325-331.

Punch, J. (1983). Characteristics of ASHA members. *Asha*, *25*, 31.

Punch, J. (1983). The prevalence of hearing impairment. *Asha*, *25*, 27.

Punch, J. (1983). The geographic distribution of speech-language-hearing personnel. *Asha*, *25*, 31.

Punch, J. (1983). Sociodemographic and health characteristics of the hearing-impaired population. *Asha*, *25*, 15.

Punch, J. (1983). Occupational mobility of speech-language pathologists and audiologists: Part I. *Asha*, *25*, 31.
Punch, J.L., & Fein, D.J. (1984). Profile of educational programs in speech-language pathology and audiology. *Asha*, *26*, 43-48.
Karr, S., & Punch, J. (1984). PL 94-142 state child counts. *Asha*, *26*, 33.
Punch, J. (1984). Occupational mobility of speech-language pathologists and audiologists: Part II. *Asha*, *26*, 29.
Punch, J.L. (1984). Salaries in the speech-language pathology and audiology profession. *Asha*, *26*, 41-46.
Mansour, S., & Punch, J. (1984). Research activity among ASHA members. *Asha*, *26*, 41.
Miyamoto, R.T., Myres, W.A., & Punch, J.L. (1987). Tactile aids in the evaluation procedure for cochlear implant candidacy. *Hearing Instruments*, *38*, 33, 36-37.
Miyamoto, R.T., Myres, W.A., Carotta, C.C., Robbins, A.M., Pope, M.L., Punch, J.L., & Steck, J. (November 1987). Cochlear implants in children. *Insights in Otolaryngology*, 2.
Williamson, M., & Punch, J. (1990). Speech enhancement in digital hearing aids. *Seminars in Hearing*, *11*, 68-78.
Punch, J., Chi, C., & Patterson, J. (1990). A recommended protocol for prescriptive use of target gain rules. *Hearing Instruments*, *41*, 12, 14, 16, 18-19.
Punch, J., Birman, M., & Balmer, W. (1990). Comparative evaluation of substitution and equivalent substitution methods of hearing aid analysis. *The Hearing Journal*, *43*, 28-29, 32-33.
Punch, J.L., & Weinstein, B.E. (1996). The Hearing Handicap Inventory: Introducing a multimedia version. *The Hearing Journal*, *49(10)*, 35-36, 38-40, 44-45.
Punch, J.L. (2001). Technologic and functional features of hearing aids: What are their relative costs? *The Hearing Journal, 54(6)*, 32, 34, 36-38, 42, 44.
Punch, J. (2001). Committee Report: A low-cost hearing aid for developing countries. *Hearing International*, *10(3)*, 4-5.
Punch, J. (2002). The differences between analog and digital hearing aids. *Hearing International*, *10(4)*, 4-5 (Part I); *Hearing International*, 11(1), 8 (Part II).
Punch, J. (2002). Technology Note: Linear vs nonlinear hearing aids. *Hearing International*, *11(2)*, 8.
Punch, J. (2002). Technology Note: Output-limiting vs wide dynamic range compression. *Hearing International*, *11(3)*, 8.
Punch, J. (2002). Technology Note: Acoustic modifications in hearing aids. *Hearing International*, *11(4)*, 7.
Punch, J. (2002). Viewpoint: The virtues of virtual learning. *Audiology Today*, *14(5)*, 18.
Punch, J. (2003). Survey of hearing aid manufacturers. *Hearing International*, *12(1)*, 7-8.
Punch, J. (2003). Technology Note: Hearing aids and the audibility index. *Hearing International*, *12(2)*, 8-9.
Punch, J. (2003). Technology Note: Assistive listening devices. *Hearing International*, *12(3)*, 7-8.
Punch, J. (2004). Technology Note: Understanding hearing aid standards organizations. *Audiology Today*, *16(4)*, 15.
Punch, J. (2005). Providing high-quality, low-cost hearing aids for developing countries. *Hearing International*, *14(3)*, 5.

Punch, J. (2006). Providing high-quality, low-cost hearing aids for developing countries: A status report 2. *Hearing International*, *14(4)*, 4-5.

Punch, J., James, R., & Pabst, D. (2010). Wind-turbine noise: What audiologists should know. *Audiology Today*, *22(4)*, 20-31.

Punch, J, & James, R. (2014). Adverse health effects of noise from industrial wind turbines. HearingHealthMatters.org, Three-part series in Hearing Health & Technology Matters. Part 1: http://hearinghealthmatters.org/hearingviews/2014/wind-turbine-health-problems-noise/, Part 2: http://hearinghealthmatters.org/hearingviews/2014/wind-turbine-noise-evidence-health-problems/, Part 3: http://hearinghealthmatters.org/hearingviews/2014/infrasound-wind-turbine-hearing-health-effects/.

MONGRAPHS

Amlani, A.M., Punch, J.L., & Ching, Y.C. (2002). Methods and applications of the audibility index in hearing aid selection and fitting. *Trends in Amplification*, *6*, 81-129.

BOOK CHAPTERS

Punch, J. (2004). High-quality, low-cost hearing aids. In *Hearing Impairment: An Invisible Disability*. Suzuki, J, Kobayashi, T, & Koga, K. (Eds). New York: Springer-Verlag.

Punch, J. (2004). Hearing International project on high-quality, low-cost hearing aids. In *Hearing Impairment: An Invisible Disability*. Suzuki, J, Kobayashi, T, & Koga, K. (Eds). New York: Springer-Verlag.

PRESENTATIONS

INVITED PRESENTATIONS

INTERNATIONAL LEVEL

Punch, J.L. (March 31, 2001). An analysis of hearing aid costs. Invited presentation at conference of Committee on Management and Rehabilitation of Hearing Loss, Hearing International, Singapore.

Punch, J (January 31, 2002). Challenges of developing and distributing a low-cost hearing aid. Invited paper, written by J. Punch and presented by Jun-Ichi Suzuki (J.I. Suzuki & J. Punch: View from the HI Rehabilitation Committee), Hearing International, Pattaya, Thailand.

NATIONAL LEVEL

Punch, J. (December 1-2, 1976). Elements of hearing aid performance and aural rehabilitation. Invited workshop participant, Little Rock, AR.

Punch, J. (March 17-19, 1983). Hearing aid selection: Listener judgments of speech quality and intelligibility. Invited participant at Three Rivers Conference on Communicative Disorders, Pittsburgh, PA.

Punch, J. (April 15-16, 1988). Introduction to digital signal processing concepts and terminology, and Summary: Project Phoenix approach in developing and evaluating the performance of a digital hearing aid. Invited speaker at meeting of Iowa Hearing Aid Society, Des Moines, IA.

Punch, J. (October 1, 1988). Recent advances in digital hearing aids. Invited speaker at program sponsored by George Washington University Medical Center and George Washington University, Washington, DC.

Punch, J. (May 20, 1989). Comparing and contrasting digital hearing aid systems. Invited participant in panel discussion at meeting of Academy of Dispensing Audiologists, Phoenix, AZ.

Punch, J. (June 16, 1989). Digital hearing aids. Invited speaker at Amplification '89 Conference, Central Michigan University, Mt. Pleasant, MI.

Punch, J. (October 26-27, 1990). How can digital hearing aids benefit the hearing impaired? Invited presentation, Iowa Hearing Aid Society, Des Moines, IA.

Punch, J. (March 12-13, 1993). DSP-based hearing aid fitting procedures. Invited presentation at Technology Summit: Sound Advice on Amplification, Starkey Laboratories, Brookland Park, MN.

Bentler, R.A., Fortune, T., Humes, L.E., McCarthy, P, Punch, J., & Van Vliet, D. (November 1994). Hearing aid fittings: A time for change. Invited miniseminar presentation to meeting of American Speech-Language-Hearing Association, New Orleans, LA.

Punch, J. (March 22-25, 1995). A hearing performance standard for police officers. Invited panel presentation at Hearing Conservation Conference III/XX, as part of Forum "The Americans with Disabilities Act: Recruiting, Retaining, and Protecting Workers with Hearing Impairment," Cincinnati, OH.

Punch, J. (December 7, 2002). Contemporary issues in hearing aid fittings. Invited presention to Palm Springs Hearing Seminars, Palm Springs, CA.

REGIONAL/STATE/LOCAL LEVEL

Punch, J. (April 26, 1980). Hearing aid evaluation: Development of alternative strategies. Invited participant at meeting of Maryland Speech-Language-Hearing Association, Annapolis, MD.

Punch, J. (January 22, 1987). Cochlear implants: Case studies. Invited speaker at Indiana University Faculty Colloquium, Bloomington, IN.

Punch, J. (April 14, 1988). Digital hearing aids. Invited speaker at meeting of Indiana Speech and Hearing Association, Ft. Wayne, IN.

Punch, J. (April 29, 1988). Development and evaluation of a digital hearing aid. Invited speaker at meeting of Speech and Hearing Association of Alabama, Orange Beach.

Punch, J. (July 21, 1988). Signal processing and digital programmable hearing aids. Invited speaker at meeting of Texas Speech and Hearing Association, Vail, CO.

Punch, J. (September 7, 1988). Digital hearing aids. Invited speaker at meeting of audiology staff of Jewish Hospital and Washington University School of Medicine, St. Louis, MO.

Punch, J. (September 23, 1988). Digital signal processing. Invited speaker at Cleveland Hearing and Speech Center, Cleveland, Ohio.

Punch, J. (November 14, 1988). Use of real ear data in hearing aid fitting. Invited speaker at Real Ear Workshop for Aurora Users, Madison, WI.

Punch, J. (March 10, 1989). Integrating digital hearing aids into clinical practice. Invited speaker at meeting of Kentucky Speech and Hearing Association, Lexington, KY.

Punch, J. (March 31, 1989). Digital hearing aids. Invited speaker at meeting of Texas Speech and Hearing Association, El Paso, TX.

Punch, J. (October 26-27, 1990). Software approaches to prescriptive hearing aid fitting. Invited presentation, Iowa Hearing Aid Society, Des Moines, IA.

Punch, J.L. (June 10-12, 1991). Sound, psychophysics, and audition, and federal and state regulations. Two CAOHC training presentations, Buick-Oldsmobile-Cadillac Plant, Lansing, MI.

Punch, J. (September 1991). CCC examination review lectures (2), Sponsored by Michigan Speech-Language Hearing Association, Michigan State University.

Punch, J. (March 12, 1992). Characteristics of well-fitted hearing aids, recent developments in hearing aids, and hearing aid troubleshooting. Invited presentation to Jackson, MI, chapter of Self-Help for the Hard-of-Hearing (SHHH).

Punch, J.L. (May 2, 1993). Hearing loss and hearing aids. Invited presentation to Michigan Department of Social Services, Lansing, MI.

Punch, J.L. (July 24, 1993). Roundtable facilitator at Committee on Institutional Cooperation (CIC) Summer Research Opportunities Program (SROP) Conference, Michigan State University.

Punch, J. (September 18, 1993). CCC examination review lecture, Sponsored by Michigan Speech-Language-Hearing Association, Michigan State University.

Punch, J. (August 8, 1994). Current audiological research in the U.S. Invited presentation to international visitors (London) to Michigan State University.

Punch, J. (September 16, 1995). CCC examination review lecture, Sponsored by Michigan Speech-Language-Hearing Association, Michigan State University.

Punch, J. (March 19, 1999). Student forum. Presented at meeting of Michigan Speech-Language-Hearing Association, Troy, MI.

Punch, J. (June 13, 2000). What about my hearing? Invited presentation at meeting of University Club members, Lunch and Learn Series, Michigan State University, East Lansing, MI.

Punch, J. (October 23-24, 2000). Current practices in hearing aid selection and fitting, Invited presentation at meeting of Hearing International, East Lansing, MI.

Punch, J. (October 24, 2001). Hearing loss and hearing aids. Invited presentation at Valley Court Community Center, East Lansing, MI.

Punch, J. (September 17, 2002). Making the most of your hearing aids. Invited presentation at Foster Community Center. Sponsored by Self Help for the Hard of Hearing, Lansing, MI.

Punch, J. (September 9, 2003). What did you say? Invited presentation at meeting of University Club members, Lunch and Learn Series, Michigan State University, East Lansing, MI.

Punch, J. (March 13, 2004). Advances in hearing aids. Invited presentation at meeting of Ohio Speech-Language-Hearing Association, Columbus, OH.

Punch, J. (July 1, 2004). Hearing loss and hearing aids. Invited presentation at Hanna Community Center, East Lansing, MI.

Punch, J. (October 10, 2006). Hearing conservation. Invited presentation at Department of Music, Michigan State University, East Lansing, MI.

Punch, J. (June 8, 2007). Technological features of modern hearing aids. Invited presentation at 2007 Golden Grads Alumni Breakfast, Michigan State University, East Lansing, MI.

Punch, J. (August 22, 2008). Hearing, hearing loss, and the audiogram. Invited presentation at Michigan Association of Disability Examiners, Lansing Community College West Campus, Lansing, MI.

Punch, J. (October 21, 2008). Hearing Loss and Over-the-Counter Hearing Aids. Invited presentation at Michigan State University Colloquy, University Club, East Lansing, MI.

Punch, J. (November 10, 2008). Hearing Loss and Hearing Aids. Invited presentation at Foster Community Center, Sponsored by Lansing-Area Chapter of Hearing Loss Association of America (HLAA), Lansing, MI.

Punch, J. (March 15, 2010). Invited presentation on variety of personal and professional topics, Sponsored by American Sign Language (ASL) class, Lansing Community College, Arts and Sciences Building, Lansing, MI.

Punch, J. (October 21, 2010). Hearing protection issues. Invited presentation at meeting of Michigan Agricultural Aviation Association, Lansing, MI.

Punch, J. (March 10, 2011). Wind Turbine Information and Issues Forum. Invited presentation at West Shore Community College, Ludington, MI (Mason County), hosted by Great Lakes Renewable Energy Association (GLREA), A Few Friends for the Environment of the World (AFFEW), and West Shore Community College.

Punch, J. L. (June 14, 2011). Does wind turbine noise cause adverse health effects? Invited presentation to Zoning Commission, Riga Township, Palmyra, MI (Lenawee County).

Punch, J. L. (April 25, 2017). Wind Turbines: What's the Noise All About? Invited lecture to Michigan State University class, ECE 491: Special Topics.

SUBMITTED PRESENTATIONS

INTERNATIONAL LEVEL

Punch, J.L. (November 1982). Computer-based information services for ASHA members. The computer and speech and hearing services: Administrative applications. Miniseminar presented at meeting of American Speech-Language-Hearing Association, Toronto, Canada.

Punch, J.L. (June 24-27, 1993). Aided listener preferences in laboratory vs. real-world environments. Paper presented at International Hearing Aid Conference II: Signal Processing, Fitting, and Efficacy, University of Iowa, IA.

NATIONAL LEVEL

Stream, R.W., et al. (1968). Hereditary low frequency hearing loss. Paper presented at meeting of American Speech and Hearing Association, Denver, CO.

Punch, J.L., & D'Agostino, A. (1972). Influence of word number on spondee threshold in normal listeners. Paper presented at meeting of American Speech and Hearing Association, San Francisco, CA.

Punch, J.L., & Rushing, C. (November 1974). Effect of poor-ear occlusion on sound field speech discrimination scores. Paper presented at meeting of American Speech and Hearing Association, Las Vegas, NV.

Punch, J.L., & Page, J. (November 1974). Evaluation of the efficiency of three hearing screening measures. Paper presented at meeting of American Speech and Hearing Association, Las Vegas, NV.

Punch, J.L., & Studebaker, G.A. (November 1975). Comparison of hearing aid and hearing aid-processed frequency response in ear canals. Paper presented at meeting of American Speech and Hearing Association, Washington, DC.

Punch, J.L. (1976). Evaluation of the Zwislocki coupler and KEMAR for use in hearing aid processing. Paper presented at 91st meeting of Acoustical Society of America, Washington, DC.

Punch, J.L., & Lawrence, W.F. (November 1976). Procedural considerations in the measurement of attack-release times. Paper presented at meeting of American Speech and Hearing Association, Houston, TX.

Punch, J.L., & Ciechanowski, J.M. (November 1977). Reliability of paired-comparison quality judgments in hearing aid evaluation. Paper presented at meeting of American Speech and Hearing Association, Chicago, IL.

Punch, J.L., & Howard, M.T. (1977). Listener-assessed intelligibility of hearing aid-processed speech. Paper presented at 94th meeting of Acoustical Society of America, Miami Beach, FL.

Punch, J.L., Montgomery, A.A., & Howard, M.T. (November 1978). Relationships between hearing aid electroacoustic characteristics and speech quality judgments. Paper presented at meeting of American Speech and Hearing Association, San Francisco, CA.

Punch, J.L., Talkin, D.T., & Lawrence, W.F. (November 1978). Measurement and analysis of hearing aid impulse response. Paper presented at meeting of American Speech and Hearing Association, San Francisco, CA.

Punch, J.L., & Parker, C.A. (November 1979). Validity of paired-comparison listener preferences in hearing aid evaluation. Paper presented at meeting of American Speech-Language-Hearing Association, Atlanta, GA.

Punch, J.L., & Beck, E.L. (November 1979). Aided speech quality judgments: Effect of varying low-cutoff frequency. Paper presented at meeting of American Speech-Language-Hearing Association, Atlanta, GA.

Howard, M.T., & Punch, J.L. (November 1980). Spondee threshold as a function of word number. Poster presented at meeting of American Speech-Language-Hearing Association, Detroit, MI.

Beck, L.B., Leatherwood, R.W., & Punch, J.L. (November 1980). Aided low-frequency response: Speech quality and speech intelligibility. Paper presented at meeting of American Speech-Language-Hearing Association, Detroit, MI.

Punch, J.L., Levitt, H., Mahaffey, R.B., & Wilson, M.S. (November 1983). Computer technology: The revolution has started without us. Miniseminar presented at meeting of American Speech-Language-Hearing Association, Cincinnati, OH.

Miyamoto, R.T., McConkey, A.J., Myres, W., Pope, M., & Punch, J.L. (May 1985). Long-term intracochlear implantation in man. Paper presented at meeting of American Neurotologic Society, Miami, FL.

Punch, J.L., & Miyamoto, R.T. (November 1985). Supplementary use of hearing aids by cochlear implantees. Poster presented at meeting of American Speech-Language-Hearing Association, Washington, DC.

Punch, J.L., McConkey, A., Myres, W., Pope, M.A., & Miyamoto, R.T. (November 1985). Relationships among selected pre- and post-implant measures. Paper presented at meeting of American Speech-Language-Hearing Association, Washington, DC.

Punch, J.L. (November 1985). Matching commercial hearing aids to prescriptive gain and SSPL requirements. Paper presented at meeting of American Speech-Language-Hearing Association, Washington, DC.

Miyamoto, R.T., & Punch, J. (October 1986). Current issues in cochlear implantation of adults and children. Miniseminar presented at Crossroads Conference on Communicative Disorders. National Student Speech-Language-Hearing Association. Purdue University, West Lafayette, IN.

Punch, J.L., Miyamoto, R.T., & Myres, W.A. (November 1986). Lipreading ability vs. auditory advantage with cochlear implants. Paper presented at meeting of American Speech-Language-Hearing Association, Detroit, MI.

Brown, D.B., Miyamoto, R.T., & Punch, J.L. (November 1986). Intraoperative ABR monitoring during vestibular nerve sections. Paper presented at meeting of American Speech-Language-Hearing Association, Detroit, MI.

Punch, J.L., Stone, R.E., Jr., Horii, Y., & Miyamoto, R.T. (November 1987). Oral-nasal coupling in the speech of cochlear implantees. Poster presented at meeting of American Speech-Language-Hearing Association, New Orleans, LA.

Myres, W.A., Miyamoto, R.T., & Punch, J.L. (November 1987). Auditory performance of a binaural cochlear implant recipient. Paper presented at meeting of American Speech-Language-Hearing Association, New Orleans, LA.

Punch, J., Chi, C., & Patterson, J. (November 1988). Factors affecting individualized target-gain based prescription of hearing aids. Miniseminar presented at meeting of American Speech-Language-Hearing Association, Boston, MA.

Punch, J., Allan, J., Sammeth, C., Palmer, R., Williamson, M., & Hecox, K. (November 1988). High-frequency limiting: Effects on laboratory and real-world performance. Paper presented at meeting of American Speech-Language-Hearing Association, Boston, MA.

Birman, M., Punch, J., & Balmer, W. (November 1988). Equivalent substitution method vs. a commonly used electroacoustic method. Paper presented at meeting of American Speech-Language-Hearing Association, Boston, MA.

Allan, J., Punch, J., & Chi, C. (November 1988). Signal averaging in real-ear measurements. Paper presented at meeting of American Speech-Language-Hearing Association, Boston, MA.

Chi, C., Balmer, W., Punch, J., & Williamson, M. (November 1988). Analysis of hearing aids: Complex signal vs. pure tone. Paper presented at meeting of American Speech-Language-Hearing Association, Boston, MA.

Allan, J., Punch, J., Lasky, R., & Chertoff, K. (November 1989). Effects of stimulus condition on preferred signal-processing characteristics. Paper presented at meeting of American Speech-Language-Hearing Association, St. Louis, MO.

Durrant, J., Punch, J., & Allan, J. (November 1989). Comparison of digital noise reduction algorithm vs. binaural processing. Paper presented at meeting of American Speech-Language-Hearing Association, St. Louis, MO.

Punch, J., Allan, J., & Jenison, R. (November 1989). Comparative evaluation of three binaural hearing aid fitting strategies. Paper presented at meeting of American Speech-Language-Hearing Association, St. Louis, MO.

Punch, J., Levitt, H., & Studebaker, G. (November 1989). Paired-comparison judgments in hearing aid evaluation: A status report. Miniseminar presented at meeting of American Speech-Language-Hearing Association, St. Louis, MO.

Benedict, E., Punch, J., Lasky, R., & Chi, C. (November 1989). The sliding scale: A preference based hearing aid fitting procedure. Paper presented at meeting of American Speech-Language-Hearing Association, St. Louis, MO.

Codd, M.B., Sammeth, C.A., Ochs, M.T., & Punch, J.L. (April 25-28, 1991). Effects of reduced low-frequency amplification on speech recognition thresholds and perceived sound quality in noise. Poster presented at meeting of American Academy of Audiology, Denver, CO.

Punch, J.L. (June 21-23, 1991). Prescriptive hearing aid fitting by parameter adjustment and selection. Paper presented at International Hearing Aid Conference: Signal Processing, Fitting, and Efficacy, University of Iowa, IA.

Punch, J., & Rakerd, B. (November 1991). Loudness matching of signals in a simulated multimemory hearing aid. Paper presented at meeting of American Speech-Language-Hearing Association, Atlanta, GA.

Punch, J.L., Robinson, D. O., & Katt, D.F. (November 1992). Hearing performance standard for law enforcement officers: Aided and unaided. Poster presented at meeting of American Speech-Language-Hearing Association, San Antonio, TX.

Punch, J.L., & Robb, R. (November 1992). A DSP-based approach to clinical hearing aid research. Poster presented at meeting of American Speech-Language-Hearing Association, San Antonio, TX.

Punch, J.L., & Hooth, A.J. (November 1992). Hearing aid fitting: A validation study. Poster presented at meeting of American Speech-Language-Hearing Association, San Antonio, TX.

Punch, J., Congdon, S., Nelson-Wade, E., & O'Connor, T. (November 1992). Comparison of three clinical hearing aid fitting procedures. Poster presented at meeting of American Speech-Language-Hearing Association, San Antonio, TX.

Hamill, T., & Punch, J. (1994). Toward valid hearing aid evaluation procedures. Instructional course presented at meeting of American Academy of Audiology, Richmond, VA.

Patterson, J.P., & Punch, J. (November 1994). Launching multimedia applications: Issues in design and development. Miniseminar presented at meeting of American Speech-Language-Hearing Association, New Orleans, LA.

Punch, J., & Weinstein, B. (November 1994). Hearing handicap inventory for the elderly: A multimedia version. Miniseminar presented at meeting of American Speech-Language-Hearing Association, New Orleans, LA.

Arsenault, M., & Punch, J. (September 11-13, 1995). Speech recognition performance in noise under monaural and binaural listening conditions. Poster presented at First Biennial

Conference, Hearing Aid Research and Development, National Institutes of Health, Bethesda, MD.

Rakerd, B., Punch, J., Hooks, W., & Vander Velde, T. (November 1996). Speech loudness changes associated with a programmable hearing aid. Presented at meeting of American Speech-Language-Hearing Association, Seattle, WA.

Weinstein, B., & Punch, J. (April 2-5, 1998). www.phd.msu.edu/hearing. Presented at meeting of American Academy of Audiology, Los Angeles, CA.

Amlani, A., Punch, J., & Rakerd, B. (March 16-19, 2000). Reliability and transitivity of forced- and unforced-choice paired-comparison preferences. Student Research Forum. Presented at meeting of American Academy of Audiology, Chicago, IL.

Shogren, S, & Punch, J. (March 16-19, 2000). Test-retest reliability of the Multimedia Hearing Handicap Inventory. Student Research Forum. Presented at meeting of American Academy of Audiology, Chicago, IL.

Jarrett, A., & Punch, J. (March 16-19, 2000). Development of a Hearing Risk Inventory for Infants. Student Research Forum. Presented at meeting of American Academy of Audiology, Chicago, IL.

Amlani, A., & Punch, J. (April 4, 2003). A web-based Audibility-Index (AI) calculator. Poster presented at meeting of American Academy of Audiology, San Antonio, TX.

Amlani, A., Punch, J., & Rakerd, B. (April 5, 2003). Polar-pattern preferences in real-world environments. Presented at meeting of American Academy of Audiology, San Antonio, TX.

Joseph, A., Punch. J., & Rakerd, B. (April 5, 2003). Effects of test order & instructions on MCL-S & UCL-S. Poster presented at meeting of American Academy of Audiology, San Antonio, TX.

Punch, J. (April 5, 2003). Hearing standards for hearing-critical occupations. Roundtable presentation at meeting of American Academy of Audiology, San Antonio, TX.

Joseph, A.R., Punch, J.L., Stephenson, M.R., Paneth, N., Murphy, W.J., & Wolfe, E. (November 1, 2005). The effect of training modality on earplug attenuation and fit. Poster presented at meeting of Association of Medical Service Corps Officers of the Navy (AMSCON) and Association of Military Surgeons of the United States (AMSUS), Nashville, TN.

Joseph, A., Stephenson, M. Punch, J., & Murphy, W. (February 17, 2006). The effect of training modality on earplug attenuation. Paper presented at meeting of National Hearing Conservation Association (NHCA), Tampa, FL.

Joseph, A.R., Punch, J.L., Stephenson, M.R., & Murphy, W.J. (February 16-18, 2006). The Sound Attenuation Fit Estimator ($SAFE_{500}$). Poster presented at meeting of National Hearing Conservation Association (NHCA), Tampa, FL.

Atienza, H., Bhagwan, S., Kramer, A., Morris, A., Pabst, D., Warren, A., Williams, N., Punch, J.L., & Elfenbein, J.L. (April 2-5, 2008). Preferred MP3 listening levels: Earphones and environments. Poster presented at meeting of American Academy of Audiology, Charlotte, NC.

Callaway, S.L. & Punch, J.L. (April 2-5, 2008). Prescriptive fitting of over-the-counter hearing aids. Poster presented at meeting of American Academy of Audiology, Charlotte, NC.

Punch, J.L., James, R., & Pabst, D. (November 19-21, 2009). Wind turbines: What you can't hear can hurt you. Paper presented at meeting of American Speech-Language-Hearing Association, New Orleans, LA.

Alkhamra, R.A., Rakerd, B., Punch, J, Zwolan, T., & Elfenbein, J. (July 24 - 29, 2011). Cognitive effort and the perception of speech by adult cochlear implant users: A survey. Poster presented at Conference on Implantable Auditory Prostheses 2011, Pacific Grove, CA.

Rakerd, B., Alkhamra, R., Zwolan, T, Punch, J, & Elfenbein, J. (November 17-19, 2011). Cognitive effort and perception of speech by cochlear implant users. Paper presented at meeting of American Speech-Language-Hearing Association, San Diego, CA.

Schutte, D., Rivard, J., Dykstra Goris, E., Schmidt, S, Punch, J., & Schutte, B. (March 7-10, 2013). Examining hearing as a potential predictor of agitation in persons with dementia: feasibility of a comprehensive hearing assessment in persons with cognitive impairment, Paper presented at meeting of Midwest Nursing Research Society, Chicago, IL.

Hitt, R., Punch, J., & Smith, S.W. (March 28-30, 2013). Effects of hearing impairment on quality of life. Poster presented at D.C. Health Communication Conference, Fairfax, VA.

Rakerd, B., & Punch, J.L. (November 9-11, 2017). Toward a simplified protocol for speech audiometry. Poster presented at meeting of American Speech-Language-Hearing Association, Los Angeles, CA.

Punch, J., & Rakerd, B. (April 18-21, 2018). Simplifying speech audiometry. Poster presented at meeting of American Academy of Audiology, Nashville, TN.

REGIONAL/STATE/LOCAL LEVEL

Miyamoto, R.T., and other members of the Cochlear Implant Team (April 17, 1986). Cochlear implants as sensory aids for deaf children. Session presented at meeting of Indiana Speech and Hearing Association, Nashville, TN.

Robinson, D.O., Punch, J.L., & Katt, D.F. (March 1992). Michigan Law Enforcement Officers Training Council's hearing performance standard: Aided and unaided. Poster presented at meeting of Michigan Speech-Language-Hearing Association, Kalamazoo, MI.

Punch, J.L., & Jarrett, A.M. (March 25-27, 1993). State hearing aid licensing statutes and the audiologist. Poster presented at Meeting of Michigan Speech-Language-Hearing Association, Shanty Creek Resort, Bellaire, MI.

Weinstein, B., & Punch, J. (May 2-5, 1996). A multimedia approach to marketing hearing health care services for older adults. Presented at meeting of New York State Speech-Language-Hearing Association, Albany, NY.

Punch, J., & Weinstein, B. (March 13-15, 1997). Hearing Handicap Inventory: From milk carton to multimedia. Presented at meeting of Michigan Speech-Language-Hearing Association, Kalamazoo, MI.

Artymovich, A., Frost, T, Jeong, M, Lin, F., Patel, N., & Sweet, E. (Mentors: J. L. Elfenbein & J. Punch) (April 13, 2007). Listening to music: University students' device preferences. Poster presented at University Undergraduate Research and Arts Forum, Michigan State University.

Artymovich, A., Frost, T, Jeong, M, Lin, F., Patel, N., & Sweet, E. (Mentors: J. L. Elfenbein & J. Punch) (April 13, 2007). University students' patterns of MP3 player use: Is there hearing health risk? Poster presented at University Undergraduate Research and Arts Forum, Michigan State University.

Atienza, H., Bhagwan, S., Kramer, A., Morris, A., Pabst, D., Warren, A., & Williams, N. (Mentors: J. Punch & J. L. Elfenbein) (March 9, 2007). Output levels of the Apple iPod® for three types of earphones. Poster presented at meeting of Michigan Speech-Language-Hearing Association, Ypsilanti, MI.

Atienza, H., Bhagwan, S., Kramer, A., Morris, A., Pabst, D., Warren, A., & Williams, N. (Mentors: J. Punch & J. L. Elfenbein) (April 13, 2007). Output levels of the Apple iPod® for three types of earphones. Poster presented at University Undergraduate Research and Arts Forum, Michigan State University.

Atienza, H., Bhagwan, S., Kramer, A., Morris, A., Pabst, D., Warren, A., & Williams, N. (Mentors: J. Punch & J. L. Elfenbein) (April 13, 2007). Preferred listening levels of MP3 music with three types of earphones. Poster presented at University Undergraduate Research and Arts Forum, Michigan State University.

Atienza, H., Bhagwan, S., Kramer, A., Morris, A., Pabst, D., Warren, A., & Williams, N. (Mentors: J. Punch & J. L. Elfenbein) (April 20, 2007). Output levels of the Apple iPod® for three types of earphones. Poster presented at Pediatric and Human Development Research Day, Michigan State University.

Atienza, H., Bhagwan, S., Kramer, A., Morris, A., Pabst, D., Warren, A., & Williams, N. (Mentors: J. Punch & J. L. Elfenbein) (April 20, 2007). Preferred listening levels of MP3 music with three types of earphones. Poster presented at Pediatric and Human Development Research Day, Michigan State University.

Sanders, S., Rajasekhar, R, & Viaches, K. (Mentors: J. Punch & S. Smith) (April 2009). Development of a quality-of-life inventory for the hearing impaired. Poster presented at University Undergraduate Research and Arts Forum, Michigan State University.

Punch, J. (February 7, 2014). Wind turbine noise: Can sounds we can't hear hurt us? Lecture presented at Research Colloquium, Department of Communicative Sciences and Disorders, Michigan State University.

WORKS SUBMITTED AND IN PRESS

Punch, J., & Rakerd, B. Evaluation of a simplified protocol for speech audiometry. In press (*American Journal of Audiology*).

Punch, J.L., Hitt, R., & Smith, S.W. Hearing loss and quality of life. Submitted, under review.

MASTER'S THESES DIRECTED

D'Agostino, A.D. (1972). Effect of word number on spondee threshold in normal listeners (Master's thesis, University of Mississippi, 1972).

Guckert, S.A. (1973). The development and evaluation of a filtered speech test for use in hearing screening. (Master's thesis, University of Mississippi, 1973).

Rushing, C. (1973). The effects of single ear occlusion on sound field speech discrimination scores (Master's thesis, University of Mississippi, 1973).

Shogren, S. (1999). Test-retest reliability and clinical utility of the Multimedia Hearing Handicap Inventory (Master's thesis, Michigan State University, 1999).

Callaway, S.L. (2007). How well do over-the-counter hearing aids benefit the hearing impaired? (Master's thesis, Copenhagen University, Denmark, 2007). Thesis co-adviser, Copenhagen University: Niels Reinholt Petersen, Ph.D.

Ph.D. DISSERTATIONS DIRECTED

Amlani, A. (2003). Paired-comparison preferences for polar directivity patterns in different listening environments (Doctoral dissertation, Michigan State University, 2003).

Joseph, A. (2004). Attenuation of passive hearing protection devices as a function of group versus individual training. (Doctoral dissertation, Michigan State University, 2004).

HONORS AND AWARDS

Fellow, American Speech-Language-Hearing Association
American Men and Women of Science
Dedicated Service Award, Michigan Law Enforcement Officers Training Council, January 1993
Editor's Award, American Auditory Society, September 1987. Relative effects of low-frequency amplification on syllable recognition and speech quality, *Ear and Hearing*, 7, 57-62 (1986), with Lucille B. Beck
Who's Who in America
The National Distinguished Service Registry: Speech, Language and Hearing
Student Research Forum Award for submission to meeting of American Academy of Audiology. Sara Shogren & Jerry Punch, Test-retest reliability of the Multimedia Hearing Handicap Inventory, March 17, 2000, Chicago, IL.
Merit Recognition Award for poster presented at University Undergraduate Research and Arts Forum, Michigan State University (Authors: Atienza, H., Bhagwan, S., Kramer, A., Morris, A., Pabst, D., Warren, A., & Williams, N.; Mentors: J. Punch & J. Elfenbein), April 13, 2007. Output levels of the Apple iPod® for three types of earphones.
James Jerger Award for Excellence in Student Research for poster presented at meeting of American Academy of Audiology. Susanna L. Callaway & Jerry L. Punch, Prescriptive fitting of over-the-counter hearing aids, April 2-5, 2008, Charlotte, NC.

PROFESSIONAL MEMBERSHIPS/CREDENTIALS/AFFILIATIONS

INTERNATIONAL ORGANIZATIONS

Member, Editorial Board, *Iranian Audiology*; October 2003-present.

NATIONAL ORGANIZATIONS

Member, American Speech-Language-Hearing Association (ASHA)

Certificate of Clinical Competence (CCC) in Audiology, ASHA
Member, American Auditory Society
Fellow, American Academy of Audiology
Member, Acoustical Society of America, 1976-1991; 2000-present

STATE ORGANIZATIONS

Member, Michigan Speech-Language-Hearing Association (MSHA); early 1990s; currently a non-member
Hearing Aid Dealers License (#17000751A), State of Indiana, May 16, 1985-June 30, 1988
Hearing Aid Dealers License (#3501003452), State of Michigan, November 2001-November 2005
Audiologist License (#1601000461), State of Michigan, May 2007-December 2009

COMMITTEE APPOINTMENTS, CONSULTANTSHIPS, AND RELATED PROFESSIONAL SERVICE ACTIVITIES

INTERNATIONAL LEVEL

Member, Hearing International, September 2000-2007; Member, Committee on Management and Rehabilitation of Hearing Loss, Hearing International, September 2000-2007; Chair, Subcommittee on High-Quality, Low-Cost Hearing Aids
Invited reviewer of promotional materials of Dr. Wahab Owolawi Owolawi, King Saud University, Saudi Arabia, June 2007

NATIONAL LEVEL

Congressional Action Contact (CAC) of ASHA, July 1972-June 1973
ASHA Committee on Audiometric Evaluation, January 1978-June 1980
Chair, ASHA Task Force on Information Services, 1982-83
Ex-officio Member: ASHA Committee on Scientific Affairs, ASHA Committee on Personnel and Service Needs in Communication Disorders, ASHA Committee on Educational Technology, July 1982-July 1984
Consultant to Deafness, Speech and Hearing Publications (DSHP) Board, ASHA, October 1982-July 1984
Chair, ASHA Task Force on Personnel Supply, Demand and Utilization, 1983-1984
Chair, Forum on Allied Health Data, Spring 1983-Spring 1984
Steering Committee, American Speech-Language-Hearing Foundation Conference, "The Personal Computer as a Professional Tool," 1983-1984
Member, ASHA Task Force on Personnel Supply, Demand and Utilization, July 1984-April 1986
Editorial Consultant, *Journal of the Acoustical Society of America*, 1987-1989, June 2014-present
Reviewer of NIH-SBIR research grant proposals, Washington, DC, March 14-15, 1995
Reviewer of House Ear Institute research proposal, March 1997

Editorial Consultant, *Journal of Speech-Language-Hearing Research* (periodic)
Editorial Consultant, *Ear and Hearing* (periodic)
Editorial Consultant, *American Journal of Audiology* (periodic)
Editorial Consultant, *Iranian Audiology* (periodic)
Editorial Consultant, *International Journal of Audiology* (March 2006-present)
Editorial Consultant, *Pediatrics*, February 2013
Editorial Consultant, *International Journal of Environmental Research and Public Health*, June 2014-present

STATE LEVEL

Member, Clinic, Hospital, and Private Practice Ad Hoc Committee, Indiana Speech and Hearing Association, September 1986-October 1987
Member, Program Committee, Indiana Speech and Hearing Association, 1986-1987, 1987-1988
Member, Michigan Speech-Language-Hearing Association, 1991-1997
Member, Audiology Committee, Michigan Speech-Language-Hearing Association, 1991
Vice-President for Membership, Executive Council, Michigan Speech-Language-Hearing Association, January 1991-December 1992
Consultant, Michigan Law Enforcement Officers Training Council re hearing standards, 1991-1992; 2003.
Michigan representative for Membership Recruitment Network, American Academy of Audiology, 1992
Consultant to Department of Veterans Affairs (DVA), Audiology Section, Ann Arbor, Michigan, 1992
Consultant to Michigan Department of Social Services, Hearing and Hearing Aid Reimbursement Program, Lansing, Michigan, 1993-1995
Reviewer, Sertoma Communicative Disorders Scholarship Applications, Michigan Region, Sertoma International, 1994-95, April 1994
Participant in first MSHA-sponsored Legislative Day, May 4, 1994, contacting offices of Senators Debbie Stabenow and Fred Dillingham and Representative Lynn Jondahl
Member, Advisory Board for Occupational Noise-Induced Hearing Loss, State of Michigan, 1995-2010
Member, Audiology Advisory Panel, Michigan Department of Community Services, 1995-1996
Participant, with Nigel Paneth, M.D., in gaining approval of Michigan Chapter of American Academy of Pediatrics to implement resolution that pediatricians refer all children to audiologists for audiological and hearing aid evaluations, 1997
Consultant to Pyle, Rome, Lichten, & Eurenberg, P.C., Attorneys at Law, Boston, MA, re cases of occupational hearing loss in law enforcement officers and firefighters, January 1999-January 2002.
Consultant, SHL, Contractor with Commonwealth of Massachusetts, Evaluation of hearing standards for police officers and firefighters, May 28, 2002
Member and Chair, Wind and Health Technical Work Group, Bureau of Energy Systems, Department of Energy, Labor, and Economic Growth (DELEG), State of Michigan, March 2010-June 2011

UNIVERSITY LEVEL

Participant in CIC Predoctoral Fellows Conference, Michigan State University, November 1993
Participant in Focus Group meeting of Committee on Improving, Evaluating and Rewarding Teaching (CIERT), Michigan State University, December 1993
Member, Ad Hoc Committee on University-Wide Performance Indicators, Michigan State University, May-June 1995
Member, Clinical Services Group, Evaluating Quality Outreach Working Group, Michigan State University, February-May 1999
Faculty Tenure Committee, Michigan State University, 1993-1995
University Committee on Research in Human Subjects (UCRIHS, or Institutional Review Board), Fall Semester 2000, January 2011-September 2017
Member, Ad Hoc Working Group on Institutional Indicators for Evaluating Quality Outreach, Michigan State University, February-May, 1999
Faculty Participant in Freshman Orientation Program, Michigan State University, June 29, 1999
Member (interim), Faculty Council, Michigan State University, January-May 2005
Member (interim proxy), Academic Council, Michigan State University, January-May 2005
Member, University Committee on Academic Policy (UCAP), May 2007-May 2009
Representative, Academic Council (from University Committee on Academic Policy), August 2007-May 2008

COLLEGE/DEPARTMENTAL LEVEL

Departmental committees (Michigan State University): Audiology Faculty Position Search Committee (1993-94); Clinical Affairs Committee (1990-94); Clinical Specialist Position Search Committee (1993); Curriculum Committee (1991-92); Faculty Advisory Committee (1990-91); Graduate Studies and Admissions Committee (1990-2010, periodically serving as Chair); Neuropathology Faculty Position Search Committee (1990-91)
College committees (Michigan State University): Intracollegiate Planning Committee (1992-1994); CAS Technology Advisory Committee (2002-2003)
Revised Departmental Handbook, Fall 2003
College Reappointment, Tenure, and Promotion Committee (2006-2007)
Member, Admissions Committee, Department of Communicative Sciences and Disorders, 2008
Member, Committee to Review Health Communication Program, College of Communication Arts and Sciences, September 2008-January 2009
Member and Chair, Admissions Committee, Department of Communicative Sciences and Disorders, 2009

MEDIA EVENTS

Interview on WJLM-TV, Channel 6, Lansing, Michigan, Better Hearing and Speech Month, May 20, 1997.
Interview on WLAN-TV, Channel 6, Lansing, Michigan, Segment on Hearing Loss, February 4, 1999.

Interview with Broadcast/Photo Division of MSU's Office of University Relations, Dennis Krolik, February 5, 1999.
MSU State News, Study Finds Hearing Loss in Youth, September 15, 2005.
Detroit News, Hearing under Assault, January 3, 2006.
Wall Street Journal, Behind the Music, IPods and Hearing Loss, January 10, 2006.
Newstips provided to Melanie Lynne Trusty (via e-mail), MSU Journalism student, February 6, 2006, concerning Apple's iPod lawsuit.
Interview with MSU Focal Point on Listening with iPods, Jamie Lauren Kandel, February 22, 2006.
Not All Hearing Aids Are Created Equal, article appearing in:
MSU News, http://news.msu.edu/story/5621/, August 13, 2008.
ScienceDaily, http://www.sciencedaily.com/releases/2008/08/080813164634.htm, August 14, 2008.
CHINA ORG.CN, http://www.china.org.cn/health/2008-08/14/content_16223170.htm, August 14, 2008.
Detroit Free Press, http://www.freep.com/apps/pbcs.dll/article?AID=/20080815/NEWS06/808150346/1008/NEWS06, August 15, 2008 (appearing under title, Drugstore Hearing Aids May Do Harm).
Hearing Review Insider, http://www.hearingreview.com/insider/2008-08-28_08.asp; August 28, 2008.
(This article also appeared on numerous additional Web sites and blogs.)
Interview with Naomi Schalit, Executive Director and Senior Reporter, Maine Center for Public Interest Reporting, Hallowell, ME on topic of wind-turbine noise, July 27, 2010.
Interview with Bob Allen, Interlochen Public Radio, Interlochen, Michigan, on topic of health effects of wind-turbine noise, January 14, 2011.
Interview with Mark Bashore, Wind Turbines Pose Health Risks, Current State, WKAR, Michigan State University, February11, 2014.
Interviews on WKAR-AM Radio Call-In Show, Michigan State University:

Topic/Theme	Date
Better Hearing and Speech Month	May 1991
Audiology Topics	September 3, 1992
Audiology Topics	March 31, 1993
Better Hearing and Speech Month	May 17, 1993
Hearing Topics: Children and Adults	July 9, 1993
Hearing Aids	September 27, 1993
Audiology Topics	January 10, 1994
Audiology Topics	March 2, 1994
Better Hearing and Speech Month	May 3, 1994
Hearing Loss and Hearing Aids	July 19, 1994
Auditory Perception Disorders and Hearing Aids	December 29, 1994

Hearing, Hearing Loss, Prevention of Hearing Loss	March 30, 1995
Better Hearing and Speech Month	May 1, 1997
Better Hearing and Speech Month	May 10, 1999
Better Hearing and Speech Month	May 16, 2000

BOOK REVIEWS

Probe Microphone Measurements: Hearing Aid Selection and Assessment (1992), by H. Gustav Mueller, David B. Hawkins, & Jerry L. Northern, San Diego, CA: Singular Publishing Group, Inc. In (1992) *Ear and Hearing*, 13, 467-468.

RESEARCH PROPOSALS, GRANTS, AND CONTRACTS

Faculty Research Grant, "Investigation of Adequacy of Audiometric Calibration in Hearing Conservation Programs," University of Mississippi, 1971-72 (funded).

Faculty Research Grant, "Development and Evaluation of a Filtered Speech Screening Test," University of Mississippi, 1972-73 (funded).

Principal Investigator, Veterans Administration Contract, "The Clinical and Acoustic Parameters of Hearing Aid Effectiveness," University of Maryland, October 1976-June 1980 (funded).

Project Director, "Speech-Language Pathology and Audiology: An Educational Perspective for the Future," American Speech-Language-Hearing Association, July 1980-June 1981 (funded $222,433).

Co-author of, and consultant to, project funded by Department of Education, "Leadership Training in Computer Technology: A Tri-Level Multidisciplinary Program for Special Educators and Speech-Language Pathologists and Audiologists," ASHA National Office, January 1983-June 1984 (funded $122,875).

Co-author of, and consultant to, project funded by Department of Education, "Validation of a Model to Evaluate Microcomputer Software for Communicatively Handicapped Students," ASHA National Office, December 1983-June 1984 (funded $154,489).

Primary writer of a grant proposal funded by NINCDS-NIH, "Comparison of Sensory Aids in Deaf Children," Indiana University School of Medicine, January 1987 (funded $348,869).

Principal Investigator of project funded by NIDCD-NIH, "A DSP-Based Approach to the Study of Hearing Aid Fitting," Michigan State University, January 1991-December 1992 (funded $63,946).

Project Director, "Development of a Multimedia-Based Version of the Hearing Handicap Inventory for the Elderly," All-University Outreach Grant, Michigan State University, July 1992-December 1993 (funded $14,947).

Project Director, "Accommodation of the Communicative Needs of Hearing-Impaired Students and Faculty at Michigan State University," Project funded (for support of Graduate Assistant) by Office of the Provost, Michigan State University, January 1995-August 1995 (funded).

Member, Project Team, Strategic Partnership Grant to Fund Hearing Research Center, Michigan State University, July 1, 1996-June 1997 (funded ~$210,000).

Lead Investigator (with Brad Rakerd and Amyn Amlani), "Intelligibility Testing of Digitized Sound Files Provided by IC Tech," Contract with IC Tech, Inc., Okemos, MI, February 6-May 31, 2001 (funded).

NIH-NIDCD Proposal, "Real-World Based Fitting of a Multimemory Hearing Aid," 2002 (unfunded).

Sponsor, NIH fellowship (1 F31 DC05429-01) to Michigan State University to support doctoral dissertation project of Amyn Amlani, "Predicting Speech Intelligibility from Directivity Index," February 2002-January 2003 (funded $25,783).

NIH-STTR Fast-Track Proposal, "High-Quality, Affordable Hearing Aids for World Markets," 2003 (unfunded).

NIH-NINCD Proposal, "Development of a Quality-of-Life (QoL) Inventory for Hearing-Impaired Adults," 2009 (unfunded).

PROGRAM SITE VISITS

Department of Audiology and Speech Sciences, Purdue University, October 19-21, 1994 (Invited by School of Liberal Arts).

Selected Audiology programs in state of Louisiana, commissioned by Louisiana Board of Regents (March 18-23, 2002; January 15, 2003); reviewed programs include Louisiana Tech University, Louisiana State University, and Louisiana State University Health Sciences Center.

ACCOMPLISHMENTS AS STAFF MEMBER OF ASHA NATIONAL OFFICE (1980-84)

Served as Project Director during first year of a federally funded three-year study of service and training needs in the profession of speech-language pathology and audiology.

Conducted study of employment and salary trends in the profession, May 1982.

Edited a comprehensive review of literature relative to incidence and prevalence of speech, language and hearing disorders entitled, "The Prevalence of Communicative Disorders: A Review of the Literature."

Co-compiled a comprehensive report on federal and private funding sources in speech, language, and hearing, "Profiles of Funding Sources."

Served as ASHA representative to Forum on Allied Health Data (FAHD), a consortium of federal, professional and private organizations devoted to establishing databases on manpower in medically related health professions; Chair of FAHD, May 1983-May 1984

Coordinated survey of graduate training programs for publication, *Guide to Graduate Education 1983.*

Coordinated development of guidelines for conduct of ASHA surveys by committees, boards, councils, and National Office staff members.

Developed proposal for comprehensive investigation of work force supply and demand in speech-language pathology and audiology profession (approved by ASHA Executive Board).

Instituted "Data Page" feature in *Asha*, a regular feature devoted to reporting data on ASHA membership, the speech-language pathology and audiology profession, and the communicatively impaired.

Coordinated development, creation, publication, and distribution of *Research Bulletin*, newsletter for member and nonmember scientists.

Conducted survey and completed co-authored report on consolidation of ASHA's scholarly publications, "National Office Report of Journals Survey."

Conducted survey and completed report on *dsh Abstracts*, Report of 1980 *dsh Abstracts* Survey

Coordinated special issue of *Asha* on science theme (December 1984); participated in interview, "*Asha* Interviews: Janis Costello, Jerry Punch, Teris Schery, Lawrence Shriberg;" and co-authored "Data Page" feature on that issue.

Developed proposal for initiating computer-based information services for use of ASHA members, and coordinated ASHA Task Force on Information Services (1982-83).

Coordinated effort to structure and initiate the Research Information Service (RIS), a computerized database containing information on research career opportunities, research technology resources, and research funding opportunities.

MISCELLANEOUS PROJECTS

Web site (http://www.msu.edu/~asc/hhi); originally developed in conjunction with Hearing Research Center, Michigan State University, September 1997; includes Web-based Hearing Handicap Inventory.

Hearing Handicap Inventory: Multimedia Version, developed in February 1998 by J.L. Punch and B.E. Weinstein. Interactive CD-ROM program designed to screen for hearing handicap, and as an outcomes-assessment measure, in young and elderly adult populations; available through MSU's Instructional Media Center.

Developed ASC 843C, Hearing Amplification I (http://vu.msu.edu/preview/asc843c/), online course offered for credit and non-credit, beginning summer 2002-fall 2006.

Developed ASC 843I, Hearing Amplification II (http://vu.msu.edu/preview/asc843i/), online course offered for credit and non-credit beginning summer 2002-spring 2006.

FORENSIC ACTIVITIES

Legal deposition, Dana Rowe v. North Reading Fire Department, Boston, MA, July 29, 1999.

Legal deposition, Boston Police Department v. Richard Dahill, Boston, MA, July 30, 1999.

Legal consultant, Montana Advocacy Program, Phil Hohenlohe, Staff Attorney, Helena, MT, 2004-2009 (no testimony given).

Legal consultant, Stephen J. Vujcevic v. Oglebay Norton Marine Services Company, LLC et al., Eastern District of Michigan, Southern Division, May 2007-December 2008.

Legal consultant, Bonfiglio v. Northridge Church, et al., Hohauser Law Firm, Rochester, Michigan, May 2008-December 2009.

Reviewed and commented on hearing standard proposed by American College of Occupational and Environmental Medicine (ACOEM), at invitation of Daniel G. Samo, MD, Medical Director, Health Promotion and Corporate Services, Northwestern Memorial Hospital, Northwestern University Feinberg School of Medicine, February-May 2009.

Legal testimony, Application of Highland Wind Farm, LLC, to construct a 102.5 MW wind electric generation facility and associated electric facilities, to be located in the Towns of Forest and Cylon, St. Croix County, Wisconsin; Hearing by Public Service Commission, Madison, Wisconsin, Docket 2535-CE-100, Towns of Forest and Cylon represented by Glenn Reynolds; Direct testimony, 8/30/12 (PSC Ref# 171133); Surrebuttal testimony, 10/3/12 (PSC Ref# 173730); Testimony re Shirley Wind, 1/15/13 (PSC Ref# 17149), Rebuttal testimony, 1/22/13 (PSC Ref# 179627).

Legal testimony on behalf of Union Neighbors United, Inc., Robert and Diane Mcconnell, and Julia F. Johnson, In the Matter of the Application of Champaign Wind LLC to Install Electricity Generating Wind Turbines in Champaign County, Ohio, Hearing by Power Siting Board, Columbus, Ohio, Case No. 12-0160-EL-BGN, Union Neighbors United, Inc. represented by Jack A. Van Kley and Christopher A. Walker; Direct testimony, 10/31/12; Oral deposition, 11/7/12; Cross examination, 11/19/12.

Legal deposition, Michigan, 7/24/13, Charles and Debby Wiltzer, and Seager Wiltzer (represented by Chester E. Kasiborski, Jr., and Susan Hlywa Topp, vs. Heritage Sustainable Energy and Heritage Stoney Corners Wind Farm LLC (represented by Robert G. Chaklos, Jr., and Kurt M. Bowden).

Legal testimony, Michigan, 12/5/13, Daubert Hearing, Charles and Debby Wiltzer, and Seager Wiltzer (represented by Chester E. Kasiborski, Jr., and Susan Hlywa Topp) vs. Heritage Sustainable Energy and Heritage Stoney Corners Wind Farm LLC (represented by Robert G. Chaklos, Jr., and Kurt M. Bowden); qualified as expert witness, 12/16/13.

Legal consultant, Iowa, Reuters v. Osceola Windpower; Abby Walleck, attorney for plaintiff, 6/30/14; Steve Hamilton currently serves as plaintiff's attorney.

Legal testimony on behalf of United Citizens for Livingston County (represented by Phillip Luetkehans) vs. Pleasant Ridge Wind Farm (Invenergy represented by Michael S. Blazer), Livingston County Zoning Board of Appeals, Livingston County, Illinois; Direct testimony, 1/21/15; cross-examination 1/22/15; additional cross-examination, 2/23/15.

Legal deposition on behalf of Daniel Brian Williams (represented by James McCandlish) vs. Invenergy LLC, Portland, Oregon, 7/2/15.

Legal testimony on behalf of Town of Somerset, Niagara County, New York, 12/22/15-1/11/16 (represented by Mark Davis) vs. Lighthouse Wind LLC.

Presentation, Wind Turbines: What's the Noise All About? Henry County, Indiana, October 15, 2016.

Letter (invited) to Board of Zoning Appeals, Warren County, Indiana, November 4, 2016.

Retained as expert witness in Falmouth Wind 1 case, Massachusetts, (plaintiffs represented by Christopher Senie), November 2016.

Expert witness in multiple cases in the state of New York (Gary Abraham, attorney for plaintiffs): (1) Citizens v. Cassadaga Wind LLC, (2) Citizens v. Lighthouse Wind LLC, (3) Citizens v. Baron Winds LLC, and (4) Combined (three-party) case involving Centerville's Concerned Citizens, Concerned Citizens of Cattaraugus County, Inc., and the Old Amish of Farmersville v. Alle-Catt Wind Energy LLC.

Expert witness, Twin Forks Wind Farm, LLC, Macon County, Illinois (Richard Porter and Jeffrey Hoskins, attorneys for plaintiffs).

Presentation and legal testimony, Bright Stalk Wind Farm, McLean County, Illinois (Phillip Luetkehans and Brian Armstrong, attorneys for plaintiffs), February 22, 2018.

CONTINUING EDUCATION ACTIVITIES
(Listed in chronological order, since 1990; does not include attendance at professional meetings or local hearing aid update meetings, at which attendance was regular prior to retirement)

- ASHA Audio Teleconference, Amplification for Difficult to Fit Clients: A Case Study Exchange, July 20, 1990.
- Van Riper Lectures in Speech Pathology and Audiology, Signal Processing Hearing Aids: Bridging the Clinical-Research Gap, Western Michigan University, Kalamazoo, MI, October 4-5, 1990.
- Introduction to the IBM Mainframe Computing System, Michigan State University, Fall 1990.
- International Hearing Aid Conference: Signal Processing, Fitting, and Efficacy, University of Iowa, Iowa City, IA, June 21-23, 1991.
- MSUnet: An Introduction to Communications and Networking, Michigan State University, Summer 1991.
- Using Multimedia for Instruction and Presentation, Michigan State University, Fall 1991
- Au.D. Audio Teleconference, Sponsored by Purdue University, October 30, 1991.
- Middle Ear Disorders in Children: An Update on Treatment and Management, ASHA Teleconference, February 26, 1993.
- Participant, Meet Michigan, guided tour of northeastern Michigan outreach programs receiving support from Michigan State University, May 10-13, 1993.
- International Hearing Aid Conference II: Signal Processing, Fitting, and Efficacy, University of Iowa, Iowa City, IA, June 24-27, 1993.
- Lilly Faculty Seminar Programs, Sheila Tobias, Conversations about Teaching and Learning: Testing Workshop, Michigan State University, January 21, 1994.
- Lilly Faculty Seminar Programs, Ann Austin, Teaching for Understanding: Building on What Students Bring to the Classroom, Michigan State University, February 11, 1994.
- Telecommunication and Community Health Care for Michigan, conference sponsored by Michigan State University, June 17-18, 1994.
- Student Information System Training Course, Michigan State University, August 16 & 18, 1994.
- Leadership Workshop for Chairs and Directors, Sponsored by Office of the Provost, Michigan State University, September 16, 1994.
- Leadership Workshop for Chairs and Directors, Sponsored by Office of the Provost, Michigan State University, October 14, 1994.
- Facilitator, Faculty retreat in Department of Audiology and Speech Sciences, October 22, 1994.
- Expanding Educational Opportunities Conference, Sponsored by ASHA, Bethesda, MD, January 28-29, 1995.
- Leadership Workshop for Chairs and Directors, Sponsored by Office of the Provost, Michigan State University, February 3, 1995.

- Leadership Workshop for Chairs and Deans, Peter Seldin and Linda Annis, Improving Teaching: What Works and What Doesn't, Sponsored by Office of the Provost, Michigan State University, February 3, 1995.
- Workshop, Sponsored by National Consortium for Universal Newborn Screening, TEOAE-Based Universal Newborn Hearing Screening, Georgetown University Medical Center, Washington, DC, November 16-18, 1995.
- Visited University College London, London, England, to establish Study Abroad semester program for MSU undergraduate students, June 24-July 6, 1996.
- Leadership Workshop for Chairs and Deans, Lou Anna K. Simon, The Continuing Dialogue on Motivating Change, Sponsored by Office of the Provost, Michigan State University, August 29, 1996.
- Leadership Workshop for Chairs and Deans, Jude West, Leadership Skills in a Changing Academic Environment, Sponsored by Office of the Provost, Michigan State University, October 2, 1996.
- Leadership Workshop for Chairs and Deans, Robert Church, Enhancing the Teaching Mission with Technology: Issues and Challenges, Sponsored by Office of the Provost, Michigan State University, November 12, 1996.
- Leadership Workshop for Chairs and Deans, Terry Curry, Faculty Performance Reviews, Sponsored by Office of the Provost, Michigan State University, February 19, 1997.
- Seminar, Internet Tools for Distance Learning, Michigan State University, April 17, 1997
- Conference, Reaching for Cultural and Social Diversity in Speech Pathology and Audiology: Assessing Cultural and Social Values, Ronald Jones, Ph.D., Co-sponsored by Department of Audiology and Speech Sciences, Michigan State University, and Speech Pathology and Audiology Program, Norfolk State University, Michigan State University, April 21, 1997.
- Conference, Preventive Ethics, Sponsored by Office of the Provost, Michigan State University, April 23, 1997.
- Graduate Program Director Workshop on Financing Graduate Education, Sponsored by the Graduate School, Michigan State University, April 30, 1997.
- Leadership Workshop for Chairs and Directors, Sponsored by Office of the Provost, Michigan State University, September 23, 1997.
- Leadership Videoconference, The Nonprofit Leader of the Future: A Seminar in Social Sector Leadership, Peter Druker, Sponsored by Office of the Provost, Michigan State University, September 25, 1997.
- Leadership Workshop for Chairs and Directors, Drug-Free Workplace, ADA, Sexual Harassment Prevention, and EAP Issues, Sponsored by Office of the Provost, Michigan State University, October 23, 1997.
- Communication and Aging: Interdisciplinary Approaches to Keep Elders Communicating, Van Riper Lectures in Speech Pathology and Audiology, Western Michigan University, October 24, 1997.
- Leadership Workshop for Chairs and Directors, Technology and Computing at the Unit Level: Issues and Opportunities, Paul Hunt, Sponsored by Office of the Provost, Michigan State University, November 11, 1997.

- Instructional Videoconference, Putting Your Course Online, Sponsored by Office of the Provost, Michigan State University, November 13, 1997
- Workshop, Using Computers in Instruction, Sponsored by Office of the Provost, Michigan State University, November 18, 1997.
- Workshop, Technology in the Classroom, Frank Tate, Sponsored by Instructional Media Center, Michigan State University, January 12, 1998.
- Workshop, Effective Teaching, Sandi Smith, Sponsored by Office of the Provost, Michigan State University, January 29, 1998.
- Workshop, Writing Faculty Performance Reviews, Terry Curry, Sponsored by Office of the Provost, Michigan State University, February 2, 1998.
- Workshop, Getting Things Done: Delegating and Accountability, Michael Polzin and Tina Riley, Sponsored by Office of the Provost, Michigan State University, February 18, 1998.
- Workshop, Getting New Faculty Started, Ann E. Austin, Sponsored by Office of the Provost, Michigan State University, October 23, 1998.
- Workshop, Faculty Course Portfolios: From Teaching to Learning, Deborah M. Langsam, Sponsored by Office of the Provost, Michigan State University, October 26, 1998.
- Workshop, Using Learning Theory to Inform Teaching Practice, Marilla Svinicki, Sponsored by Office of the Provost, Lilly Faculty Seminar Programs, Michigan State University, November 6, 1998.
- Workshop, Writing Faculty Performance Review: What We Have Learned in One Year, Terry Curry, Sponsored by Office of the Provost, Michigan State University, February 9, 1999.
- Workshop, The Chairs Plague: Dealing with Difficult People, George A. Lopez, Sponsored by Office of the Provost, Michigan State University, March 3, 1999.
- Workshop, Survival Skills for Administrators, Kristina Gunsalus, Sponsored by Office of the Provost, Michigan State University, April 28, 1999.
- Audiology Curriculum Conference, Wendell Johnson Speech and Hearing Center, University of Iowa, July 9-11, 1999.
- Participant, Parent Panel for Parent Orientation Program (POP), Michigan State University, June 29, 1999.
- Educational Seminar, Directional Microphone Usage in Hearing Aids, Unitron Industries, Inc., Grand Rapids, MI, July 8, 1999.
- Academic Leaders Program, Presented by Faculty of the Wharton School of Business and Institute for Research on Higher Education, University of Pennsylvania, Grand Rapids, MI, August 19-21, 1999.
- Leadership Workshop for Chairs and Deans, Lou Anna K. Simon, The Continuing Dialogue on Motivating Change, Sponsored by Office of the Provost, Michigan State University, September 28, 1999.
- Sexual Harassment Workshop, Sponsored by Office of the Provost, Michigan State University, October 8, 1999.
- Dreamweaver2, Levels 1 and 2 (Web Publishing Software), Seminars for Faculty on Instructional Technology, Libraries, Computing and Technology, Michigan State University, January 6, 2000.

- Virtual Universities: Online and On Target?, Video Teleconference, Sponsored by Dallas County Community College District, February 3, 2000.
- Fulbright Scholar Program, Sponsored by Michigan State University Office of International Studies and Programs, May 9, 2000.
- Blackboard II (Advanced Features), Mary Longcore, Sponsored by Office of Libraries, Computing and Technology, Michigan State University, July 2000.
- Creating a High Impact Classroom Climate, James Eison, Lilly Faculty Seminar Programs, Michigan State University, September 15, 2000.
- Copyrights and Wrongs for the Web and the Classroom, Michael Seadle, Explorations in Instructional Technology Series, Michigan State University, September 22, 2000.
- Blackboard I (October 26, 2000) & Blackboard II (November 15, 2000), Ben Goodsell, Sponsored by Office of Libraries, Computing and Technology, Michigan State University
- Cerumen-Related Hearing Aid Repairs, Offered by Michael Phillips, Phonak, Inc., East Lansing Marriott, November 10, 2000.
- Teaching Online, One-week seminar offered by William A. Draves, LERN organization (http://www.lern.org), February 5-9, 2001.
- Using Video to Enhance Lectures and Courses, WKAR Staff, Michigan State University, March 23, 2001.
- Visited Singapore to attend meeting of *Hearing International*, March 2001
- Unison Digital Systems Training Seminar, Unitron Hearing, August 19, 2002
- Angel A and B, Anne Hunt, Sponsored by Office of Libraries, Computing and Technology, Michigan State University, May 6, 2003.
- Web Page Design, Sponsored by Office of Libraries, Computing and Technology, Michigan State University, June 3 & 5, 2003.
- Web Accessibility, Sponsored by Office of Libraries, Computing and Technology, Michigan State University, June 6, 2003.
- Fireworks MX, Level 1, Sponsored by Office of Libraries, Computing and Technology, Michigan State University, June 16, 2003.
- Dreamweaver MX, Level 1, Sponsored by Office of Libraries, Computing and Technology, Michigan State University, June 17 & 19, 2003.
- Dreamweaver MX, Level 2, Sponsored by Office of Libraries, Computing and Technology, Michigan State University, July 24, 2003.
- Socrates in Cyberspace, Cecil Mackey, Explorations in Instructional Technology Series, Michigan State University, October 3, 2003.
- Grant-Writing Strategies in the Social Sciences and Education, Sponsored by The University Research Council and The Office of Faculty and Organizational Development, Kellogg Center, Michigan State University, March 30, 2004.
- Three Proven Approaches to Web-Supported Teaching, MSU Virtual University Design and Technology (vuDAT) Breakfast Series, February 28, 2005.
- Maintaining, Storing and Using Sensitive Data, Sponsored by MSU Libraries, Computing & Technology, October 25, 2005.
- Human Participant Protections Education for Research Teams, Sponsored by the National Cancer Institute, NIH, Certification awarded December 19, 2005.

- Output Levels of Personal Stereo Systems, and What Audiologists Need to Know, Brian Fligor, Live Online Videoconference Sponsored by Audiology Online eLearning, February 22, 2006.
- Constructing Knowledge through Inquiry: Teaching Students the Art of Asking Questions in the Disciplines, Laura Greene, Sponsored by Office of the Provost, Michigan State University, May 16, 2006.
- Grants.gov Workshop, Sponsored by Office of Contracts and Grants Administration, Michigan State University, August 16, 2006.
- LSE Workshop, Sponsored by Department of Epidemiology, Michigan State University, July 10, 2007.
- Developing and Operating an Online Course for Over 1000 Students per Year, Sponsored by Explorations in Instructional Technology Series, Michigan State University, November 9, 2007.
- LSE Workshop, Sponsored by Department of Epidemiology, Michigan State University, November 29, 2007.
- Hear the Difference: What Audiologists Need to Know about the Baha Implantable Hearing Solution. Workshop sponsored by Cochlear Americas, Lansing, Michigan, May 7, 2008.
- Visited University of Dakar (UCAD), Senegal, Africa, to assist in establishing a special-education program at the graduate level, March 23-June 2, 2008 (with Ida Stockman, Ph.D.).
- Completed continuing-education unit (CEU) requirements for continued certification by ASHA and licensing by state of Michigan as an audiologist (completed 3.5 CEUs; 3.0 CEUs required for certification and licensing), December 2008.
- CITI Collaborative Institutional Training Initiative (most recent update), April 1, 2009
- Data Analysis Using SPSS, Sandra Herman, Sponsored by Center for Statistical Training & Consulting, Michigan State University, October 9, 2009.
- Funding and Proposal Writing Resources, Jon Harrison, MSU Libraries, Michigan State University, September 18, 2009.
- Workshop: The Grant Process, Maria Lapinski, College of Communication Arts and Sciences, Michigan State University, October 23, 2009.
- Completed continuing-education unit (CEU) requirements for continued certification by ASHA as an audiologist, December 2011.
- IRB Retreat, Michigan State University, June 8, 2013.
- IRB Administrative Workshops, Kuali Coeus IRB Blueprint Sessions 1 and 2, Michigan State University, October 31 and November 4, 2013.
- Audiology Online, Continuing-education credits completed toward renewal of ASHA Certificate of Clinical Competence through 2017, October 2014.
- Hearing Technology: Stream On, Conference sponsored by Department of Otolaryngology, University of Michigan, East Lansing Marriott, East Lansing, Michigan, October 14, 2015.
- Audiology Online, Continuing-education credits completed toward renewal of ASHA Certificate of Clinical Competence through 2020, August 2017.

STATE OF SOUTH DAKOTA) : SS	IN CIRCUIT COURT
COUNTY OF BON HOMME)	FIRST JUDICIAL CIRCUIT

GREGG AND MARSHA HUBNER, Appellants, vs. SOUTH DAKOTA PUBLIC UTILITIES COMMISSION; PREVAILING WIND PARK, LLC; SOUTH DAKOTA PUBLIC UTILITIES COMMISSION STAFF; PAUL AND LISA SCHOENFELDER; SHERMAN FUERNISS; KELLI PAZOUR; KAREN JENKINS; AND CHARLES MIX COUNTY, SOUTH DAKOTA; Appellees.	04CIV18-000084 **APPENDIX TO APPELLANTS' OPENING BRIEF**

1. Final Decision and Order Granting Permit to Construct Facilities and Notice of Entry dated November 28, 2018.

2. Notice of Application; Order for and Notice of Public Input Hearing; Notice of Opportunity to Apply for Party Status. (AR 001212-13.)

3. Order Granting Party Status and Establishing Procedural Schedule. (AR 001928-32.)

4. Relevant Portions of Transcript of October 9-12, 2018 Evidentiary Hearing:
   October 9 (Day One)[1] Evid. HT 226-227;
   October 10 (Day Two)[2] Evid. HT 614-625;
   October 11 (Day Three)[3] Evid. HT 669-689; 792-921; 954; 959;
   October 12 (Day Four)[4] Evid. HT 1045-1084.

[1] The entire transcript of October 9 (Day One) is found at AR 011148-011528.
[2] The entire transcript of October 10 (Day Two) is found at AR 011640-012002.
[3] The entire transcript of October 11 (Day Three) is found at AR 012013-012413.
[4] The entire transcript of October 12 (Day Four) is found at AR 012448-012678.

5. Transcript of November 20, 2018 Ad Hoc Commission Meeting (Commission Deliberations). (AR 018447-018546.)

6. Intervenors' Post-Hearing Brief. (AR 018266-018286.)

7. Evidentiary Hearing Exhibit I-1, Pre-filed Testimony of Richard James; highlighted portions were stricken by Hearing Examiner. (AR 018018-018030.)

8. Evidentiary Hearing Exhibit I-1(a), Bio Materials for Richard James. (AR 017220-017225.)

9. Evidentiary Hearing Exhibit I-2, Pre-filed Testimony of Jerry Punch; highlighted portions were stricken by Hearing Examiner. (AR 018031-018045.)

10. Evidentiary Hearing Exhibit I-2(a), Curriculum Vitae for Jerry Punch, Ph.D. (AR 017284-017313.)

11. Evidentiary Hearing Exhibit I-2(b), Wind Turbine Noise and Human Health: A Four-Decade History of Evidence that Wind Turbines Pose Risks. (AR 017314-017385.)

12. Live testimony of Richard James and Jerry Punch; highlighted portions were stricken by Hearing Examiner. (AR 018078-018110.)

13. Transcript from December 5, 2013 Daubert Hearing before the Honorable William Fagerman, State of Michigan, Circuit Court for the County of Missaukee.

14. Evidentiary Hearing Exhibit I-24 (refused), Email sent by Roland Jurgens. (AR 010038.)

15. "New Wind Farm Ready for Next Step in Three Area Counties," Yankton Daily Newspaper Article dated January 16, 2019, available at https://www.yankton.net/community/article de578c94-1a0d-11e9-8e6e-ef7719e7a046.html.

16. Research Article – Analysis of throw distances of detached objects from horizontal-axis wind turbines. (AR 015944-015959.)

17. Email from South Dakota Public Utilities Commission Executive Director dated April 26, 2018.

18. Evidentiary Hearing Exhibit I-23, Draft Model Ordinance for Siting of Wind Energy Systems. (AR 017497-017505.)

19. Transcript of Commissioner Hanson's January 15, 2019 testimony to the South Dakota Legislature.

ATTACHMENT 11

Wind Turbine Noise and Human Health: A Four-Decade History of Evidence that Wind Turbines Pose Risks*

Jerry L. Punch,[i] Richard R. James[ii]

Abstract

Many expert-review panels and some individual authors, in the U.S. and internationally, have taken the position that there is little literature to support concerns about adverse health effects (AHEs) from noise emitted by industrial wind turbines (IWTs). In this review, we systematically examine the literature that bears on some of the particular claims that are commonly made in support of the view that a causal link is non-existent. Investigation of the veracity of those claims requires that multiple topics be addressed, and the following specific topics were targeted for this review: (1) emissions of infrasound and low-frequency noise (ILFN) by IWTs, (2) the perception of ILFN by humans, (3) the evidentiary bases for establishing a causative link between IWTs and AHEs, as well as the physiological bases for such a link, (4) recommended setback distances and permissible noise levels, (5) the relationship between annoyance and health, (6) alternative causes of the reported health problems, (7) recommended methods for measuring infrasound, (8) foundations for establishing a medical diagnosis of AHEs due to IWTs, (9) research designs useful in establishing causation, (10) the role of psychological expectations as an explanation for the reported adverse effects, (11) the prevalence of AHEs in individuals exposed to IWTs, and (12) the scope and quality of literature addressing the link between IWT noise and AHEs. The reviewed evidence overwhelmingly supports the notion that acoustic emissions from IWTs is a leading cause of AHEs in a substantial segment of the population.

*Revised October 21, 2016

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Key Words: Adverse health effects, human health, industrial wind turbines, infrasound, inner ear, low-frequency noise, wind turbine noise

Introduction

Whether infrasound and low-frequency noise (ILFN) from industrial wind turbines (IWTs) is detrimental to human health is currently a highly controversial topic. Advocates of industrial-

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scale wind energy assert that there is no credible scientific evidence of a causal relationship, while many reputable professionals believe that there is sufficient scientific evidence to establish a causal link between IWTs and detrimental health effects *for a non-trivial percentage of individuals who reside in communities hosting IWTs.* The veracity of claims regarding the effects on human health is being debated on a global scale by the wind industry; individuals living near IWTs; attorneys and expert witnesses in courts of law; print and web-based media; documentary films (which currently include *Windfall*, *Wind Rush*, and *Down Wind*); and scientists and other professionals in government reports, on the Internet, and in scientific and professional papers presented at society meetings and published in peer-reviewed journals.

The debate surrounding IWTs extends to many controversial issues, including physical safety, visibility, shadow flicker, and threats to property values and wildlife. Many problems involving wind turbines, including mechanical failures, accidents, and other mishaps, have been discussed on the Internet. At least one website has extensively catalogued these incidents,[1] and the large number of incidents reported by that site is described by its webmaster as grossly underestimating the actual number of documented incidents. The most vigorous debate, however, centers on ILFN and its effects on human health.

The overall purpose of this article is to provide a systematic review of legitimate sources that bear directly and indirectly on the question of the extent to which IWT noise leads to the many health complaints that are being attributed to it. The authors accessed most articles and reports referenced in this review by employing Google, Google Scholar, and PubMed as the primary search engines. Our basic aim was to provide a comprehensive and representative—though not exhaustive—review of the literature that is relevant to many of the claims made by wind industry advocates. An exhaustive review is an elusive and impractical goal, given the large volume of directly and indirectly related work done in this area over the past several decades and the current pace of such work.

The role of evidentiary facts

Adverse impacts on people and property are among the most contentious issues that are typically the focus of legal proceedings involving IWT noise. Based on the forensic and research experiences of the authors, we believe that a resolution of the controversial aspects of this debate will require not just relevant scientific research, but rather a series of legal judgments based on the effective evaluation and interpretation of the existing research. In fact, much research and some already-rendered legal decisions show convincingly that some segments of the population suffer damaging effects from exposure to wind turbine noise (WTN). What is needed among the scientific community, local and national governmental agencies, and political leaders, is honest

discourse about methods for reducing carbon emissions in ways that do not turn some rural communities into *sacrifice zones*.[2, 3]

Many symptoms and complaints of adverse health effects (AHEs) related to IWTs have been self-reported by individuals living near wind turbines and described in published case reports. There is a group of core symptoms and complaints, however—including sleep disturbance, headache, dizziness, vertigo, and ear pressure or pain—that are remarkably common worldwide. Dr. Nina Pierpont was the first to report these core symptoms in a case series,[4] and she termed these core symptoms *Wind Turbine Syndrome*. For the sake of brevity, we will on occasion refer to Wind Turbine Syndrome as a substitute for this group of common symptoms and complaints, even though the phrase itself is currently not utilized as a medical diagnostic entity.

Numerous reviews of the literature have already been published that allege that there is no credible link between WTN emissions and AHEs. Those reviews have typically been sanctioned by state or provincial government agencies that have missions to support the development of wind energy, and which in turn appoint *expert panels* whose members hold views that regularly favor the wind industry and, therefore, may have conflicting interests. Too often, in the opinion of the authors, such reviews are biased in support of political policy decisions that promote the financial interests of wind developers, and perceived financial benefits to local communities, over the common good. None of those reviews has been specifically targeted toward describing or explaining the relationship between exposure to complex, dynamically modulated infra- and low-frequency sound from wind turbines or other industrial sources (e.g., noise-induced Sick Building Syndrome) and AHEs. Our primary objective in this article is to review the existing scientific and professional literature that is frequently overlooked in such reviews conducted by wind energy proponents. Such literature can be useful in legal proceedings in questioning and articulating the available evidence of risks to people who live in the footprint of utility-scale wind energy projects.

Some of the published reviews have been criticized for their failure to meet the standards noted by Horner,[5] who reminds us that readers should regard literature reviews with caution, and employ an audit strategy in evaluating their completeness, accuracy, and objectivity. Authors, including ourselves, have an inherent obligation to ensure that such reviews cite all known legitimate sources that serve as the basis for their views of the issues and reflect accurately the contents of all references cited.

Some courts of law in the U.S. and other countries now tend to rely heavily on testimony that adheres to the principle that proof of evidence of causation of AHEs from IWTs be based on the

peer-reviewed literature. Presumably, that practice in the U.S. stems at least partially from advocacy by the Office of Management and Budget[6] that internal and external government science documents be peer-reviewed government-wide for the purpose of increasing the quality and credibility of scientific information generated by the federal government. Peer-review standards are considered paramount in that effort.

While the peer-review process has many virtues, it also has its shortcomings, which are well known. For example, not all journals or individual reviews of submitted manuscripts are of equal quality, as specific journals and specific reviewers may have ideological or philosophical biases, which may or may not be surmised from the journals' mission statements. Nonetheless, the peer-review process is one of the most widely acknowledged ways to control the quality of published works. We contend, however, that there are other credible sources of information, even though those sources may not have been subjected to as rigorous a peer-review process as that employed by many scientific journals. Such sources include papers presented at meetings of scientific and professional societies; reports and other documents commissioned by state and local governmental agencies, especially if such documents are authored by independent researchers; legal testimony given under oath by qualified scientists and professionals; and some information available on the Internet, especially if written by professionals who have reputable track records in their disciplines. Although we will emphasize the peer-reviewed literature in this article, we will also cite some of these additional sources as authoritative. Our citing of selected non-peer-reviewed reports, with a few exceptions, is based on our familiarity with the professional reputations of the authors of those reports, normally earned through publication of a solid body of work in the peer-reviewed literature and by acceptance of their work by other professionals and peers. Typically, individuals so referenced enjoy positive national or international recognition in their respective fields of expertise.

We begin this review by calling attention to a quote from geophysicist Marcia McNutt, who once headed the U.S. Geological Survey and is now editor of the prestigious journal *Science*. McNutt has been quoted as stating: "Science is not a body of facts. Science is a method for deciding whether what we choose to believe has a basis in the laws of nature or not."[7] In fact, science consists of a variety of overlapping methodological approaches, which must be interwoven to discover answers to complex problems. That conviction has guided our attempt to re-examine the controversial topic at hand.

Review of wind industry claims and positions

Our review is organized by summarizing the past and present literature that addresses each of 12 selected statements, listed below, that encapsulate specific claims, or positions, commonly taken by advocates for the wind industry:

1. Infrasound is not an issue, as infrasound generated by wind turbines is not perceptible to humans.
2. There is nothing unique about wind turbine noise, as infrasound and low-frequency noise are commonly produced by the body and by many environmental sources.
3. There is no evidence that wind turbine noise, audible or inaudible, is the cause of adverse health effects in people, and there are no physiological mechanisms to explain how inaudible acoustic energy can be harmful.
4. Setback distances of 1,000-1,500 ft. (approximately 0.3-0.5 km) are sufficiently safe to protect humans from harm, regardless of height or other physical characteristics of the IWTs.
5. Annoyance is a nuisance, but it is not a health issue.
6. Noise cannot account for all of the complaints of people living in the vicinity of wind turbines; there must be another, unknown reason for the complaints.
7. Infrasound from wind turbines is sufficiently correlated to the A-weighted sound emissions to allow an A-weighted model to be used to predict how much infrasound is present in homes.
8. Wind Turbine Syndrome has not been accepted as a diagnostic entity by the medical profession, so medical professionals cannot diagnose or treat it.
9. Peer-reviewed epidemiological literature is the only acceptable basis for proving a causative relationship between wind turbine noise and adverse health effects.
10. The nocebo effect, a manifestation of psychological expectations, explains why people complain of adverse health effects when living near wind turbines.
11. Only relatively few people, if any, are adversely impacted by wind turbine noise, and the majority have no complaints.
12. There is no evidence in the literature to support a causative link between wind turbine noise and adverse effects.

Statement 1: Infrasound is not an issue, as infrasound generated by wind turbines is not perceptible to humans.

The argument that infrasound as a cause of AHEs is not an issue has been advanced in the published literature primarily by Dr. Geoff Leventhall,[8, 9] with support from several other researchers. Those researchers have dismissed the influence of infrasound on human health by describing it as not exceeding the thresholds of audibility, and therefore ineffectual, without noting that those thresholds were established using steady pure tones instead of the complex, dynamically modulated tones emitted by wind turbines. Leventhall claims that infrasound from wind turbines is not a problem and that it is misunderstood largely because of mischaracterization by the media and by "those with limited knowledge" (p. 29). He states that there may be noise problems associated with wind turbines, but that such problems are due to *audible* swishing sounds due to interactions of the blades with the tower. Supporters of wind energy have generally followed Leventhall's lead, although his own research has shown conclusively that exposure to modulated ILFN produced by large industrial equipment, including heating, ventilating and air-conditioning (HVAC) systems, leads to mental fatigue, lack of concentration, headaches, reduced performance, and work dissatisfaction. Indeed, there is a long history of noise-induced *Sick Building Syndrome*, stemming from investigations in the 1970s-1990s of the effects of low-frequency noise on knowledge workers (see James[10] and Schwartz[11] for reviews of that research). Leventhall[12] stated:

> "Low frequency noise causes extreme distress to a number of people who are sensitive to its effects. Such sensitivity may be a result of heightened sensory response within the whole or part of the auditory range or may be acquired. The noise levels are often low, occurring in the region of the hearing threshold, where there are considerable individual differences" (p. 4).

Later in the same document, he states:

> "There is no doubt that some humans exposed to infrasound experience abnormal ear, CNS (central nervous system), and resonance induced symptoms that are real and stressful. If this is not recognised by investigators or their treating physicians, and properly addressed with understanding and sympathy, a psychological reaction will follow and the patient's problems will be compounded. Most subjects may be reassured that there will be no serious consequences to their health from infrasound exposure and *if further exposure is avoided* (emphasis added) they may expect to become symptom free" (p. 60).

Leventhall has also stated that the ear is designed to protect us from infrasound and that, in essence, *If you can't hear it, you can't feel it.*[13, 14] The idea that ILFN from wind turbines does

not affect health was further reinforced in a 2009 white paper co-authored by Leventhall and sanctioned by the wind industry,[15] to be reviewed later.

The position that infrasound from wind turbines is not harmful to humans because it is not perceptible to the human ear also has support from Møller & Pedersen,[16] who investigated noise emissions from 48 wind turbines with electrical output capacities of between 2.3 and 3.6 MW. They stated:

> "The turbines do emit infrasound (sound below 20 Hz), but levels are low when human sensitivity to these frequencies is accounted for. Even close to the turbines, the infrasonic sound pressure level is much below the normal hearing threshold, and infrasound is thus not considered as a problem with turbines of the investigated size and construction" (pp. 3742-3743).

Evans et al[17] found that levels of infrasound measured at two residential locations near wind projects in South Australia were within the range of infrasound levels experienced in other urban and rural environments. Although Colby et al[15] and Bolin et al[18] dismiss wind turbines as a cause of AHEs, they acknowledge that turbines emit ILFN. A number of authors indicate that large turbines emit more such noise than smaller turbines (see, for example, Bolin et al[18] and Møller & Pedersen.[16]) George Kamperman (personal communication, 2009) has concluded that the amount of low-frequency noise generated by IWTs increases by 3–5 dB for every megawatt of electrical power generated.

Evidence that IWTs produce perceptible levels of infrasound, in addition to audible low-frequency noise above 20 Hz, has been available since the 1980s. In their seminal research on large-scale wind turbines, which was funded by the U.S. Department of Energy, Kelley et al[19] measured noise levels emitted by a DOE/NASA MOD-1 wind turbine operating near Boone, North Carolina, in response to noise complaints. They concluded that:

> "…one of the major causal agents responsible for the annoyance of nearby residents by wind turbine noise is the excitation of highly resonant structural and air volume modes by the coherent, low frequency sound radiated by large wind turbines. Further, there is evidence that the strong resonances found in the acoustic pressure field within rooms actually measured indicates a coupling of subaudible energy to human body resonances at 5, 12, and 17-25 Hz, resulting in a sensation of whole-body vibration" (p. 120).

Those conclusions were further strengthened in a subsequent report.[20] In a second follow-up report, also funded by the Department of Energy, Kelley[21] electronically simulated three interior environments resulting from low-frequency acoustical loads radiated from both single and grouped upwind and downwind turbines. (These terms refer to the placement of the rotor and

blades with respect to the tower. With upwind designs, the more contemporary design, the airflow strikes the blades before striking the tower, and with downwind designs, the airflow strikes the tower before striking the blades.) Relatively low levels of low-frequency acoustic noise from a single, 2-MW MOD-1 wind turbine led to annoyance of residents of the surrounding community, largely through interaction with residential structures. Most importantly, Kelley found that the turbines radiated their peak sound power in the infrasonic range, typically between 1 and 10 Hz. An extensive investigation revealed that the reported annoyance was the result of a coupling of the turbine's impulsive low-frequency acoustic energy into the structures of some of the surrounding homes, and that annoyance was "frequently confined to *within the home itself*" (p. 1). Despite these early findings that IWTs generate infrasonic levels that produce acoustic energy, vibrations, and resonances that affect people in their homes, the wind industry has chosen to regard them as insignificant or only applicable to obsolete, downwind wind turbine designs.

The basis for discounting the research by Kelley and associates is predicated on the assumption that pressure changes of equal levels to wind turbines occur in natural environments and do not cause any similar complaints. The authors find that their own experiences with rapidly changing pressures have caused similar experiences. If these rather short-duration sensations were to continue over days, weeks, and months, as they do for people living near wind projects, they would likely find them to be unacceptable.

The primary argument of people who deny any effects is encapsulated by Leventhall[9] in his *Child on a Swing* example:

> "A child on a swing experiences infrasound at a level of around 110dB and frequency 0.5Hz, depending on the suspended length and the change in height during the swing" (p. 30).

The inference is that because children often swing on swings, there are no adverse sensations. That fails to acknowledge that the experience of swinging is one that elicits many visceral sensations that are pleasant to the child as long as the sensations stop when the swing stops. The example, however, misses one major point. The duration and motion of the swing provide a smooth, sinusoidal pressure change that has two high pressure points (at the top of each swing) that occur over a period of several seconds or so. This is a completely different experience to that of pressure pulses lasting 100 msec or less. If one considers a swing with a period of 3.5 sec, there is a pressure change at 1.75 sec, resulting in a frequency of 0.57 Hz. The pressure changes are approximately 120 dB peak-to-peak, or 110 dB rms. The overall G-weighted value in this example is -60 dB, with a smooth pressure change, resulting in a net 50 dBG for the child, versus

the 75 dBG experienced as a pulse for a person living near a wind turbine (calculations provided by Malcolm Swinbanks, personal communication, 2010).

The assertion that wind turbine infrasound immissions, especially when received in the bedroom of a quiet home, must be at or above the threshold of hearing to cause adverse effects has been disproved, as noted above in the works of Kelley and colleagues in the 1980s.[19, 20, 21] The significant finding of the Kelley studies is that when the intruding infrasound is dynamically modulated short-duration pulses (generally under 100 msec and as short as 4 msec), the thresholds of sound pressure levels (SPLs) for non-auditory perception are in the range of 60 to 70 dB. In the work by one of the authors of this paper (James, with Mr. Wade Bray, INCE, of Head Acoustics, GMBH), infrasound pulsations were measured from a GE 1.5-MW wind turbine with a blade-pass frequency of 1 Hz that reached a level as high as 100 dB.[22] The people living in the home 'felt' the pulsations when the crests of the pressure waves were as low as 60 dB at 1 Hz. During similar measurements, Swinbanks, who has reported that he is sensitive to infrasound pulsations, was present at the test site. His experience was that he could feel the pulsations outside the home at similar SPLs.

Subsequent to the papers by Kelley and colleagues, several other studies have also reported the thresholds for significant experiences at similar thresholds, all substantially below the threshold for audibility of steady pure tones. In many of those tests, the rms SPL of the dynamically modulated blade-pass tone and its harmonics has been as low as 40 dB when using narrow-band analysis with windows of 40 to 80 sec, providing the crest of the pressure waves are 10 to 15 dB higher than the rms levels. These studies include the works of Robert Rand, INCE, and Stephen Ambrose, Bd. Cert., INCE, in their study of homes of complainants in Falmouth, Massachusetts;[23] Walker, Hessler, Hessler, and Schomer, in their work at the Shirley Wind project in Brown County, Wisconsin, for the Wisconsin Public Health Service;[24] and most recently, Steven Cooper's study of the Cape Bridgewater project in Victoria, Australia.[25] All of these studies report similar findings, namely that perception, generally non-auditory in character, begins when the rms SPLs of the modulating tones are as low as 40 dB rms, with increasing impacts as the rms levels rise to 50, 60, and to 70 dB and higher levels. In all these studies, the dynamic modulation of the blade-pass tones produce pressure peaks that are often 10 dB or more, sometimes much more, than the rms values.

In the opinion of the authors, a paper prepared by Swinbanks for the 2015 conference on wind energy in Glasgow, Scotland, shows the impact of dynamically modulated infrasound on a sensitive individual—himself—along with high-quality measurements of the environments in which he experienced the sensations.[26] That paper shows that a highly respected acoustician and

scientist with expertise in infra- and low-frequency sound also responds to this acoustic energy in a way that is similar to the many complaints from others, both in the location of his tests and at other wind energy projects around the world. In the paper, Swinbanks reports that he was able to differentiate the pulsations in the test data from at least six separate wind turbines in a project consisting of 46 1.5-MW GE models. He also reports that he was able to perceive the effects of the pulsations in his home's basement, approximately 3 km from the nearest operating wind turbine, with the SPLs of the blade-pass frequency and harmonics summing to about 55 dB rms. At closer locations, he measured positive-going pressure peaks of 87 dB with corresponding negative-going peaks of equal level. It is worth noting that at the Glasgow conference, Swinbanks presented the paper as a poster session,[27] as he was informed by the conference moderator that time restraints prevented him from presenting his paper to conference attendees.

In the 2012 investigation of infrasound at the Shirley Wind project, where local regulations require that the Nordex 2.5-MW turbines be sited at least 1,250 ft., or 381 m, from residences, Walker et al reported infrasound levels at one of the three test homes.[24] WTN was not audible outside the residence where infrasound was greatest, supporting the position that infrasound is at the root of at least some of the complaints. The blade-pass frequency and harmonics were clearly evident from the measurements inside that one home, and the family had moved far away for a solution.

Following the Shirley Wind team study, several members of the community conducted a series of micro barometer measurements inside homes ranging from 1,280 ft. to approximately 6 mi. from the wind turbine towers. Infrasonic tones at blade-pass frequencies and harmonics were found at all test sites, including test sites at distances of several miles or more from towers under downwind conditions. Testimony to Wisconsin's Brown County Board of Health by people with homes more than 4 mi. from the nearest wind turbines reported AHEs during the times the turbines operated. In mid-October 2014, the Brown County Board of Health went on record declaring that wind turbines at the Shirley Wind site "…are a human health hazard."[28] That action, which appears to be a precedent in the U.S., meant that Duke Energy's Shirley Wind utility were forced to prove to the Board that the utility was not the cause of the health complaints documented in the study and voiced by community residents. The outcome could result in a shut-down order, but no final decision had been made in that case at the time of this writing. Other examples of legally ordered turbine shutdowns include those in Massachusetts[29, 30] and Portugal.[31]

We will return to the issue of perceptibility of infrasound later in this paper, as we describe the physiological bases for perceptibility.

Statement 2: There is nothing unique about wind turbine noise, as infrasound and low-frequency noise are commonly produced by the body and by many environmental sources.

To begin, when the spectral characteristics of IWT noise, as depicted in several papers,[24, 32, 33] are compared to the spectra of subsonic jet transport planes,[34] five different types of aircraft,[35] and road traffic noise,[36] it is clear that noise generated by wind turbines has a number of unique acoustical characteristics. These comparisons reveal dissimilarities in spectral and peak levels in both the higher and lower frequency regions, including the low-frequency and infrasonic range.

Leventhall[37] was one of the first to describe how low-frequency noise is a special noise problem, particularly to sensitive people in their homes. He indicated that annoyance to low-frequency noise increases rapidly with level, often starting just above the threshold of audibility, and that about 2.5% of the population may be 12 dB more sensitive than the average person to low-frequency noise. He also noted that the World Health Organization (WHO) places a special emphasis on low-frequency noise as an environmental problem and source of sleep disturbance, even at low levels. The WHO[38] acknowledges that a noise consisting of a large proportion of low-frequency components may considerably increase AHEs and should be limited to below 40 dBA. Cummings[39] notes that sound levels of 40 dBA trigger high levels of community pushback.

Jung et al[40] experimentally identified the characteristics of acoustic emissions from large upwind wind turbines, with emphasis on ILFN. The sound spectral density showed that the blade-passage frequency component is clearly dominant, revealing up to 6-7 harmonics that generally occupy the infrasonic frequency region of 1 to 10 Hz. They voiced a concern that the low-frequency noise of the 1.5-MW and 600-kW wind turbines in the frequency range over 30 Hz would very likely lead to psychological complaints from ordinary adults.

In responding to a bylaw to restrict wind turbine infrasound in the town of Plympton-Wyoming, Ontario, Leventhall[41] declared that "Infrasound has become the Godzilla of acoustics" (p. 2). He concluded that science does not support the conditions in the bylaw, which was largely aimed at restricting blade-passing tones, because "There is no evidence that the very low level of blade passing tones affects humans, whilst there is evidence that it does not" (p. 7). Based on the kinds of evidence just discussed, we strongly disagree.

WTN has been described as having a character that makes it far more annoying and stressful than other sources of noise at the same A-weighted level, including traffic and industrial noise.[42, 43, 44, 45] Harrison[42] concluded that IWTs cause annoyance in about 20% of residents living within a distance considered acceptable by most regulatory authorities, and that for many of the 20%, the

annoyance and sleep disturbance lead to AHEs. Thorne[46] has pointed out that human perception of noise is based primarily on sound character rather than sound level, and that wind turbines are unique sound sources that exhibit special audible and inaudible modulated and tonal characteristics. He states that sound levels of 32 dBA Leq outside a residence and/or above an individual's threshold of hearing inside the home are markers for serious AHEs, especially among susceptible individuals.

Structural and human responses to low-frequency noise, including noise from wind turbines, have been described by Hubbard.[47] Hubbard and Shephard[48] illustrated the special characteristics of WTN by explaining its sources, pathways, and receptors. Thorne[46, 49] described wind turbines and *wind farms* as a unique source of sound and noise, like no other noise source or set of noise sources. The sounds are often of low amplitude and shifting in character, making it difficult for people who have never been exposed to such sounds to understand the problems of those who complain about the sounds. Shepherd et al[50] have described WTN as having characteristics sufficiently different from other, more extensively studied, noise sources to justify the application of standards different from pre-existing noise standards.

The preponderance of evidence on this point leads to the conclusion that WTN has special acoustic characteristics that distinguish it from other industrial sounds. A primary feature is that it consists of measureable energy down to below 1 Hz.[24, 51, 52] Its sound pressure level decreases rapidly with increasing frequency from about 0.5-5 Hz. It varies in amplitude over time,[9, 49, 51, 53, 54, 55, 56, 57, 58] it tends to have an intermittent tonal quality,[49, 52, 59] and its characteristics vary with distance and direction.[52, 53] It can result in an impulsive sound,[21, 40, 49, 60] even at long distances.[52] According to Lee et al,[53] the swishing sounds of turbines can be perceived from all directions, but at long distances from a turbine, low-frequency amplitude-modulated sounds can be heard only in particular directions and when the SPL is sufficiently high. This effect may make the WTN seem more impulsive at long distances despite an overall SPL that is relatively low.

Furthermore, ILFN from any source, including IWTs, is well known to penetrate walls and other barriers (e.g., Minnesota Department of Health[55]); is typically more disruptive indoors than outdoors;[46, 47, 61, 62, 63] and is not easily masked by atmospheric sounds, including road traffic and other sources of infrasound.[63, 64, 65, 66] The perception of low-frequency noise depends on density level, modulations, bandwidth, purity of blade-pass tones and harmonics, discrete beating tones, or other time-varying properties, and can occur even at near-infrasonic frequencies if any of these factors is present; otherwise, it might pass unnoticed.[57, 67, 68] James[69] describes the

infrasound occurring when wind turbine blades rotate past the tower as a short pressure pulse that consists of a well-defined array of tonal harmonics below 10 Hz. If the pressure peaks are received at the same time, they sum in a linear manner that significantly raises the overall SPL. Often, however, there are many wind turbines rotating at similar speeds, but not synchronized in time. This can lead to another form of modulation as the wind turbine infrasound is perceived as rising and falling, intermittent, or pulsating with variable intensity.

A common argument of wind industry proponents—one that is sometimes raised in legal proceedings—is that humans themselves generate infrasound by virtue of their own heartbeat and breathing, at levels that can be substantially higher than an external noise source such as wind turbines. In a rebuttal to a formal statement to this effect by the Association of Australian Acoustical Consultants (AAAC), Salt has provided a definitive explanation of why the two sources of infrasound (internal vs. external) cannot be equated. In a letter addressed to the AAAC,[70] Salt stated:

> "Stimulation of the ear occurs not directly by pressure (which is why deep sea divers can still hear) but by induced motions of the inner ear fluids, which in turn move sensory tissues and motion-sensitive cells….when low frequency and infrasound enters the ear via the stapes, it causes fluid movements throughout the entire ear between the stapes in the vestibule, through scala vestibuli and scala tympani to the compliant round window membrane at the base of scala tympani. It is these fluid movements that drive sensory tissue movements and cause stimulation. In contrast, pressure fluctuations generated by the body, such as by heartbeat and respiration, enter the ear via the cochlear aqueduct, not through the stapes. The cochlear aqueduct enters the ear adjacent to the round window membrane in the very basal part of scala tympani, so the fluid flows are localized in this tiny region of the ear. As the rest of the ear is bounded by a bony shell which is not compliant, fluid flows in the rest of the ear are substantially lower so that displacements of sensory tissues are negligible. Infrasound generated by the body, because it enters through the aqueduct, therefore does not cause stimulation of the ear."

Statement 3: There is no evidence that wind turbine noise, audible or inaudible, is the cause of adverse health effects in people, and there are no physiological mechanisms to explain how inaudible acoustic energy can be harmful.

In fact, there is ample evidence that noise in general, and especially low-frequency noise, has long-term consequences for human health.[71, 72] For example, long-term exposure to ordinary traffic noise has been associated in a dose-dependent manner with higher risk of myocardial infarction.[73]

Two landmark reports embodying diametrically opposing perspectives with regard to the impact of WTN on health appeared almost concurrently in 2009. One was published as a book by Dr.

Nina Pierpont,[4] a Fellow of the American Academy of Pediatrics who holds an MD degree from Johns Hopkins University School of Medicine and a PhD degree in Population Biology from Princeton University. The other report was written by a panel of seven experts (three physicians, two acousticians, an audiologist, and an audiologist/hearing scientist) commissioned by the American Wind Energy Association and the Canadian Wind Energy Association. The latter report[15] is commonly referred to as the AWEA/CanWEA report, or white paper. These respective reports, more than any others, quickly became the rallying cry for so-called anti-wind and pro-wind advocacy groups in the media, in the public discourse, and in court proceedings.

In her book, Pierpont[4] coined the term *Wind Turbine Syndrome* to describe a range of symptoms reported for 38 family members (adults and children) of 10 families who lived near wind turbines. Based on telephone interviews, she treated her observations and analyses as a case-series research design. She described the syndrome as consisting of 10 classes of symptoms (enumerated below), many of which she attributed to overstimulation of the vestibular system of the inner ear by ILFN. The wind industry, in its AWEA/CanWEA report and elsewhere, has vigorously criticized her study for being non-scientific and non-peer-reviewed. In fact, Pierpont's book was critically reviewed by far more than the usual number of reviewers for a peer-reviewed journal article. While it is true that case series are prone to selection bias, and can at best suggest hypotheses, many discoveries of new phenomena begin with a case study or case series. Furthermore, an increasing body of scientific evidence supports Pierpont's observations of a relationship between WTN and AHEs. More recent laboratory research, described later in this review, suggests that a variety of health symptoms may be due to ILFN stimulation of both vestibular and cochlear components of the inner ear.

Prior to Pierpont's book,[4] Dr. Amanda Harry[74] and Dr. Robyn Phipps and colleagues[75, 76] had documented the occurrence of ill effects from IWTs by use of questionnaire-based surveys of the health complaints of people living near wind projects in Cornwall, England, and Palmerston North, New Zealand, respectively. These authors concluded that a substantial number of people living near wind turbines suffer from health problems and that the cause of the disturbances was the complexity of the noise and vibration. Harry[74] observed that the symptoms were evident for people living within a mile from the wind development and recommended that no wind turbine should be sited closer than 1.5 mi. from the nearest residents. She noted that the guidelines used at the time to site wind turbines were developed when the turbines were 20% the size of the current ones. She concluded that annoyance from noise adversely affects human well-being, and that developers are wrong when they state that WTN is not a problem. Phipps et al[75] noted that 45% of households living within 2 km of the wind farm and 20% of households living up to 8

km away reported hearing noise from the turbines. Phipps[76] reported on the negative consequences of noise that were evident in her own survey and in the works of others, warning that residents do not readily habituate to the presence of WTN.

The AWEA/CanWEA report[15] has been widely used by the wind industry as a basis for its denial of AHEs from IWTs. However, the report is the product of a hand-picked group of experts, at least some of whom were known to hold positions favorable to the report's sponsors, it was never peer-reviewed, and it shows signs of bias, such as conclusions not supported by the research referenced in the report. That white paper concluded that sound from wind turbines, including sub-audible low-frequency sound, does not pose a risk of hearing loss or any other AHE in humans, whether those health effects are described as Wind Turbine Syndrome or otherwise. It also concluded that some people may be annoyed at the presence of sound from wind turbines, including its fluctuating nature, but described annoyance as unrelated to health. Although there is indeed no evidence that IWTs causes hearing loss, the report's conclusion that ILFN does not cause AHEs, and its dismissal of annoyance as a serious entity, have been heavily criticized as erroneous. Horner et al[77] cite many specific examples of the AWEA/CanWEA report's failure to use proper documentation, concluding that it lacks scientific merit and that it is neither authoritative nor convincing. They criticized the report's conclusion that the issue of AHEs stemming from IWTs is settled and that no more research is required, a conclusion that is rarely voiced by scientists. Horner[78] has characterized the report as offering nothing new in its treatment of annoyance, as annoyance has long been known to result from the stress effects of exposure to noise, and he criticized the report for downplaying the relationship between annoyance and health. Phillips[79] has indicated that the report mischaracterized the research designs used by epidemiologists. Despite widespread denial by wind industry advocates of a causal relationship between IWTs and AHEs, the vast majority of peer-reviewed papers have shown that IWTs significantly disturb sleep in at least some residents at distances and noise levels that are typical where IWTs are installed. Furthermore, not a single well-designed scientific study has found WTN to be harmless.[80, 81]

A panel of seven independent experts was commissioned by the Massachusetts Departments of Environmental Protection and Public Health to identify any documented or potential health impacts of risks that may be associated with exposure to IWTs and to facilitate a discussion of IWTs and public health based on scientific findings. The panel generated a report[82] concluding that scientific evidence is lacking to show that WTN leads to AHEs and that a more comprehensive assessment of WTN in populated areas is needed for establishing and refining siting guidelines and for developing best practices. Closer investigation was recommended near

homes where outdoor A- and C-weighted levels differ by more than 15 dB, a strategy for detecting the presence of ILFN (e.g., Kamperman & James[83]). The Massachusetts report has been criticized as misrepresenting the evidence it cites, as well as underestimating evidence indicative of AHEs from IWTs.[84, 85] Schomer and Pamidighantam[86] have described the report as a critique of the literature relating to wind turbine acoustic emissions and health effects, and one with problems similar to those it criticizes.

Some laypersons have remarked disparagingly in the media on the factual evidence—including observations and scientific reports—that shows a relationship between IWTs and AHEs. Shahan,[87] for example, confidently states: "To date, there is no scientific evidence that anything such as 'Wind Turbine Syndrome' actually exists." A common argument of wind energy advocates is that studies show that wind turbines do not lead to AHEs, or that studies that draw such a conclusion are not sufficiently scientific to establish causation. Efforts to discredit those who take a skeptical view toward the wind industry commonly use terms such as *opponents*, *detractors*, *anti-wind activists*, or in the case of Shahan,[87] "paid anti-wind 'experts' who have a long history of directly testifying against wind energy in various court cases." Such critics casually ignore the fact that many of the industry experts, including consulting acousticians and physicians, routinely testify on behalf of the industry in such cases, sometimes for substantial fees, and those individuals are rarely described as paid pro-wind experts or activists.

Numerous researchers have reported the existence of a constellation of health symptoms, either directly mirroring or closely related to those described as Wind Turbine Syndrome by Pierpont,[4] in persons living near IWTs. Significantly, the WHO[38] states that there is sufficient evidence that nighttime noise, irrespective of its source, is related to self-reported sleep disturbance and other health problems, and that these effects can lead to a considerable burden of disease in the population.

Sleep disturbance has been identified as a major adverse impact of IWTs.[4, 18, 45, 47, 54, 57, 58, 72, 74, 76, 77, 79, 80, 81, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107] Nighttime exposure to 40-dBA low-frequency noise has been shown to affect cortisol levels, a physiological indicator of stress. Those levels, following awakening, have been found to be associated with subjective reports of lower sleep quality and mood changes.[108] Sleep is a biological necessity, and disturbed sleep is associated with a number of adverse health conditions. The WHO[71] has concluded that there is available, good-quality evidence supporting a causal association between noise and sleep disruption. Sleep disturbance has important implications for public health and may be a particular problem in children.[84, 94, 109]

Even if no other adverse effects were associated with WTN, sleep disturbance alone is a sufficient reason to site turbines at distances that do not disrupt sleep. Many rural communities have background, nighttime sound levels that do not exceed 25 dBA, and observable effects of nighttime, outdoor noise do not occur at levels of 30 dBA or lower.[71] As outdoor sound levels increase, the risk of AHlEs increases, the most vulnerable populations being the first to show their effects. Vulnerable populations include elderly persons; children, especially those younger than age six; and people with pre-existing medical conditions, especially if sleep is affected.[38, 71] According to the WHO, there is ample evidence to link AHEs with prolonged exposure to outdoor sound levels of 40 dBA or higher. It is important to note that the WHO guidelines are based largely on industrial and transportation noise research, and not on wind turbine research. Because multiple studies (covered in this review) have indicated that WTN is significantly more annoying, has higher infra- and low-frequency sound energy, and is modulating, pulsatile, and sometimes tonal, it may impact health to a greater degree than other noises. This means that noise limits in the WHO guidelines may need to be adjusted downward when applied to WTN.

Additional factors increase the probability of sleep disruption due to WTN. The noise can be heard especially well in areas with low background noise levels, which usually occur at night. Also, lower nighttime wind speeds at ground level increase the nighttime contrast between WTN and background sound levels. Using test data taken during daytime wind conditions will result in a large underestimate of nighttime WTN levels, and thus underestimate the potential for sleep disruption.[38, 58]

Researchers who have studied the impacts of ILFN in general and WTN specifically on health, including some who have reviewed and assessed the findings of other researchers, have attributed a variety of symptoms to ILFN exposure. Those symptoms have been variously described by different researchers, with varying degrees of overlap and detail. They are shown, in no particular order, in Table 1.

Clearly, in addition to annoyance, the most commonly experienced and least-contested health symptom suffered by people living near IWTs is sleep disturbance.[110] Both the United Nations Committee against Torture (CAT) and the Physicians for Human Rights[111] describe sleep deprivation as critical to human functioning. According to Physicians for Human Rights:

> "Sleep deprivation ... causes significant cognitive impairments including deficits in memory, learning, logical reasoning, complex verbal processing, and decision-making; sleep appears to play an important role in processes such as memory and insight formation" (p. 22).

Table 1. Health symptoms described by different researchers as linked to exposure to infrasound and low-frequency noise, including exposure to industrial wind turbines.

Author (Year)	Reference	Symptomatology
Pierpont (2009)	4	Sleep disturbance; headache; Visceral Vibratory Vestibular Disturbance (VVVD); dizziness, vertigo, unsteadiness; tinnitus; ear pressure or pain; external auditory canal sensation; memory and concentration deficits; irritability and anger; and fatigue and loss of motivation
Leventhall (2003)	12	Vibration of bodily structures (chest vibration), annoyance (especially in homes), perceptions of unpleasantness (pressure on the eardrum, unpleasant perception within the chest area, and a general feeling of vibration), sleep disturbance (reduced wakefulness), stress, reduced performance on demanding verbal tasks, and negative biological effects that include quantitative measurements of EEG activity, blood pressure, respiration, hormone production, and heart rate
Kasprzak (2014)	112	
Havas & Colling (2011)	91	Difficulty sleeping, fatigue, depression, irritability, aggressiveness, cognitive dysfunction, chest pain/pressure, headaches, joint pain, skin irritations, nausea, dizziness, tinnitus, and stress
Horner (2013)	78	Headaches, nausea, tinnitus, vertigo, and worsened sleep
Paller et al (2013)	113	
Jeffery et al (2013)	92	Sleep disturbance; subjective complaints such as headaches, fatigue, temporary feelings of dizziness, and nausea; objective complaints such as vomiting, insomnia, and palpitations; annoyance; and reduced quality of life (QoL)
Jeffery et al (2014)	93	Negative impacts on the physical, mental and social well-being of people
Krogh et al (2012)	96	Annoyance (regarded as an adverse health effect associated with stress), sleep disturbance, headaches, difficulty concentrating, irritability, fatigue, and a variety of more-serious ailments
Minnesota Department of Health (2009)	55	Annoyance, reduced quality of life, sleeplessness, and headache
Howe Gastmeier Chapnik Limited (2010)	114	High levels of annoyance in a non-trivial percentage of persons, with annoyance associated with sound from wind turbines expected to contribute to stress-related health impacts in some persons

Author (Year)	Reference	Symptomatology
Nissenbaum (2013)	81	Sleep disturbances/sleep deprivation and the multiple illnesses that cascade from chronic sleep disturbance, which include cardiovascular diseases mediated by chronically increased levels of stress hormones, weight changes, and metabolic disturbances (including the continuum of impaired glucose tolerance through diabetes); psychological stresses that can result in cardiovascular disease, chronic depression, anger, and other psychiatric symptomatology; headaches, auditory and vestibular system disturbances; an increased requirement for and use of prescription medication; tinnitus; and vertigo
Nissenbaum et al (2012)	97	Increased sleep disruption, reduced mental health
Thorne (2013)	49	Sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic attack episodes
Pawlaczyk-Luszczyńska et al (2005)	115	Problems with vision, concentration, and continuous and selective attention (especially in persons who are highly sensitive to low-frequency noise)
Pedersen (2011)	99	Annoyance (both outdoors and indoors), statistically related to SPLs; sleep interruption, diabetes, and tinnitus (at one of three test sites); annoyance outdoors, significantly related to sleep interruption, tension, stress, irritability (at all three sites), headache (at two sites), and undue fatigue (at one site); annoyance indoors, significantly related to sleep interruption (at all three sites), and to diabetes, headache, undue fatigue, tension, stress, and irritability (at one of three sites)
Roberts & Roberts (2013)	102	Vibration or fatigue, annoyance or unpleasantness
Shepherd & Billington (2011)	103	Annoyance, which has been linked to increased levels of psychological distress, stress, difficulty falling asleep, and sleep interruption
Taylor (2013)	58	Annoyance, stress, sleep disturbance, interference with daily living, headache, irritability, difficulty concentrating, fatigue, dizziness, anxiety, and reduced QoL
Ambrose et al (2012)	61	Dizziness, irritability, headache, loss of appetite, fatigue, inability to concentrate, a need to leave the home, and a preference for being outdoors (during investigations of WTN by seasoned researchers, including acousticians)
Rand et al (2011)	116	
Thorne (2011)	46	Sleep disturbance, anxiety, stress, and headaches

Author (Year)	Reference	Symptomatology
Palmer (2013)	117	Negative impacts on sleep, job stability, social relationships, care giving, pursuit of hobbies, leisure, learning, and overall health (based on interviews of residents four years after living near operational wind turbines)
Castelo Branco & Alves-Pereira (2004)	118	Vibroacoustic disease, described as occurring only after extensive exposure to high levels of infrasound
Castelo Branco (1999)	119	

Other sources quoted by the Physicians for Human Rights[111] note that:

> "A review of the medical literature reveals numerous adverse cognitive effects of sleep deprivation including impaired language skills-communication, lack of innovation, inflexibility of thought processes, inappropriate attention to peripheral concerns or distractions, over-reliance on previous strategies, unwillingness to try out novel strategies, unreliable memory for when events occurred, change in mood including loss of empathy for colleagues, and inability to deal with surprise and the unexpected" (pp. 22-23).

Another line of reasoning is that there is a cause-effect relationship between AHEs and ILFN from wind turbines that mirrors that in motion sickness. Kennedy et al[120] made acceleration recordings during 193 standard training mission scenarios for two moving-base flight trainers. The pilots, who were of comparable age and experience in both groups, were interviewed for motion sickness symptomatology and tested for ataxia after leaving the simulators. Motion sickness incidence was high for one of the simulators, but not for the second. Ataxia scores departed slightly from expected improvements following exposure in both simulators. Spectral analyses of the motion recordings showed significant amounts of energy in the *nauseogenic range* of 0.2 Hz. The authors concluded that simulator sickness in moving-base simulations may be, at least in part, a function of exposure to infrasonic frequencies that make people seasick. Later, von Gierke and Parker[121] advanced the notion that motion sickness may involve an intermodal sensory conflict between visceral graviceptor signals and vestibular stimulation. Schomer and colleagues[52, 86] have argued that similarities with motion sickness may explain some of the health symptoms suffered by individuals living near IWTs, given that the inner ear is capable of responding to accelerations of the kind that lead to seasickness. These accelerations correspond to frequencies in the infrasonic range, around and under 1 Hz. Schomer[66] states that

some persons affected by WTN may be responding directly to acoustic factors, rather than to non-acoustic factors, as argued by Leventhall.[14]

In a rare show of cooperation between the wind industry and independent acousticians, Pacific Hydro agreed to allow acoustician Steven Cooper, a consultant for The Acoustic Group,[25] unlimited access to its Cape Bridgewater wind project in SW Victoria, which had been in operation for about six years. The company allowed Cooper to make noise measurements and independently investigate the noise complaints of six affected residents at three residences located 650-1,600 m from the nearest turbines while the company controlled the on-off cycling of turbine operation. Given Cooper's credentials as an acoustician, the study was described as an acoustical study, as opposed to a medical study. Noise levels were based on A-, G-, and Z-weighted measurements, as well as 1/3-octave band and narrow-band measurements. Participants vacated their homes at night when necessary for Cooper to perform his acoustic studies, and they provided detailed diary accounts of their observations during on-off cycles. Those accounts included severity ratings of perceptions of noise impacts, vibration impacts, and other disturbances, which were collectively labelled as *sensations*. The sensations included headache; pressure in the head, ears, or chest; ringing in the ears; heart racing; or a sensation of heaviness. Synchronization of the timing of the residents' experiences with turbine operational data revealed heightened sensations inside their dwellings during turbine operation. Sensations were not dependent on the ability to hear or see the turbines, as residents were not aware of any of the turbines' operational characteristics. Cooper found that *sensation*, and not *noise disturbance*, was the major disturbance identified. Furthermore, sensations were most related to several different operating conditions of the turbines: at start-up, when there was an increase or decrease in power output of about 20%, and when the turbines were operating at maximum power and the wind speed increased above 12 m/sec.

Based on narrow-band data, Cooper identified a unique *wind turbine signature* (WTS) in which there was an energy peak at the blade-pass frequency and first five harmonics. Shutdown testing confirmed that the WTS, which included an amplitude-modulated signal, was present when the turbines were operating, but not in a natural environment during a turbine shutdown. Participants rated sensations as proportionally more severe as increases occurred in the magnitude of the low-frequency amplitude-modulated signature. The identification of infrasound components was consistent with earlier observations of Kelley et al.[19] Based on his findings, Cooper recommended that further studies be conducted to determine a threshold level of the WTS that protects against adverse impacts, and that the signature concept be used in medical studies by

identifying energy from the operation of wind turbines, as the A-weighted scale inside homes is of no assistance in such studies.

In consideration of the above findings and observations, it is reasonable to conclude that IWTs cause AHEs and other unwanted disturbances. We next examine the physiological mechanisms that may explain how inaudible infrasound can be harmful.

In a recent paper, Berger et el[122] concluded that ILFN levels are insufficient to induce AHEs, given the levels of ILFN typically produced by wind turbines, and that guidelines for audible noise are sufficient to protect human health. Their conclusions were based on measurements of indoor infrasound levels and low-frequency noise levels at distances >500 m that were similar to background levels. While we believe the design and major conclusions of their study to be faulty, their conclusions are consistent with the position taken by Leventhall and other wind energy advocates over the past decade.

In her original description of Wind Turbine Syndrome, Pierpont[4] described a distinctive constellation of symptoms that she believed to be due to stimulation, or overstimulation, of the vestibular organs of balance as a consequence of ILFN from wind turbines. She termed these symptoms Visceral Vibratory Vestibular Disturbance (VVVD). In a follow-up report, Pierpont[100] suggested that the observed symptoms of Wind Turbine Syndrome are due to air-borne or body-borne low-frequency sounds that directly stimulate the inner ear, both the cochlea, or hearing organ, and the vestibular organs of balance and motion detection. As discussed below, research by Salt and associates shows that responses in the cochlea suppress the perception of low-frequency sound but still send signals to the brain, signals whose function is, at present, mostly unknown. The physiologic response of the cochlea to WTN is also a trigger for tinnitus and the brain-cell-level reorganization that tinnitus represents. Although cochlear and vestibular organs are housed within the same bony (otic) capsule, evolutionary adaptations have led to selective activation of auditory or vestibular hair cells. In the presence of certain disorders of the inner ear, however, anatomical defects in the otic capsule can alter the functional separation of auditory and vestibular stimuli, resulting in pathological activation of vestibular reflexes in response to sound.[123] The possibility that high-level ILFN can stimulate the vestibular organs lends credibility to Pierpont's suggestion and may explain the basis for symptoms that mimic other vestibular disorders. Physiologic responses from the otolith organs generate a wide range of brain responses, including dizziness and nausea, seasickness (even without bodily movement), fear and alerting responses such as startle and wakefulness, and difficulties with visually based problem-solving.[100] One candidate for the other destination of cochlear input from the outer hair cells may be the interface between the insula and the medial surface of the transverse (Heschl's)

gyrus, where primary hearing is experienced but not recognized as sound; the latter involves adjacent secondary areas.[124]

WTN can increase alerting responses that disturb sleep, even when people do not recall being awakened. This effect is one that clearly disturbs sleep and mental well-being out to 1,400 m (4,600 ft.) from turbines, with diminishing effects out to 3 km (3 mi.), as shown in a cross-sectional study by Nissenbaum et al.[97]

Laboratory studies conducted by Salt and colleagues have provided evidence that clearly establishes the biological plausibility that infrasound can adversely affect health. That work shows that there are mechanisms in the inner ear that are capable of transducing infrasonic energy into a neural signal that can be transmitted to the brain, where the signals can lead to such symptoms as tinnitus, dizziness, pulsations, and sleep disturbance. Those studies by Salt and associates have involved laboratory experiments funded primarily by the National Institutes of Health and conducted mostly on guinea pigs, whose ears are very similar to human ears. Basically, electrodes were inserted into the inner ears to determine which structures respond to specific types of electroacoustic stimulation. Their findings help to explain why sound that is normally inaudible can result in the kinds of negative reactions reported by people who are exposed to wind turbine ILFN. Findings from their research indicate the following:

(1) The inner hair cells (IHCs) of the inner ear, which are primarily responsible for transmitting signals to the brain that are interpreted as sound, are velocity-sensitive, and thus unresponsive to infrasound. The outer hair cells (OHCs), on the other hand, are displacement-sensitive and respond to infrasonic frequencies at levels well below those that are heard (i.e., interpreted as sound). This suggests that most IWTs produce an unheard stimulation of OHCs;[56, 125, 126] specifically, at 5 Hz the OHCs can be stimulated at sound pressures 40 dB below those that stimulate the inner hair cells associated with conscious hearing.[126]

(2) Low frequencies, which are coded in the cochlear apex, require less low-frequency SPL to be amplitude modulated, when compared to higher frequencies, which are coded in the cochlear base. This means that amplitude modulation of audible sounds by wind turbine infrasound may be the basis for complaints of those living near wind turbines, including complaints such as annoyance or feelings of throbbing and rumbling sensations. It also means that infrasound from wind turbines need not be audible to annoy people, since infrasound can amplitude modulate sounds that are within the range of audibility.[54]

(3) There are several ways that infrasound could affect people, even though they cannot hear it: (a) causing amplitude modulation (pulsation) of heard sounds, (b) stimulating subconscious pathways, (c) causing endolymphatic hydrops, and (d) possibly potentiating, or exacerbating, noise-induced hearing loss.[127]

(4) Responses to infrasound reach the brain through pathways that do not involve conscious hearing but instead may produce sensations of fullness, pressure or tinnitus, or absence of sensation. Activation of subconscious pathways by infrasound could disturb sleep.[128]

(5) The presence of other, higher-pitched sounds (between 150-1,500 Hz) can suppress infrasound.[129, 130, 131] Because the ear is maximally sensitive to infrasound when higher frequency sounds are absent, this means that WTN is most disturbing to persons inside their homes at night, when background sound levels are low and higher-pitched sounds are attenuated by walls and other physical structures.

(6) A pathway exists, through the OHCs, for infrasound to reach the brain. There, parts of the brain other than auditory centers become active and the signals are perceived as something other than sound. This pathway to the brain, which also includes the vestibular mechanism of the inner ear, means that it is biologically plausible for infrasound to produce a variety of sensations, including pulsation, annoyance, stress, panic, ear pressure or fullness, unsteadiness, vertigo, nausea, tinnitus, general discomfort, memory loss, and disturbed sleep (with chronic sleep deprivation leading to blood pressure elevation and possibly changes in heart rate).

On the above grounds, Salt dismisses the common perception that *What we can't hear can't hurt us*, and has stated unequivocally that "Wind turbines can be hazardous to human health."[132]

Interestingly, Oohashi et al,[133]using non-invasive physiological measurements of brain responses, found evidence that sounds containing *high-frequency* components *above* the audible range, or ultrasound, significantly affect the brain activity of healthy human listeners. It should not be considered implausible, therefore, that infrasonic stimulation can also activate the brain.

Recent research supports the plausibility of such effects. Bauer et al,[134] using functional magnetic resonance imaging (fMRI), found a significant response down to the 8 Hz, the lowest frequency presented, to be localized within the auditory cortex. Using magnetoencephalography (MEG), significant brain responses could be detected down to a frequency of 20 Hz. The authors hypothesized that a somatosensory excitation of the auditory cortex possibly contributes at these frequencies. In a somewhat related study, He and Krahé[135] demonstrated a significant relationship between EEG reactions under different low-frequency noise exposures and

subjective annoyance. Noise sensitivity was also found to be an important factor in most of the observations. The authors of these two studies suggested that EEG, fMRI, and MEG may serve as effective physiological measures to explain negative reactions to low-frequency noise.

Kugler et al[136] measured spontaneous otoacoustic emissions (SOAEs) before and after stimulation with perceptually unobtrusive low-frequency sound (30 Hz) and found significant changes to occur; these changes were positively correlated in frequency and level to pre-exposure status and lasted for about 2 min after stimulation. SOAEs are narrow-band acoustic signals that are spontaneously emitted by the inner ear in the absence of acoustic stimulation, and they can be recorded simply and non-invasively in the ear canal with a sensitive microphone. Otoacoustic emissions, first reported by physicist David Kemp,[137] are a by-product of active biophysical amplification by OHCs in the cochlea, persisting in relatively stable form for years under normal physiological conditions. The main task of the OHCs is to detect and mechanically amplify sound waves. In acting as a cochlear amplifier, OHCs actively generate mechanical energy, which is fed back into the cochlear travelling wave to maximize the sensitivity and dynamic range of the mammalian ear. In humans, non-invasive recordings of different classes of sound-evoked otoacoustic emissions (EOAEs) allow indirect access to OHC function, but only SOAE measurements can probe the cochlea in its natural state. The presence of OAEs signals a healthy ear, and their absence or changes in their response patterns can signal pathological function. The significance of the work by Kugler et al is that it reveals OHC function to be affected by a brief exposure to very low-frequency sound that is largely imperceptible. It also reveals that measures of perception severely underestimate OHC sensitivity. The authors concluded that direct quantifications of inner ear active amplification, as measured in their study, are well suited for assessing the risk potential of low-frequency sounds. In the present context, the study provides further support for the notion that what we can't hear can potentially affect us.

Motion sickness has been mentioned in this article as being among the variety of symptoms suffered by individuals living near IWTs. Recalling the work of Kennedy et al,[120] who found evidence of motion sickness in Navy pilots subjected to acceleration during flight simulation, Schomer et al[138] stated that it is plausible that the ear responds similarly to accelerations of a moving vehicle and acoustic pressures at infrasonic frequencies under 1 Hz, in the nauseogenic range. They suggested that the AHEs experienced as a consequence of exposure to IWTs not only bear a striking resemblance to motion sickness, but that the condition may be induced by stimulation of the otolithic organs in the vestibular system of the inner ear. That type of stimulation is purportedly worse when a person is subjected to pressure changes in a closed

cavity, including inside one's home. Further, they describe the type of research needed to verify their hypothesis.

Michaud and colleagues have recently authored a series of papers[139, 140, 141, 142, 143, 144, 145] describing a cross-sectional epidemiological study conducted under the sponsorship of Health Canada, in which they investigated the prevalence of health effects or health indicators among a sample of Canadians exposed to WTN. The studies employed both self-reported and objectively measured health outcomes. The final sample, drawn from communities in Ontario and Prince Edward Island where a sufficient number of dwellings were located near wind turbine installations, included 1,238 participates (606 males, 632 females) living between 0.25 and 11.2 km from operational turbines. One participant between the ages of 18-79 years was randomly selected from each household. The reported response rate was 78.9% and did not significantly vary across sampling strata or provinces. Modelled A- and C-weighted WTN levels reached 46 dBA and 63 dBC, respectively, and the two levels were found to be highly correlated, which suggested that C-weighted values offered no additional information beyond that offered by A-weighted values. Only minor differences across strata were reported for age, employment, and type and ownership of dwelling. WTN exposure was not found to be related to hair cortisol concentrations, blood pressure, resting heart rate, or any of several measured sleep parameters (i.e., sleep latency, sleep time, rate of awakenings, sleep efficiency). Self-reported results obtained through an in-person questionnaire did not provide support for an association between increasing WTN levels and self-reported sleep disturbance, use of sleep medication, or diagnosed sleep disorders. Similarly, no significant association was found between WTN levels and self-reported migraines, tinnitus, dizziness, diabetes, hypertension, perceived stress or any measure of QoL. However, they observed statistically significant exposure-response relationships between increasing WTN levels and the prevalence of long-term high levels of annoyance toward noise, shadow-flicker, visual impacts, blinking lights, and vibrations.

The authors of the present report, along with a number of professional colleagues with acoustical or medical expertise, have carefully analyzed the reports by Michaud and colleagues and have concluded that the research protocol of the Health Canada study reflects shortcomings that severely undercut the conclusions that were drawn in the various reports. To enumerate the major flaws in the Michaud et al reports:

(1) They incorrectly concluded that AHEs were not found when sound levels were below 46 dBA by failing to benchmark their "surrogate control group" against the general population. Proper analysis, using a proper control group, would have resulted in high correlations of these symptoms with decreasing distances to, and increasing noise levels from, wind

turbines. In reports of the sound-exposure data, sound levels of 30-35 dBA were significantly associated with increases in the prevalence rates of symptoms. This indicates that the 40 dBA currently used as the permissible threshold in Ontario and other Canadian provinces is not protective of the public's health and welfare.

(2) Key health symptoms were reported primarily for non-vulnerable populations, in that younger individuals and individuals who had left their homes were excluded from participation. Those exclusions invalidate the study as a reflection of health conditions in the general population.

(3) Evidence provided by the World Health Organization[38] showing that exposure to noise from vehicles, railways, and aircraft is linked to serious physiological and psychological health effects at sound levels of 40 dBA and higher, and that lower levels are needed to protect the more vulnerable members of the population, was ignored in the Health Canada study. The finding that AHEs did not occur below 46 dBA should have been a warning sign to the researchers that their study design, their analyses, or both, were flawed.

Statement 4: Setback distances of 1,000-1,500 ft. (approximately 0.3-0.5 km) are sufficiently safe to protect humans from harm, regardless of height or other physical characteristics of the IWTs.

Many zoning ordinances that regulate IWTs specify the height of the turbine tower from its base to blade tip, plus 10% to 100%, as a setback distance that sufficiently protects residents against a catastrophic event such as a tower failure, a falling blade, or ice throw. Some ordinances specify a distance of twice the base-to-blade tip height, roughly 900 ft., while others arbitrarily specify slightly longer distances such as 1,500 ft. or 0.5 km. Most of the reported health symptoms have been observed at distances much greater than these setback distances. One can deduce, therefore, that *setbacks intended to protect physical health from mechanical or other traumatic failure of a wind turbine component are not adequate to protect general health and well-being.*

While terrain, weather patterns, number and size of turbines, and the turbine array itself can influence the ILFN emitted from IWTs, the two major factors are turbine size and distance from the receiver. Distance is the only practical means of achieving acceptable sound levels, as controlling the noise through the erection of barriers or enclosures near the source or receiver are not feasible or effective. Because infrasound is involved, closing windows, insulating buildings (including residences), and sleeping in basements are not normally helpful in attenuating the noise, and there is less likelihood that the emissions will be masked by wind at ground level.[60, 146] Noise levels must be measured by qualified personnel, and the sound level at the residence—or arguably at the property line—is the key element in protecting the health of residents.

To protect human health, a number of researchers have recommended specific distances, while others have recommended limitations on sound levels, irrespective of the distances needed to achieve those levels. Such recommendations are based on observed or reported complaints of AHEs. Though quite specific, the recommendations vary somewhat widely, as shown in Table 2.

The recommendations in Table 2 include boundaries of distance and noise levels of 0.5-2.5 mi. and 30-40 dB, respectively, that are believed by various professionals to protect human health. Although the use of maximum permissible noise levels appears to be the optimal approach for protecting the greatest number of people, the existence of multiple acoustic and environmental factors complicates our ability to recommend a single distance or noise level that protects most residents. Those factors are covered elsewhere in this review.

Table 2. Recommended minimum siting distances and maximum noise levels of industrial wind turbines, based on the protection of human health.

Author (Year)	Reference	Distance/Level
Pierpont (2009)	4	Distance of 1.25 mi, or 2 km
Kamperman & James (2008)	83	
Nissenbaum et al (2012)	97	Minimum distance of 0.87 mi, or 1.4 km, based on experimental conditions studied
Harry (2007)	74	Minimum distance of 1.5 km from nearest turbine
Frey & Hadden (2007)	90	2 km between family dwellings and IWTs of up to 2-MW installed capacity, with greater separation for a wind turbine greater than 2-MW installed capacity
Shepherd & Billington (2011)	103	4 km, to protect against amplitude-modulated turbine noise
Position of the National Institute of Public Health-National Institute of Hygiene on wind farms (2016)	147	A minimum distance of 2 km of wind farms from buildings
Cummings (2011)	39	Distance of ½ mi or greater; noise levels within 5-10 dB of existing background conditions; sound levels below 40 dBA, or even 30-35 dBA, as levels of 40 dBA or higher trigger large numbers of noise complaints
World Health Organization (2009)	38	Outdoor sound levels <40 dBA, with vulnerable populations expected to be most affected

Author (Year)	Reference	Distance/Level
Knopper et al (2014)	148	Sound levels <40 dBA, for non-participating receptors
Horner (2013)	78	Sound levels <30 dB
Harrison (2011)	42	Sound levels limited to 35 dBA at nighttime and 40 dBA during daytime hours; 5-dBA and 4-dBA penalties, respectively, imposed for the periodic or impulsive character of turbine noise and for uncertainty in noise prediction
Thorne (2013)	49	Sound levels <32 dB LAeq outside a residence

Statement 5: Annoyance is a nuisance, but it is not a health issue.

In the past few years, the position of the wind industry has changed from a blanket denial of any impact from noise to admitting that IWT noise is annoying to a substantial portion of exposed populations, and that annoyance from ILFN is a well-accepted phenomenon. While Bolin et al[18] and Ellenbogen et al[82] downplay the relationship between annoyance and WTN, the larger research community has documented that ILFN from wind turbines and other sources leads to annoyance.[12, 14, 15, 19, 21, 37, 38, 40, 42, 46, 49, 55, 58, 59, 63, 64, 74, 78, 80, 81, 90, 92, 94, 98, 99, 102, 118, 146, 149, 150]

Several investigators have concluded that annoyance increases in a dose-response relationship as distance from turbines is reduced.[44, 89, 146] A number of studies have concluded that noise annoyance appears to be worse when nearby residents have negative attitudes and when visual annoyance or intrusive sound characteristics are also involved.[e.g., 44, 65, 112, 146, 151] However, the annoyance from visual stimulation and the annoyance from noise may be entirely independent. The two irritants do not have to be linked. The common factor is that as one moves closer to a wind turbine, it is perceived as both larger *and* louder. One recent study,[152] which compared visual, audible noise, and combined visual-auditory representations of wind turbines, found noise sensitivity to correlate with both noise and visual annoyance. That study also demonstrated a reciprocal influence between auditory and visual stimuli, but in essentially a direction opposite that predicted by earlier studies of wind turbine visibility and noise. Interestingly, the study showed that a visual stimulus had a mitigating effect on noise annoyance, while an auditory stimulus had a disturbing effect on visual annoyance. This finding supports the idea that humans perceive the environment holistically and in context of all perceptual information. In suggesting that auditory and visual features are processed in close interaction, it forces us to question the idea that annoyance from WTN arises largely because the turbines are visible. Given our current

state of knowledge, it seems reasonable to accept that people can be annoyed by auditory and visual irritants independently, even though there may be interactions between them.

Annoyance occurs in residents living near wind turbines at lower sound levels than for transportation noise, industrial noise, or other sources.[38, 42, 43, 58, 64, 93] Perception and annoyance have been found to be associated with both urbanized and rural terrains.[149] Pedersen et al,[146] in summarizing survey data on annoyance from wind turbines in the Netherlands and Sweden, found that 25% or more of all respondents were annoyed by levels of 40-45 dBA, while about 18-20% were very annoyed by those levels. A total of 18% found outdoor levels of 35-40 dBA to be rather annoying or very annoying outdoors and 8% found those levels to be rather or very annoying indoors. For outdoor levels of 40-45 dBA, 18% and 16% were rather or very annoyed outdoors and indoors, respectively. Because such surveys tend to emphasize *noise* from wind turbines, results often reflect levels of annoyance that relate more directly to audible sounds, as opposed to infrasound.

While few would argue that noise from wind turbines annoys a substantial percentage of nearby residents, there is disagreement over whether it leads to AHEs. Colby et al[15] stated that:

> "…there is no evidence for direct physiological effects from either infrasound or low frequency sound at the levels generated from wind turbines, indoors or outside" (p. 3-8).

They reasoned, therefore, that annoyance is not a pathological entity. Their basic contention was that although wind turbines produce infrasound, it is not harmful because people can't hear it. They contended that while some people may be annoyed by the sound from wind turbines — presumably audible sound—annoyance is primarily due to the fluctuating nature of the noise and personal attitudes. In their view, it is a psychological reaction, as opposed to a direct physiological reaction to sound. As noted above, however, several investigations[44, 89, 146] have found a dose-response relationship to exist between measured or estimated sound levels and annoyance. IWT noise emissions have been found to be a mediator between exposure and sleep disturbance and psychological distress,[89] and to be directly associated with stress.[e.g., 104]

The documented health symptoms from exposure to wind turbines are often stress-related and exacerbated by sleep disorders; they appear to be mediated through both direct and indirect pathways, and the result can be serious harm to human health.[92] There is an association between WTN, stress, and well-being, and this association is a potential hindrance to psycho-physiological restitution.[58, 98] The WHO 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.[38] A range of symptoms, often described as stress responses, have been associated with

WTN in people living in the vicinity of wind projects. As Pierpont[4] and others have noted, these symptoms include headache, irritability, difficulty concentrating, fatigue, dizziness, anxiety, and sleep disturbance. Regardless of whether the perceived impacts of noise from wind projects are physiological or psychological in nature, they are considered to cause AHEs through sleep disturbance, reducing the quality of life and serving as a source of annoyance that sometimes leads to stress-related symptoms.[71] The potential of environmental noises to induce stress reactions is well known. These reactions are dependent on how the noises are interpreted in the central nervous system; medical effects such as increased blood pressure, for example, are known to result from prolonged noise exposure.[153]

Generally, models that explain the relationship between noise and health fall into two broad categories, based on pathways that are *direct* or *indirect*. Figure 1, which is a modification of a figure from Shepherd et al,[50] depicts three models, one direct and two indirect, that have been described in the contemporary literature. The first (Fig. 1a) represents a direct pathological relationship between an environmental parameter (e.g., noise level) and a target organ that affects health. For example, in this model, noise can affect both cognition and sleep, and thus directly impact health. An alternative approach (Fig. 1b) distinguishes between direct health effects and psychosomatic illness. This approach suggests that any physiological illness coinciding with the onset of WTN may be caused by a negative psychological response to the noise, and not the noise *per se*. Any anxiety or anger resulting from the presence of WTN induces stress and strain that, if maintained, can eventually lead to AHEs. Another explanation that involves an indirect pathway from sound to health effects is one that is consistent with the WHO's definition of health.[38] That model (Fig. 1c) recognizes the role of environmental moderators, or mediators, in the determination of whether a sound is (unwanted) noise, and, if so, whether or not the noise

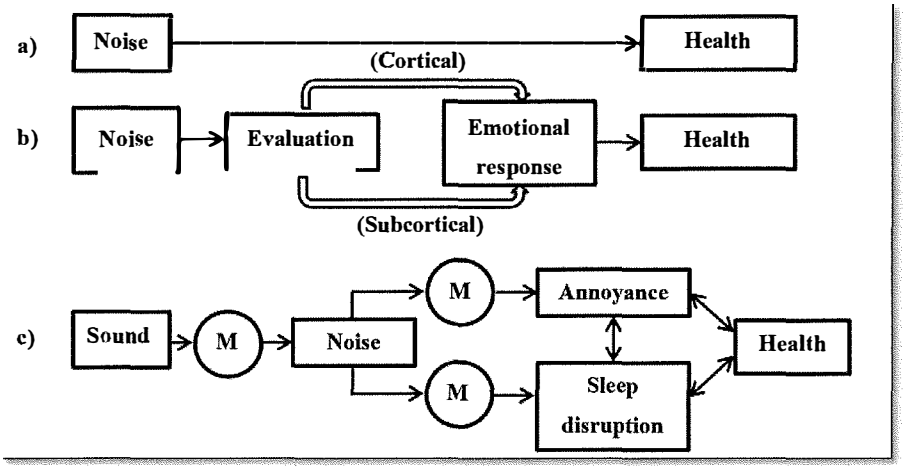


Figure 1. Three models representing the relationship between noise and health: the biomedical model (a) stipulating a direct causal relationship and indirect models (b and c) containing moderators and mediators (Adapted from original source and used with permission of first author, Daniel Shepherd).[50]

negatively impacts health. Mediators include factors such as degree of urbanization, house type, and sound level, and psychological and demographic moderators such as age, gender, education, employment status, attitudes to wind energy, noise sensitivity, and whether the individual receives a monetary return from the turbines. In this model, sleep disruption plays a major role in producing AHEs, with annoyance and sleep disruption being intervening factors between noise and AHEs for some people.

Authors of a recent study,[154] which focused on the province of Ontario, acknowledge both the link between annoyance and health and the possibility that wind projects can exacerbate psychosocial health problems through social processes such as intra-community conflict. They list socially mediated health concerns, distribution of financial benefits, lack of meaningful engagement, and failure to treat landscape concerns seriously, as the core stumbling blocks to a community's acceptance of wind energy development.

Statement 6: Noise cannot account for all of the complaints of people living in the vicinity of wind turbines; there must be another, unknown reason for the complaints.

Havas & Colling[91] have observed that wind turbines generate electromagnetic waves in the form of poor power quality (*dirty electricity*) and ground current, and speculate that these waves can adversely affect those who are electrically hypersensitive. McCallum et al[155] performed magnetic field (EMF) measurements in the proximity of 15 Vestas 1.8-MW wind turbines, two substations, various buried and overhead collector and transmission lines, and nearby homes in the vicinity of Goderich, Ontario, during high-wind, low-wind, and shut-off operational stages. They concluded that there is nothing unique to wind farms with respect to EMF emissions, finding that magnetic field levels in the vicinity of wind turbines were lower than those produced by many common household electrical devices and that levels were well within any existing regulatory guidelines with respect to human health.

Although at least a few of the health symptoms mentioned above have been self-reported by individuals who are exposed to electromagnetism, clinical trials to date suggest the link between health complaints and exposure to electromagnetism to be a purely psychological one, or a nocebo effect, in that self-described sufferers of electromagnetic hypersensitivity are unable to distinguish between exposure and non-exposure to electromagnetic fields.[156] Another review paper[157] found no convincing scientific evidence that symptoms are caused by electromagnetic fields. However, one cannot rule out that the design of the experiments upon which the review papers drew their conclusion may have missed some unique characteristic that could account for the anecdotal evidence. (See our earlier statements describing how failure to identify infrasound

pulsations as a causal factor for perception at pressure levels below those needed for audibility have led some to conclude that IWT infrasound causes no harm.) When faced with health complaints from families who live near IWTs, especially when there are repeated instances of symptoms that wax and wane with alternating sequences of exposure and non-exposure, and especially when those families have taken the drastic step of abandoning their homes, it is unreasonable to argue that noise is not the cause of the complaints. Even if other factors such as electromagnetic waves are the root cause of a given complaint, it is still the placement of turbines too close to those residents that is the most likely cause of the problem.

Unfortunately, not as much is known about the effects of electromagnetism as is known about ILFN. At this point in time, therefore, it is reasonable to conclude that more people who live near wind turbines are negatively affected by ILFN than by hypersensitivity to dirty electricity or ground current, as measurable levels of ILFN from wind turbines are highly associated with individual complaints. When Stigwood et al[57] studied and analyzed complaints at over 75 wind developments in the U.K., they found that identifying the problems was straightforward, occurrence was common (i.e., some residents reported problems in all developments), all developments generated excess amplitude modulation (AM), and AM was the cause of the vast majority of the complaints. These findings have recently been reinforced by Cooper's work[25] in Australia.

Statement 7: Infrasound from wind turbines is sufficiently correlated to the A-weighted sound emissions to allow an A-weighted model to be used to predict how much infrasound is present in homes.

This statement is not typically stated explicitly, but it is one that is inherent in the positions commonly taken by wind energy advocates and regulatory bodies through their interpretations and acceptance of research on WTN, which is based largely on A-weighted levels. As noted in many previous papers, including one of our own,[101] the continued use of the A-weighting scale in sound level meters is a major basis for misunderstandings that have led to acrimony between advocates and opponents of locating wind turbines in residential areas. The dBA scale was devised as a means to incorporate into measurements of environmental and industrial SPLs the inverse of the minimum audibility curve[158] at the 40-phon level. It is typically used, though, to specify the levels of noises that are more intense, where the audibility curve becomes considerably flattened, obviating somewhat the need for A-weighting. Use of the A-weighted scale is mandated or recommended in various national and international standards for measurements that are compared to damage-risk criteria for hearing loss and other health effects resulting from occupational or environmental noise exposure. It drastically reduces sound-level

readings in the lower frequencies, beginning at 1,000 Hz, and reduces sounds at 20 Hz by 50 dB. For WTN, the A-weighting scale is especially inappropriate because of its devaluation of the effects of ILFN. Many authors have commented on its inadequacy. For example, Pederson and Persson Waye[159] state:

> "There is… support both from experimental and field studies that intrusive sound characteristics not fully described by the equivalent A-weighted sound pressure level contribute to annoyance with wind turbine noise" (p. 4).

A number of researchers have recommended comparing C-weighted measurements to A-weighted measurements when considering the impact of sound from wind turbines.[10, 12, 37, 61, 67, 75, 76, 83, 101] According to these sources, the presence of infra- and low-frequency sound is generally indicated when the difference between levels on the two scales differs by 10-20 dB. When such differences are observed, the use of third-octave or linear-scale measurements is typically recommended (for example, see Shepherd et al[50]). Other weighting scales have been suggested for wind turbine applications, but at present, linear-scale or narrow-band measurements, used in conjunction with a conventional sound level meter (with low-frequency microphone) and micro barometer, offer the best potential for accurately and completely describing the soundscape in the vicinity of IWTs.

As noted above, Cooper[25] has suggested that A-weighted levels, measured inside homes, are not likely to be useful indicators of AHEs. That report concluded that A-weighted levels are not a valid index of protection from AHEs and recommended the further exploration of a newly developed *wind turbine signature* scale, based on the discovery of its capability to quantify the amplitude-modulated peak energy in the infrasonic frequency region. That scale was shown to be directly linked to a variety of adverse bodily sensations when nearby turbines were operating or undergoing transitions in operation.

Although A-weighted sound level measurements have been the *sine qua non* for specifying environmental and occupational noise levels for many decades, we must recognize the inherent inadequacies of applying the A-weighting scale to quantifying noise emitted by IWTs. Bray[160] goes even further by noting that people, and not electronic devices, are the ultimate analysts of data that affect their responses to sound, making the point that people's responses should be given the credence they deserve, and not be devalued when physical measurements fail to confirm them.

Statement 8: Wind Turbine Syndrome has not been accepted as a diagnostic entity by the medical profession, so medical professionals cannot diagnose or treat it.

Currently, Wind Turbine Syndrome is not included in the International Classification of Diseases (ICD) coding system, which is used globally for purposes of establishing categories for diagnosing diseases and other health conditions, and as a basis for reimbursing medical providers for diagnostic and treatment services. Yet, of the 10 symptom sets comprising Pierpont's Wind Turbine Syndrome,[4] at least seven are included as a category or subcategory in the newly revised (ICD-10) coding system. The fact that the syndrome itself is not included may be due to its relatively recent discovery, but is more likely due to the fact that the syndrome consists of symptoms that are highly variable from person to person and affect a minority of the exposed population.

Especially in legal proceedings, it is important to distinguish between the terms *differential diagnosis* and *causation assessment*. It is the latter that is most often the subject of such proceedings. Attorneys and expert witnesses often get the terms confused. Differential diagnosis refers to the identification of disorder(s) that may account for a particular complaint or symptom complex. It rarely deals with the external cause of the disorder. Causation assessment, on the other hand, typically requires an evaluation of whether potential causative agents have irritating properties; a determination of the approximate amount of exposure, or dose, of that agent, and the timing between exposure (and non-exposure) and the occurrence of symptoms; and an assessment of whether alternative potential causes of the disorder can be ruled out. These latter steps are not necessarily considered part of the diagnosis.

Notwithstanding the fact that Pierpont herself is a practicing pediatrician, a couple of recent developments would appear to increase the prospect that medical personnel will soon be able to establish Wind Turbine Syndrome, by that or a similar label, as a clinical entity caused by exposure to WTN. Dr. Robert McMurtry, a physician who is a special advisor to the Canadian Royal Commission on the Future of Health Care, and a long-time advocate for more effective public involvement in healthcare policy, recently published a set of highly specific criteria for establishing such a link. McMurtry[161] originally proposed a case definition that identifies first-, second-, and third-order criteria, as well as specified circumstances and symptoms that must be established before AHEs can be attributed to wind turbine exposure. According to those criteria, probable AHEs are present when:

(1) All four of the following first-order criteria are met: (a) The individual resides within 5 km of IWTs, (b) Health status is altered following the start-up of or initial exposure to, and during

the operation of, IWTs (a latent period of up to 6 months may be allowed), (c) Amelioration of symptoms occurs when more than 5 km from the environs of IWTs, and (d) Recurrence of symptoms occurs upon return to the environs of IWTs within 5 km.

(2) At least three of the following second-order criteria are met (occurring or worsening after the initiation of operation of IWTs): (a) Compromised quality of life, (b) Continuing sleep disruption, difficulty initiating sleep, and/or difficulty with sleep disruption, (c) Annoyance producing increased levels of stress and/or psychological distress, and (d) A preference to leave the residence temporarily or permanently for sleep restoration or well-being.

(3) At least three specified symptoms occur or worsen following the initiation of IWTs, those symptoms referred to as third-order criteria that fall within the following categories: (a) Otological and vestibular disorders, (b) Cognitive disorders, (c) Cardiovascular disorders, (d) Psychological disorders, (e) Regulatory disorders, or (f) Systemic disorders.

To be confirmed as AHEs from WTN exposure, McMurtry indicated that consideration should be given to other stressors present in the community, that sleep studies be carried out if at all possible, and that a licensed physician be able to rule out alternate explanations for AHEs. These alternate explanations include substantial barometric changes from prevailing winds, a stressful home environment, and psychological and/or mood disorders, all of which can normally be ruled out when symptoms subside or disappear when the individual leaves the vicinity of the wind turbines. Apart from these three factors, he indicates that there are very few, if any, other health conditions that can mimic those caused by exposure to wind turbines and at the same time meet the three orders of criteria outlined in his case definition. More recently, McMurtry and Krogh[162] published a revised case definition, in which the third-order criteria—which are commonly present—are not considered essential elements. In both papers, the authors acknowledged that the identification of IWTs as the cause of adverse health symptoms is a complex emerging issue that requires further study to validate the criteria. They proposed key elements that ought to be included in any model used to assess the validity of the case-definition criteria.

McCunney and colleagues[163] have challenged those case definitions as having poor specificity, leading to a substantial potential for false-positive assessments and missed diagnoses. A potential fallacy in this challenge is that the authors unnecessarily conflate the concept of case definition for medical practitioners with that of an epidemiologic research plan. The case definitions presented by McMurtry[161] and McMurtry and Krogh[162] represent guidelines for medical doctors whose individual patients are experiencing new or unusual symptoms. It is erroneous to purport that a physician's mental process can be encapsulated into a set of equations, especially

during the earliest stages of developing a case definition. The criticisms of these early case definitions should not deter physicians from attempting to evaluate and treat patients who report AHEs after living in the vicinity of IWTs. This area may indeed benefit from further study. Our view, however, is that such criteria provide an adequate starting point for guiding medical practitioners.

Dr. Steven Rauch, an otolaryngologist at the Massachusetts Eye and Ear Infirmary and a professor at Harvard Medical School, recently declared that he believes Wind Turbine Syndrome to be a real phenomenon.[164] As reported by numerous websites and newspapers, multiple patients have sought treatment from him for AHEs stemming from consistent exposure to IWTs. Rauch compares the syndrome to migraine headaches and believes that people who suffer from migraines are among the most sensitive to the effects of WTN, and he has stated that the wind industry aims to suppress the notion of Wind Turbine Syndrome by blaming the victim.

Given these developments, it is possible that the medical profession may someday embrace Wind Turbine Syndrome—by that or another name—as a clinical entity. This prospect is encouraging, as such acceptance by the profession will facilitate efforts to protect individuals from the harmful health effects of exposure to IWTs. Even though it may be some time before such a diagnostic label is formally acknowledged as an ICD code, it is currently possible for physicians to identify many of the specific symptoms associated with wind turbine exposure and to bill for diagnosing and treating those symptoms, with or without regard for their underlying cause. Paradoxically, it is apparently the case that the most effective treatment for AHEs associated with WTN exposure is non-medical in nature; it is to recommend that patients physically remove themselves from the vicinity of IWTs.

Statement 9: Peer-reviewed epidemiological literature is the only acceptable basis for proving a causative relationship between wind turbine noise and adverse health effects.

This issue runs as a thread through virtually all the other issues addressed in this paper, as it relates to the kind of scientific evidence frequently called for, especially in legal settings, to prove that IWTs are the cause of AHEs. While personal physicians of complainants in legal cases are often considered the only expert witnesses qualified to establish *specific causation*, others can testify to *general causation*, which is the methodology by which scientists determine whether or not an agent is responsible for producing a particular disorder. In general, this requires evaluation of the scientific and medical literature to identify documented instances of health-related conditions arising from exposure to specific agents and, when available, the dose-response relationships between agents and their effects. This process is highly similar to that of

causation assessment, as explained above, and it does not necessarily require the input of a complainant's personal physician, although such input may be helpful. In legal cases involving WTN, it is critical that expert witnesses in acoustics and health be able to reconcile their positions with the reports and standards of the WHO,[165] the International Organization of Standards (ISO),[166] and the American National Standards Institute/Acoustical Society of America (ANSI/ASA)[167] that have linked low-frequency noise to symptoms of the type involved in complaints. These acoustical documents and research reports are seldom, if ever, included in literature reviews used by the industry to deny potential health risks. If challenged on the validity of the available evidence, acousticians need to be knowledgeable of the relevant acoustical standards and make sure that they are understood by all parties. In reality, the wind industry's almost universal refusal to cooperate with researchers has made it virtually impossible to conduct proper acoustical or epidemiological studies. The industry has been largely unwilling, or claims it is unable, to shut down or modify operations of its turbines for experimental purposes. To date, such a situation has rarely occurred, most notably in the case of the Cape Bridgewater study.[25]

The veracity of Statement 9 is strongly challenged by the classic address by Sir Austin Bradford Hill,[168] Professor Emeritus of Medical Statistics, University of London, to the newly founded Section of Occupational Medicine of the Royal Society of Medicine. In his essay, Hill shared his thinking about association and causal evidence surrounding environmental disease. He posited nine elements that are critical in establishing causation:

(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).

Extrapolating from Hill's essay, the totality of our knowledge gained from the available evidence must be considered when examining the link between WTN and AHEs. Fortunately, in addition to experimentation, this evidence includes simple tools that are useful, particularly if we are willing to recognize their collective value. Those tools begin, but do not end, with adverse health reporting.

Dr. Carl Phillips, a specialist in epidemiology and science-based policy making, and a former professor of public health, has stated:[169]

> "In cases of emerging and unpredictable disease risk, adverse event reports are the cornerstone of public health research. Since it is obviously not possible to study every possible exposure-disease combination using more formalized study methods, just in case an association is stumbled on, collecting reports of disease cases apparently attributable to a particular exposure is the critical first step" (p. 304).

He gives familiar examples of hazards revealed by adverse event reporting, including infectious disease outbreaks and side effects from pharmaceuticals. He points out that:

> "Pharmaceutical regulators rely heavily on clearinghouses they create for adverse event reporting about drug side effects (and often become actively concerned and even implement policy interventions based on tens of reports)" (p. 304).

Phillips indicates that the case of wind turbines and health fits the same pattern. He describes adverse event reporting as a special type of case study—sometimes denigrated as anecdotes—that generally reports on the rapid onset of a disease that appears to be related to a particular exposure. He advocates self-reporting of adverse events as a highly useful approach in studying the health effects of wind turbines. In addition, he advocates the use of case-crossover experiments as useful and well-accepted sources of epidemiologic information, stating that they are intuitively recognized by both experts and laypersons seeking to assess whether an exposure is causing specifiable outcomes.

Other forms of evidence, all considered scientific, have been or can be used to determine the impacts of WTN on health. These include case studies, case-series studies, and other pre-experimental, quasi-experimental, true experimental, correlational analysis, and single-subject designs. Single-subject designs, like the case-crossover design used by epidemiologists, can also be applied across multiple individuals to reveal relationships between specific interventions and changes in outcomes in individuals or groups. In both designs, subjects serve as their own controls while crossing over from one treatment to another (A vs. B) during the course of the experimental trial. Both are flexible designs and useful in studying events that are infrequent or sporadic. Numerous individuals living near IWTs have experienced health symptoms that have waxed and waned during repeated cycles of exposure (A) and non-exposure (B), which indicates that the wind industry has unwittingly engaged individuals and families worldwide in a series of quasi-empirical studies for many years, without obtaining informed consent from un-enrolled subjects, typically by downplaying any concerns about potential health impacts. The outcomes from these experiments offer some of the strongest evidence available that there is a causative link between WTN and AHEs in some individuals.

According to the WHO,[170] epidemiology is "the study of the distribution and determinants of health-related states or events (including disease), and the application of this study to the control of diseases and other health problems. Although the randomized clinical trial (RCT) is generally considered the *gold standard* of designs for establishing causation, various methods can be used to carry out epidemiological investigations: surveillance and descriptive studies can be used to study distribution; analytical studies are used to study determinants." Epidemiology uses a

systematic approach to study the differences in disease distribution in subgroups and allows for the study of causal and preventive factors.[171] Descriptive epidemiological studies describe the occurrence of outcomes, and analytical studies reveal associative linkages between exposure and outcomes. Descriptive studies include primarily case reports and case-series studies. Analytic designs include experimental studies such as community trials and randomized controlled clinical trials, and observational studies, in which observations can be made retrospectively, concurrently, or prospectively. Observational studies include those in which either grouped (i.e., ecologic) or individual data are collected, the latter normally favored by the scientific community. Those designs involving individual data include cross-sectional, cohort, case-control, and case-crossover studies. Although epidemiological studies rely on statistical analyses of relationships between exposure to specific agents and AHEs in relatively large samples of the population, they are not aimed at revealing the cause of a disease or disorder in specific individuals. A cogent summary of research designs used in *evidence-based medicine* can be found online.[172]

Cross-sectional studies survey exposures and disease status at a single point in time in a cross-section of the population. They measure prevalence, not incidence, of a disease process, and have the disadvantage of difficulty in establishing the temporal sequence of exposure and effect. Also, rare and quickly emerging events may be difficult to detect. Their major advantage is that data can be collected at the same time on all participants, which means the study can be completed in a relatively short time. Notably, several cross-sectional investigations of the effects of WTN exposure have been reported.[44, 97, 98, 99, 104, 149] These studies serve as major contributions to the scientific literature on the subject.

Cohort studies involve an observational design in which a sample of the population is followed to discover new events.[75] They compare individuals with a known risk factor or exposure with others without the risk factor or exposure and aim to determine whether there is a difference in the risk, or incidence, of a disease over time. They tend to be the strongest observational design, especially when the data are collected prospectively, as opposed to retrospectively. Compared to the cross-sectional design, cohort studies tend to require more time, which partially explains the paucity of such studies involving wind turbine exposure.

Case-control designs compare exposures in diseased cases vs. healthy controls from the same general population. Specific disease states must be known prior to initiation, and exposure data must be collected retrospectively. This design can be applied to cases of IWT exposure, despite the fact that it requires the cooperation of affected and unaffected segments of the same population, a circumstance made difficult by attempts on the part of energy companies to

maintain confidentiality and privacy as a means to facilitate wind turbine development in areas involving both participants and non-participants.

In case-crossover studies, which are a special type of case-control design, the *case* and *control* components reside in the same individual. This design is especially useful in investigating triggers of a disease process within an individual. In the behavioral sciences, it is commonly referred to as a *single-subject design*, as already described. The case component signifies the hazard period, which is the time period before the disease or event onset (e.g., exposure to IWTs), and the control component signifies a specified time interval other than the hazard period, namely the non-exposure interval. As already mentioned, wind companies themselves have unwittingly subjected residents to the basic conditions of this design, and results clearly suggest that exposure to WTN leads to a variety of health complaints in some individuals and families. Phillips[79] argues that:

> "A case-crossover study is one of the most compelling sources of epidemiologic data. It consists of observing whether someone's outcomes change as their exposure status changes. This is often not possible because the outcomes only happen a single time as a result of long-term exposure (e.g., cancer) or the exposure cannot be changed. But the observed effects of turbine exposure lend themselves perfectly to such studies because the exposure is transient and the effects, while not instantaneous in their manifestation or dissipation, are generally transient over a period of days or weeks at most. Thus, unlike a case of a lifelong exposure or non-transient disease, where we can only make one observation about disease and outcome per person, the effects of turbines allow multiple observations by the same person, including experimental interventions" (p. 305-306).

Turning to experimental designs, the clinical trial is considered the ideal design to test hypotheses of causation. In a clinical trial, the investigator has control of the exposure to an extent similar to a laboratory experiment. The subjects generally are randomly assigned to one of at least two groups, an experimental and a control group. The experimental group receives the treatment (i.e., exposure in the case of wind turbines) and the control group does not; instead, it usually is subjected to a condition that simulates a generic treatment of some type, and the purpose and procedures of the control condition are explained only after the experiment ends.

A fully developed clinical trial of residents who live near wind turbines has never been conducted, and the reasons are fairly clear if we consider the circumstances surrounding such a trial. In a rigorous trial done to establish the link between AHEs and WTN, the investigator would randomly assign hundreds of people selected from the general population—including adults and children, elderly adults, and chronically ill adults—to either an experimental or a control group. Randomization would control for pre-experimental biases toward or against wind

energy, as well as for other factors that could confound the outcome. The experimental group would be required to spend a significant period (day and night for weeks or months) in homes located between approximately 1,000 ft. and several miles from the nearest wind turbine. The control group would be required to take up residence several miles or more away from the nearest wind turbine, where they would presumably be free from any effects due to extraneous noise or infrasound. Homeowners who leave their homes, as well as research participants occupying those homes, would have to adjust to new residences and modify their work and school activities, eating patterns, and overall lifestyles. Participants in both groups and at least some of the homeowners who vacate their homes for the experiment would have to be reimbursed for their participation, as well as for the costs incurred as a result of their participation, and the research staff would also have to be paid. To maintain some control across sites, the average age and health status within each group should be equivalent, and data would have to be gathered regarding such factors as turbine size, wind speed and other weather conditions, length of time the turbines were operating, terrain, the exact distance of each participating family from the nearest turbines, and actual noise levels present outside and inside the homes. Scientifically rigorous methods for measuring low-frequency noise and infrasound would have to be agreed upon and used. Although self-report via a survey technique could be part of the experimental design, medical examinations and physiological measurements, including sleep studies, should also be incorporated into the research protocol.

While possible, it is not practical to expect such a study design, in its ideal form, to be implemented. Aside from the difficulty of recruiting and enrolling enough families in enough geographic areas to form statistically strong samples, legitimate ethical questions should be raised regarding the exposure of individuals, especially children and other vulnerable individuals, to potentially hazardous conditions. One might conjecture, however, that consent to participate in such a study could be gained from fully informed adults because the effects of WTN are widely believed to be reversible when a period of non-exposure follows a period of exposure.

Statement 10: The nocebo effect, a manifestation of psychological expectations, explains why people complain of adverse health effects when living near wind turbines.

This statement is the core position of some of the most outspoken critics of the view that IWTs cause AHEs. Any discussion of this statement should begin with an acknowledgment that human behavior and beliefs are highly variable and are often driven by psychological and emotional influences, and not just by observations, logic, intellectual knowledge, or cognitive thought processes. It is not surprising, therefore, that some have adopted the view that negative reactions

to wind turbines are based primarily or solely on psychological expectations. Our analysis of the limited literature on the topic leads us to state unequivocally that it is lacking in scientific rigor. Even if the results were as described, the existing studies and observations do not support a conclusion that psychological forces are the only or even primary explanation for most of the negative reactions toward IWTs. Here, we will critically review four papers, all supporting a psychological explanation for the negative reactions.

Chapman et al[173] tested four hypotheses relevant to psychogenic explanations of the variable timing and distribution of health and noise complaints about wind farms in Australia. They obtained records from the wind companies of complaints about noise or degraded health from residents living near 51 wind projects operating between 1993 and 2013 and corroborated those records with complaints documented by three government public agencies, news media records, and court affidavits. Complaints were expressed as proportions of estimated populations residing within 5 km of a wind project. The authors concluded that historical and geographical variations in complaints were consistent with psychogenic hypotheses expressing health problems as "communicated diseases," with nocebo effects likely to play an important role in the etiology of complaints.

Nocebo effects are commonly described as being the opposite of placebo effects. While the *placebo effect* usually refers to a positive reaction to an inert substance—the placebo—the *nocebo effect* refers to a negative reaction to an inert substance—the nocebo. Both effects are psychogenic, but known to exert powerful influences on human physiology, behavior, and attitudes. Essentially, Chapman and his supporters believe that psychogenic reasons are the basis for health complaints about wind turbines, which they believe to be harmless.

Our major criticism of the work of Chapman et al is that wind companies typically engage in practices that discourage local residents to complain. These companies require participating residents to sign contracts before turbines are constructed and before the residents can receive compensation for leasing their land, and they often request non-participating residents to sign contracts prior to initiating a project. Those contracts, which are binding, often include gag clauses that effectively limit resident complaints. The contracts have often stipulated not only that residents refrain from voicing negative views of the wind project, but also that they support the development of future projects. Such conditions create an atmosphere in which is it is highly unlikely that the records of wind companies, governments, courts, or the media will sufficiently reflect all of the complaints that residents have and would voice under less-restrictive circumstances. We argue that the only way to gather accurate data on such complaints is through a survey of either an adequate sample of residents living near multiple wind projects or all such

residents, where residents are free of restrictions by the wind companies. Such data would allow a valid determination of the proportion of residents who experience adverse effects. Whether that proportion is large or small, we could all act on the basis of factual evidence, as opposed to incomplete observations.

Another shortcoming of the study by Chapman et al,[173] which is less well documented but a factor observed in legal cases in which the present authors have been involved, is that residents near IWT projects tend to be delayed in their responses to AHEs. Many of them believe their health problems to be linked to other causes before suspecting that the turbines are the cause. Some or most of these individuals were supporters of wind projects prior to experiencing such problems, as Phipps et al[75] noted in New Zealand. The delay factor would mean that the types of records used by Chapman et al would not likely reflect the reactions of many affected residents.

Crichton and colleagues conducted two laboratory investigations, each of which has bolstered the argument that negative reactions to audible and inaudible WTN can be explained by psychological expectations. Crichton et al[174] conducted what they described as a sham-controlled double-blind provocation study, in which participants were exposed to 10 min of infrasound and 10 min of sham infrasound. Fifty-four participants were randomized to high- or low-expectancy groups and presented with audio-visual information, using material from the Internet that was designed to invoke either high or low expectations that exposure to infrasound causes specified symptoms. High-expectancy participants reported significant increases, from pre-exposure baseline assessment, in the number and intensity of symptoms experienced during exposure to both infrasound and sham infrasound. There were no symptomatic changes in the low-expectancy group. Healthy volunteers, when given information about the expected physiological effect of infrasound, reported symptoms that aligned with that information, during exposure to both infrasound and sham infrasound. According to the authors, results suggest that psychological expectations are sufficient to explain the link between wind turbine exposure and health complaints.

Punch[175] has criticized that study as methodologically weak, on the following grounds:

(1) Subjects were never exposed to infrasound that adequately represented that to which residents near wind turbine projects are subjected. It is extremely unlikely that the employed studio woofer was capable of producing a 5-Hz stimulus; the authors did not describe or show a graph of the output spectrum. Even if a true infrasound stimulus was produced by their equipment, 40 dB (presumably SPL) was not sufficient to represent the level of

infrasound commonly produced by IWTs. Even if a sufficient stimulus had been produced to represent wind turbine infrasound, a 10-min exposure would have been meaningless in representing the duration of exposure that is likely necessary to produce any substantial health symptoms.

(2) In effect, subjects were exposed to two sham conditions. If they had been exposed to infrasound that adequately mimicked infrasound from IWTs (preferably actual IWT infrasound), subjects in both the high- and low-expectancy groups would have had a physical stimulus (in the infrasound condition) that could have overridden, or at least moderated, their psychological reactions.

(3) The design limited the study's external validity, the ability to generalize the results to other populations and situations. Most of the individuals who have reported AHEs from WTN, some of whom have abandoned their homes, are not people who were adequately warned of potential health effects prior to their exposures. In fact, most of them were likely told by the wind company to expect no harmful effects. Again, many individuals who report AHEs were advocates of wind energy prior to being exposed. Because the major premise underlying the study is that people complain of WTN based primarily on expectancies that align with prior information, the study is based on a false premise. Also, the recruitment of university students does not represent the type of subjects who are apt to complain about WTN. This population is probably the least vulnerable to the effects of WTN in that few, if any, were very young, very old, likely to have chronic health conditions, or disabled. Also, they are more likely to exhibit a response bias because they are less likely than prospective residents of a wind project to believe that they might be harmed by participating in an experiment. Furthermore, the extensive use of pretesting introduced reactive or interactive effects that could have affected post-test behaviors and ratings. Finally, the use of a laboratory setting and short exposure times, as opposed to a real-life setting in which wind turbine blades are turning at night and the subjects are inside a home, introduced situational effects that limit the ability to generalize the data. The authors admit this shortcoming in their statement:

> "… exposure to infrasound in a listening room purpose (sic) built for sound experiments may not be directly comparable to exposure to infrasound from a wind farm" (p. 4).

(4) This was an experiment whose outcomes could have been predicted, given the conditions employed. Aside from the fact that the outcome had virtually nothing to do with the real-world conditions of exposure to infrasound from wind turbines, none of the factors that influence how expectations can affect perceptions through top-down, or cognitive- based, processing, as opposed to bottom-up, or stimulus-based, processing, were controlled or even

discussed. (Interested readers should refer to Williams[176] for examples of the effects of top-down processing and for a discussion of how such experiments might be improved.)

In a second laboratory study by Crichton and colleagues,[177] similar in design to the first, the authors investigated whether positive expectations can produce a reduction in symptoms and improvements in reported health. Sixty participants were randomized to either positive or negative expectations and subsequently exposed to audible wind turbine sound and infrasound. According to the authors,

> "Participants were … exposed to infrasound (9Hz, 50.4dB) and audible wind farm sound (43dB), which had been recorded 1 km from a wind farm, during two 7-minute listening sessions. Both groups were made aware they were listening to the sound of a wind farm, and were being exposed to sound containing both audible and sub audible components and that the sound was at the same level during both sessions" (p. 2).

Prior to exposure, negative-expectation participants watched a DVD incorporating TV footage about health effects said to be caused by infrasound produced by wind turbines. In contrast, positive-expectation participants viewed a DVD that:

> "…framed wind turbine sound as containing infrasound, sub audible sound created by natural phenomena such as ocean waves and the wind, which had been reported to have positive effects and therapeutic benefits on health" (p. 2).

The authors described the results as indicating that during exposure to audible wind turbine sound and infrasound, symptoms and mood were strongly influenced by subject expectations. Negative-expectation participants experienced a significant increase in symptoms and a significant deterioration in mood, while positive-expectation participants reported a significant decrease in symptoms and a significant improvement in mood. The authors concluded that if expectations about infrasound are framed in more neutral or benign ways, then it is likely that reports of symptoms or negative effects could be nullified.

That second investigation by Crichton and colleagues has some of the same methodological weaknesses as the first, particularly with respect to the use of what was described as experimental infrasound. Again, recordings of WTN were used, and no description of the recording instrumentation was provided, leading us to assume that the instrumentation may have been incapable of accurately reproducing infrasound, and thus its true effects. All participants were informed of the purpose of the study, which was:

> "…to investigate the effect of sound below the threshold of human hearing (infrasound) on the experience of physical sensations and mood" (p. 2).

Preferably, the purpose should have been divulged only after the data were gathered because the description of sounds as those that humans cannot hear would presumably have established a mind-set, or bias, in both groups that the sound would have little impact. That preconception could have confounded any reactions to the different DVD messages. Another criticism of the study is that wind companies frame their turbines in the best possible light, so positive expectations have already been established in the minds of most wind-project participants and non-participants. Despite neutral or positive framing that has sometimes included assurance that the turbine sounds would be no louder than that of a refrigerator (see, for example, Chen & Narins[178]), the consequences of living near IWTs are catastrophic for some residents.

Tonin et al[179] repeated the experimental work of Crichton and her colleagues by using specially modified headphones to produce infrasound, as opposed to the loudspeaker system used in the previous studies, and exposed participants to 23 min of infrasound, as opposed to the 10-min exposures in the Crichton studies. Similar results were reported, suggesting that the simulated infrasound had no statistically significant effect on the symptoms reported by volunteers, while the prior expectations the volunteers had about the effect of infrasound had a statistically significant influence on the symptoms reported, thereby supporting the nocebo effect hypothesis. Some of the same criticisms of the Crichton et al study[174] levelled by Punch[175] also apply to the Tonin et al study, as participants were not being stimulated by sufficient durations or peak levels of infrasound exposure to which residents living near IWTs are exposed, and participants were effectively exposed to two sham conditions, denying them any opportunity to experience realistic infrasonic stimuli that could have overridden or moderated their psychological reactions based on expectancy.

In a related study, Taylor et al[180] assessed the effect of negatively oriented personality (NOP) traits (Neuroticism, Negative Affectivity and Frustration Intolerance) on the relationship between both actual and perceived noise on "medically unexplained non-specific symptoms (NSS)" (p. 338), presumably their euphemism for Pierpont's Wind Turbine Syndrome.[4] Households within 500 m of 8 0.6-kW micro turbine installations and within 1 km of 4 5-kW small wind turbines in two U.K. cities were surveyed, and 138 questionnaires were completed and returned for analysis. Turbine noise level for each household was also calculated. There was no evidence for an effect of calculated noise on NSS. A statistically significant relationship was found between perceived noise and NSS for individuals high in NOP traits.

That study is similar in concept to those performed by Crichton and colleagues,[174, 177] with virtually the same conclusion—that the link between wind turbines and AHEs has a psychological origin. The study can be criticized on several grounds:

(1) Only smaller wind turbines were investigated; there is virtually no literature demonstrating that such turbines produce noise levels of any consequence to humans. The fact that no relationship was found between "calculated actual noise" from the turbines and participants' attitudes toward wind turbines was thus predictable because the noise levels were either too low to affect attitudes differentially or were completely inaudible.

(2) The authors state:

> "Actual noise turbine level for each household was also calculated" (p. 338).

Calculated levels (from noise maps) are not necessarily actual levels, so this procedure was, at a minimum, mischaracterized.

(3) It should not be surprising to find that individuals with negatively oriented personalities respond negatively to WTN, as they would likely respond negatively to almost any stimulus. However, the findings, as acknowledged by the authors, resulted from reports of participants' retrospective perceptions of noise from turbines and symptoms at the same point in time, possibly resulting in common-method variance and retrospective bias. Also, although the authors reported a statistically significant relationship between NSS and negatively oriented personality, the reported variance explained by those relationships was quite low. That finding suggests that a meaningful (i.e., clinical) significance was not established, in which case one might reasonably question whether symptom reporting in the study was actually linked to negative personality type.

(4) Among other possible confounders, individual differences are likely to have complicated the authors' analyses (see Williams[176] for an explanation).

To conclude this section, we believe that while psychological expectations conceivably can influence perceptions of the effects of WTN on health status, no scientific studies have yet convincingly shown that psychological forces are the major driver of such perceptions. Based on the bulk of literature covered in this review, those drivers are the physical stimuli themselves and the internal physiological reactions they induce.

Statement 11: Only relatively few people, if any, are adversely impacted by wind turbine noise, and the majority have no complaints.

As indicated earlier, most of the studies that have documented specified percentages of the population adversely affected by WTN have been those focusing on annoyance, as opposed to health. While the exact percentage of people whose health is affected by WTN has not been accurately determined, countless reports worldwide suggest that the acoustic energy emitted by

IWTs is harmful to the health of substantial numbers of people. As already noted, Phipps et al[75] found that 45% of households living as far away as 4 km from a wind project and 20% of households living up to 8 km away reported hearing turbine noise. Those figures take into account only the audible noise, of course, and not the inaudible infrasound, and they do not account for any documented adverse impacts.

Estimates of the percentage of people adversely affected by WTN should not be based solely on questionnaire surveys of populations known to be experiencing health problems, due to selection bias. Such surveys can be helpful in arriving at rough estimates of AHEs, however, but only if those surveys also report estimates of the total population from which the affected sample is drawn. The main value of surveys that include only affected individuals (e.g., Harry[74]; Pierpont[4]; The Acoustic Group[25]) is that they strongly suggest that substantial numbers of people living near wind turbines suffer health symptoms. For example, Harry[74] reported that 81% of her 42 survey respondents had health complaints, 76% had visited a doctor regarding those complaints, and 73% reported a reduced quality of life. In a somewhat more representative survey of residents living within 15 km of a wind turbine project—most of whom lived within 3 km—Phipps[76] found that 42 of 614 households who responded to a questionnaire (6.8%) reported occasional sleep disturbance, another 21 (3.4%) reported frequent sleep disturbance, and an additional 5 (0.8%) reported sleep disturbance most of the time due to WTN. Eleven percent of households, therefore, reported suffering at least occasional sleep disruption due to the wind turbines. Fifteen percent of respondents to that survey reported that they had suffered at least occasional reductions in their quality of life since the turbines became operational.

Despite the lack of definitive scientific evidence, we cannot ignore the numerous accounts of such effects reported worldwide on the Internet, in legal proceedings, and in news accounts. Krogh et al[96] have reviewed studies that document such incidents, many of which have involved the abandonment of homes. In a 2010 report commissioned by the Ontario Ministry of the Environment, the engineering firm of Howe Gastmeier Chapnik Limited,[112] despite its general conclusion that Ontario IWTs do not pose a risk to human health, stated:

> "The audible sound from wind turbines, at the levels experienced at typical receptor distances in Ontario, is nonetheless expected to result in a non-trivial percentage of persons being highly annoyed .... research has shown that annoyance associated with sound from wind turbines can be expected to contribute to stress related health impacts in some persons" (p. 39).

In conclusion, we should recall that Phillips[169] advocates self-reporting of adverse events as a critical element in the study of the health effects of wind turbines. As stated earlier, he has noted

the importance of case-crossover experiments as useful and well-accepted sources of epidemiologic information. Numerous households around the world have been subjected to this type of quasi-experiment by the wind industry. It is unfortunate that an accurate count of these incidents has never been tallied formally and scientifically. Although that task must be left to future research, we should regard complaints of AHEs from individuals living near wind turbine installations seriously, when they occur, and the wind industry must act responsibly by siting its turbines at distances from residents that protect health and quality of life.

It is widely accepted that the industry has warned that tighter siting restrictions will destroy its prospects for growth. Such growth, however, should not continue in areas where there are probable and potential risks to human health. There are regions of the U.S. and other countries where turbines can operate safely, presumably without such risks. Some examples of those sites are illustrated in Figure 2.

Statement 12: There is no evidence in the literature to support a causative link between wind turbine noise and adverse health effects.

The above review has been aimed specifically at addressing this point, which is often cited as factual by wind industry advocates in the literature and in legal proceedings. Namely, there is an abundant literature, much of it peer-reviewed and authored by highly reputable researchers, indicating that audible and inaudible noise emitted by IWTs adversely impacts the health and well-being of substantial numbers of people who are regularly exposed to wind turbines. It is clear that the literature reviews and papers claiming no AHEs fail to include important studies, international standards, guidance from the WHO, and research conducted on wind turbine noise and other sources of infra- and low-frequency sound. Whether this is through oversight or calculation, only reports that cite scientifically credible references should be considered legitimate sources of information. Our review has shown that it is unacceptable simply to state that the literature contains little or no evidence of a causal link between WTN and AHEs. At a minimum, those effects have been shown to be regularly correlated to living in proximity to IWTs, and there is sufficient evidence that those effects are highly associated with objective measurements of audible noise and infrasound.

Although sleep disturbance and its associated impacts on health and quality of life appear to be the most salient consequences of IWT noise, varying health effects that are unrelated to sleep have also been widely and consistently reported by different investigators. While not everyone who is exposed to IWTs suffers AHEs, it is incumbent on governmental officials and the wind industry to take seriously the health implications of their decisions to locate wind turbines near

residential and other populations, especially vulnerable populations, that are or likely to be negatively affected.

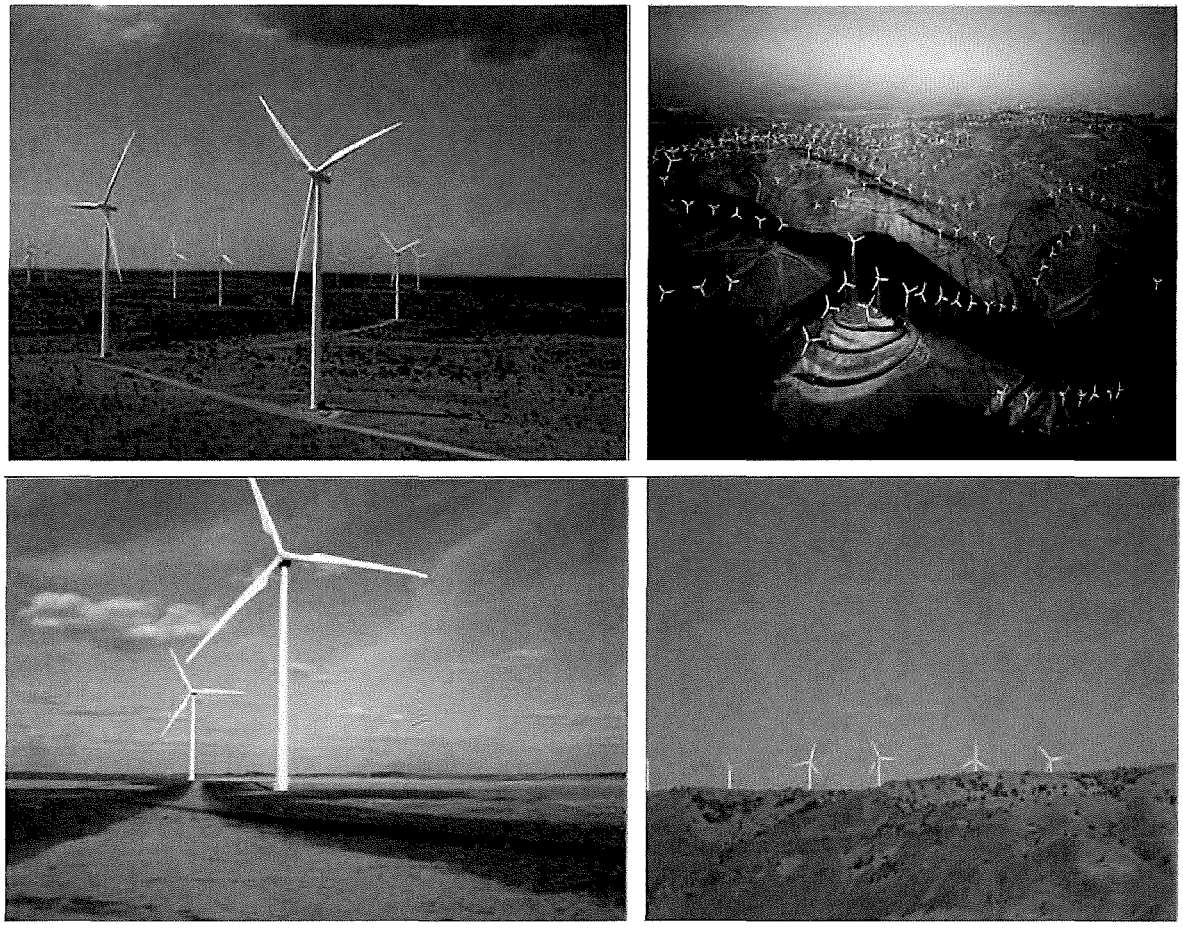


Figure 2. Photographic images of sites illustrating onshore landscapes where industrial wind turbines expose humans to minimal health risks due to large setback distances. Note that homes are not seen in the photos. (Source: https://images.search.yahoo.com/search/images?p=wind+turbine+images+california&fr=tightropetb&imgurl=http%3A%2F%2Fwww.freefoto.com%2Fimages%2F39%2F01%2F39_01_1---Wind-Turbine-Generators--Palm-Springs--California_web.jpg#id=36&iurl=http%3A%2F%2Fmedia-cdn.tripadvisor.com%2Fmedia%2Fphoto-s%2F01%2F70%2Ff9%2Fbb%2Ftehachepi-area-california.jpg&action=close).

Conclusion

We have discussed in this paper various elements of acoustics, sound perception, sound measurement, and psychological reactions, and the role these factors play in support of the view that a general-causative link exists between human health and ILFN emitted by IWTs. The available evidence warrants the following conclusions:

(1) Large wind turbines generate infrasound, which is not normally experienced as sound by most human listeners. Some people, however, experience it in the form of pathological

symptoms such as headache, dizziness, nausea, or motion sickness, which appear to be caused by the excitation of resonances inside closed structures and the human body itself.

(2) WTN has unique acoustic characteristics when compared to other environmental noises. These characteristics include low-amplitude, amplitude-modulated, intermittent occurrences of tones that mirror the peak energy of the blade-pass frequency and the first several harmonics. The coupling mechanisms in the inner ear prevent internally generated sound, but not externally generated sound, from being perceived, which means that perception of wind turbine infrasound is far more disturbing than infrasound generated within the human body.

(3) There is voluminous evidence, ranging from anecdotal accounts from around the world to peer-reviewed scientific research, that audible and inaudible low-frequency noise and infrasound from IWTs lead to complaints ranging from annoyance to AHEs in a substantial percentage of the population. Although sleep disturbance is the most common problem cited, a variety of other health problems has been reported by numerous reputable sources. Recent research is largely consistent with Pierpont's original description of Wind Turbine Syndrome. Research on humans and lower animals has shown that it is biologically plausible that inner ear mechanisms, in conjunction with the brain, can process acoustic energy in ways that result in pathological perceptions that are not interpreted as sound. Both balance and hearing mechanisms appear to be involved in evoking these perceptions. The findings that infrasonic stimuli can amplitude modulate higher frequencies in the audible region, and that infrasound may be more perceptible when higher frequencies are absent, are especially compelling in suggesting that what we can't hear can hurt us.

(4) To prevent AHEs, scientists have recommended that distances separating turbines and residences be 0.5-2.5 mi., and 1.25 mi. (2 km) or more has been commonly recommended. Clearly, the short siting distances used by the industry for physical safety do not protect against AHEs. Alternatively, researchers have recommended sound levels typically ranging from 30-40 dBA for safeguarding health, which is consistent with the recommendation of nighttime noise levels by the WHO.

(5) Annoyance is a health issue for many people living near IWTs, which is consistent with both the WHO's definition of health and contemporary models of the relationships among annoyance, stress, and health.

(6) The scientific evidence regarding factors other than amplitude-modulated ILFN as an explanation for most of the health complaints near IWTs, including electromagnetic fields (dirty electricity), is weak; the preponderance of research suggests that ILFN is the most viable explanation for such complaints.

(7) The A-weighted decibel scale, which effectively excludes infrasound and substantial amounts of low-frequency noise, is inadequate to predict the level of outdoor or indoor infrasound, to reveal correlations to infrasound, or to show a definitive relationship with AHEs. Achievement of these goals requires the development of new measurement methods.

(8) Even though Wind Turbine Syndrome is not currently included in the ICD coding system, that system includes most of the acknowledged symptoms of the syndrome. Medical professionals, therefore, have the necessary tools to evaluate and treat it, and that process has already begun on a limited scale.

(9) While some epidemiologically solid research has been done in the area of IWTs and AHEs, evidence from other sources cannot be ignored. Hill noted the nature of such sources in 1965, and Phillips, in 2011, described the importance of other kinds of evidence, including adverse event reports, in establishing a causative relationship. One of the strongest types of evidence is the case-crossover experimental design, which the wind industry has unwittingly imposed for years on multiple families, many of whom have abandoned their homes to escape IWT noise exposure.

(10) While psychological expectations and the power of suggestion conceivably can influence perceptions of the effects of WTN on health status, no scientifically valid studies have yet convincingly shown that psychological forces are the major driver of such perceptions.

(11) Accurate estimates of the percentage of people who are affected by IWTs exist only for annoyance, not AHEs. Multiple reports, however, emphasize the relationships that exist between annoyance, stress, health, and quality of life, and indicate that a non-trivial percentage of people who live near IWTs experience AHEs. Those reports are consistent with thousands of reports worldwide. Although it seems reasonable to conclude that noise from IWTs does not cause AHEs in the majority of exposed populations, and that accurate estimates of AHEs are yet to be established, it is also clear that considerable numbers of people are affected and that they deserve to be heard and protected from adverse health impacts.

(12) The available literature, which includes research reported by scientists and other reputable professionals in peer-reviewed journals, government documents, print and web-based media, and in scientific and professional papers presented at society meetings, is sufficient to establish a general causal link between a variety of commonly observed AHEs and noise emitted by IWTs.

Based on all the evidence presented, our fundamental view is that the controversy surrounding AHEs should not be polarized into two groups consisting of either *pro-wind* or *anti-wind*

factions, but rather one in which there is room for a third, *pro-health*, perspective. Essentially, the pro-wind view is that IWTs should be installed wherever feasible, that definitive scientific research is lacking to indicate that turbines cause AHEs, and that if you can't hear it, you can't feel it. The anti-wind view is that IWTs should not be installed anywhere because wind is not an economically viable source of renewable energy, that all government subsidies and development efforts should end, and that what we can't hear can hurt us. A pro-health view is that there is enough anecdotal and scientific evidence to indicate that ILFN from IWTs causes annoyance, sleep disturbance, stress, and a variety of other AHEs to warrant siting the turbines at distances sufficient to avoid such harmful effects, which, without proper siting, occur in a substantial percentage of the population. That view holds that what we can't hear can hurt some of us, and that the precautionary principle must be followed in siting IWTs if such health risks are to be avoided. Industrial-scale wind turbines should not be located near people's homes, educational and recreational facilities, and workplaces. It is our belief that the bulk of the available evidence justifies a pro-health perspective. It is unacceptable to consider people living near wind turbines as collateral damage while this debate continues.

Further scientific investigations of the dose-response relationship between IWT noise and specific health effects in exposed individuals are sorely needed. However, people should be protected by conservative siting guidelines that recognize the concerns raised in this review. Hopefully, such research can and will be planned and executed by independent researchers with the full cooperation of the wind industry. The major objective of such research should be to reveal directions for the industry in balancing the energy needs of society with the need to protect public health.

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ATTACHMENT 12

RECROSS-EXAMINATION

BY MS. PAZOUR:

Q. I have a question for you. Like infrasounds next to a wind turbine, like with somebody that's sensitive to noise, would that be more bother some for them?

A. If that person had this particular sensitivity that we've been talking about, then yes.

Q. Like somebody with like a -- like a hearing aid.

A. No. No. I don't think that would make any difference.

Q. With the ear or nothing?

A. Huh-uh.

MS. PAZOUR: Okay.

MR. DE HUECK: Did you have anymore questions?

CHAIRWOMAN FIEGEN: She can just word it, and you'll make a decision.

MR. DE HUECK: Just throw it out there. Throw it out there.

Q. I guess is it possible between infrasounds and reversible systems that the inner ear could feel infrasounds?

A. That sounds like a question for one of those doctors mixed up in this thing.

MS. PAZOUR: Okay.

MR. DE HUECK: Okay. Mr. Hessler, thank you for

your testimony. You're excused.

(The witness is excused.)

MR. DE HUECK: We'll break for lunch and plan on getting things rocking at 1:45.

(A lunch recess is taken.)

MR. DE HUECK: Welcome back, everyone. We're going to get back in our proper order. We're back in session in EL18-026. I guess we are missing an Intervenor but I'm sure she'll be here soon. And we'll let Reiss continue with his case in chief and call his next witness.

MR. ALMOND: Intervenors call Rick James.

MR. DE HUECK: Mr. James, we can see you up there on the Skype TV. And welcome to South Dakota James James thank you.

MR. DE HUECK: My name is Adam de Hueck. I'm the hearing examiner for this proceeding and I'm going to go ahead and swear you in.

(The oath is administered by Mr. de Hueck.)

MR. DE HUECK: You are sworn in. Go ahead, Mr. Almond.

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Mr. James, can you introduce yourself to the Commission and briefly describe your education and

experience?

A. My name is Richard James. I go by the name Rick for all practical and business persons, Rick James. I'm an acoustician who has been working in the field of measurement noise and the impact of noise on people since the late '60s, officially 1972 after I formed a new company.

I started working for Chevrolet motor division and left them to form my own company in 1972.

In the intervening years my companies -- and I had two -- became the consultants who were considered the subject matter experts for noise to corporations like General Motors, good year, Anheuser-Busch, major corporations who had both employee issues and who desired to keep their names out of the newspaper for noise complaints with community noise.

So my focus has always been on how do you design a new project or how do you operate a project so as to minimize the adverse impacts on a community and on workers although it's less of an issue here. And I am very much a pro business acoustician but my focus is not on getting the project done one way or the other. It's getting a project done that's compatible with a host community.

In 2006 due to some serious health issues with my

heart, my partner and I closed my old company, James Anderson and associates and I decided that I would go into semi retirement. Shortly thereafter, actually almost immediately there after I started getting calls from people in Michigan where wind projects had been proposed. One of those wind projects is actually one that Mr. Hessler worked on back in the late 2000s.

My first analysis of that was these machines don't belong in quiet rural areas. They're going to cause a problem. And I presented that to the County Commissioners but they decided to build the project my way.

Since then I have focused mainly on wind turbine noise, although I do other types of complaint driven noise generally as an expert related to hearings like this or lawsuits. I don't seek out just general business. At 70 years old I need a little bit of time off.

Over the past 10 years I've really become very interested in one issue of why is it that wind turbines which don't produce high levels of audible noise as measured on a dBA scale generate so much complaints and why are we seeing symptoms such as dizziness, tinnitus, migraines, pressure, odd sensations that have nothing to do with audible sound? And so that's led me into the

area of kind of going into detail into infrasound.

Q. I think that's a good recap of your experience unless you want to add anything in addition to that that you think --

A. Well, I was just going to add one thing. In 2009 I had an opportunity to use very high end acoustical equipment, and that was the first time we managed to measure the infrasound pulses from wind turbines.

The measurement methods that I used were the same ones that the Shirley Wind study team used. And since then I have focused basically on that type of measurement, along with micro barometers.

So I'll open it up for any of your questions, Mr. Reiss.

Q. Thank you, Mr. James. Did you prepare prefiled testimony in this matter?

A. Yes, I did.

Q. And that prefiled testimony has been marked as Exhibit I-1. I understand you want to make a change to that testimony?

A. Yes, I do.

Q. And what change to the testimony do you want to make?

A. This is on page 1, line 24. The question is, "what experiences have you had that qualify you as an and it

currently reads health expert in cases involving wind turbine noise."

I would ask that the words "a health" be scratched out and be replaced with "an acoustical." So it would read what experiences have you had that qualify you as an acoustical expert in cases involving wind turbine noise.

Q. Are there any other changes to your prefiled testimony that you'd like to make?

A. None that are substantive.

Q. And long with your prefiled testimony were there exhibits attached to that?

A. Yes, there were. There were five exhibits.

Q. I count six?

A. Six. Excuse me.

Q. And those have been marked as Exhibits 1-1 A through F.

A. That's correct.

Q. And during the course of this proceeding did you have an opportunity to respond to some questions raised by the PUC Staff via a data request?

A. Yes, I did.

Q. And I don't know if you have Exhibit I-34 in front of you.

A. Yes, I do.

Q. Okay. And are those the responses that you provided

in response to questions raised by PUC Staff?

A. Yes, they are.

Q. At least responses next to your name?

A. Yes.

Q. And if I were to ask you all of the questions that are included in your prefiled testimony, as well as those questions that the PUC Staff asked you, would you give the same answers today?

A. Yes, I would.

MR. ALMOND: At this time I'd move for the admission of Exhibit I-1 as well as exhibits I-1 A through F.

MS. EDWARDS: No objection from Staff.

MR. DE HUECK: I'll hear any objection from Prevailing Wind.

MS. SMITH: No objection.

MR. DE HUECK: So admitted, Mr. Almond.

Q. Mr. James, were you listening in to the testimony from earlier this morning?

A. I was able to hear parts of it.

Q. And there was some discussion about the measurement of infrasound, how to do it, et cetera. Have you ever measured infrasound?

A. Yes, I have.

Q. And how far have you measured infrasound -- let me

ask you a different question.

Have you ever measured infrasound generated by a wind turbine?

A. Yes, I have. Very specifically I understand turbine from a sound as contrasted to other types of infrasound from wind. Low frequency trucks, et cetera.

Q. And in your -- how many times have you measured infrasound generated by wind turbines?

A. I probably measured infrasound in over 50 homes ranging from projects here in the U.S., ridge top projects out west to -- in Oregon, New York, Massachusetts, Maine, West Virginia, Michigan, Wisconsin, Illinois. Pretty much almost all of the states.

And those measurements are always inside a home because it is almost impossible to get an accurate infrasound measurement outside of a home.

Q. And in your experience -- and I think a question was asked earlier, approximately how far infrasound from a wind turbine can travel, can you answer that question?

A. Yes. And if you'd give me permission, I'd like to reference one of my exhibits, which gives a visual depiction, and that is -- I guess it would be my Exhibit 5, which was three pages of densely annotated color charts.

Q. And I think you're referring to what your Exhibit 6

was which was Exhibit I-1 F. And it's a three-page exhibit with colorful graphs. Is that what you're referring to?

A. That's what I'm referring to, yes. Colorful graphs.

Q. Okay.

A. Pictures.

If we could look at page 3 of that exhibit, I'll explain it because I'm sure that it's not self-explanatory to most people.

These two graphs, the top one and the bottom one, represent measurements using a micro barometer and that's an instrument designed specifically to measure infrasound that was left in a home. In both cases -- the one on top represents a home that's actually the same home that Mr. Hessler was talking about, R-1 from Shirley Wind, where the people living in it were very sensitive to the infrasound, and the top one shows a period of about, oh, let's say 12 hours or so from the left to the right.

The bottom one is a home 4 miles away over much of the same period. If you look at the big circle with -- the big white circle with the dashes, those two correlate to the same time period.

What we're looking at in the top graph, you'll see these horizontal bands of light blue lines. Those are the spikes or the tones produced by the wind turbine

blade as it passes in front of the tower, releasing the energy causing a pulse. And when we look at it over compressed into like a 12-hour window they begin to look like narrow bands. This is actually specific enough in this case you can see where the solid circle is on the top, you can see the waive. And that shows that the wind turbines that were being measured were changing in RPM.

So we can trace -- using this kind of a method we can trace very specifically the sound from a wind turbine as contrasted to other sounds.

If we look over at the right-hand side of that graph, just to the right of the white solid circle, we see a period where wind turbines aren't operating. And so the comparison between what's happening in the home when the wind turbines are operating within that dashed circle and then when they're not is dramatic. We see that there's no longer any tones. There's also a lot less scatter on the bottom, the red and yellow spikes along the bottom.

We come down to the bottom graph, this shows a home for the same period of time roughly four miles away. And we can see within the dashed circle there that even at 4 miles these horizontal bands which represent the wind turbine tones are still distinctive.

So what this shows is that even at a distance of 4

miles infrasound inside a home is measurable, and the occupant of that home, the reason we were there was reporting to the Brown County board of health that she was suffering headaches whenever the wind turbines operated.

Now when I investigated the home I found that it was impossible to see the wind turbines from their home. They're actually down in a little valley with a hill separating them from the wind turbines so there wasn't even a line of sight.

My point here is that people who say that wind turbine noise blends in with the background, infrasound or that it's not measurable beyond a short distance, really that's a result of them not having the right tools and not having the right analysis methods, properly analyzed a simple instrument like a micro barometer produces very clear graphs.

And this has now become a norm within measuring wind turbine from a sound micro barometers are the preferred tool because of their simplicity and the durability of infrasound sonic microphone is very delicate, very expensive. A micro barometer is durable enough you can drive a truck over it if you need to.

So that's my explanation for how far. And also to show just how clearly wind turbine from a sound can be

defined when properly measured.

Q. And have you had the opportunity to review that German study that was attached to Dr. Roberts's Direct Testimony?

A. Yes, I did.

Q. That discussed the measurement of infrasound and seemed to suggest that infrasound dissipated at 700 meters?

A. Yes.

Q. Do you have a response for that?

A. Yes. And I believe this corresponds fairly well with what Mr. Hessler said this morning.

When you have a microphone outside, any air movement over that microphone will generate what's called pseudo noise. It looks like noise but it's really just the air movement causing the microphone diagram to move. So it's not surprising that they were doing tests outside and couldn't find any difference between the wind turbines on or off because they weren't measuring -- they weren't measuring wind turbine infrasound. They weren't measuring ambient wind turbine sound or nonwind turbine sound. They were really just measuring the artifact of wind blowing over the microphone.

This is a common mistake. I've seen it in Australian studies I've seen it in others. The other

mistake in that report is that they started with the premise that unless the sound pressure levels were sufficient to be audible -- this is the threshold of audibility -- that they weren't of any significance.

And what we have found in fact we've known since the 1980s when Dr. Neal Kelly first did an experiment using pressure pulsations what we found is when the infrasound is pulsed, when it occurs as a whoomp whoomp whoomp although you feel it rather than hearing it, that the human vestibular system can pick that up.

And the sensations when they're picked up, when people have that sensitivity -- we can get into Dr. Schomer's paper later that explains how that happens. But when the vestibular system is triggered the body tends to produce nausea. It's an impact caused by the eyes are giving a certain input. The body sensations don't pick up movement. But we have vestibular data saying something's moving.

The end result of that is people get dizzy or they get nauseous or they have headaches.

Q. Thank you, Mr. James.

Q. Are you familiar with the Steven Cooper study that we've been discussing quite a bit this morning?

A. Yes. I've worked with Steven Cooper since my first paper in 2010 demonstrating how to measure the infrasound

sonic pulses. Steve modeled his study at Cape Bridgewater after the design that we used at Shirley and at other studies.

I also helped him in his analysis of his data and I'm quite familiar with it.

Q. And did you hear testimony from Mr. Hessler this morning that said once he saw this Cooper study it really linked up in his opinion the issue of infrasound and the complaints related there to? I guess can you just expand on that or comment on that and how that relates to everything you've just been talking to about infrasound?

A. Okay. Yes. I can expand upon it.

As I said back in the 1980s Dr. Neal Kelly working for the Department of energy and NASA did a study of early model wind turbines and the complaints of -- the similar complaints of dizziness, nausea, tinnitus, headaches, et cetera, and he concluded that it was from an infrasound sonic pulse caused by the blade passing in front of the tower.

The wind industry was aware of that. It was presented at conferences but has chosen instead to argue and do so very effectively that unless the pressure pulses exceed the threshold of audibility that they can't be perceived. The source of that is an acoustician in Brittain called Dr. Jeff Leventhal who said if you can't

feel it you can't hear it. I mean, if you can't hear it, you can't feel it.

The problem here is Dr. Kelly moved him wrong four years after he made that statement. But that concept of that infrasound has to exceed the thresholds of audibility has been promoted very heavily through other acousticians who have picked up on it, not done the proper research and have repeated test after after test saying well I've tested wind turbines in Australia and they don't exceed the threshold of audibility so there can't be any problem.

But there is a problem. In fact, the German paper you referenced earlier made an interesting comment. They said they noticed some tones it the very low frequent infrasound but those didn't matter. Actually those are the ones that matter. So that whole German paper and many of the others that are similar to it have consistently ignored the place where the problem is, looked at places where the problem is not and then concluded there is no problem, which whether for the purposes of pleasing a client or through improper research has led to the confusion we have.

We know that -- we know that infrasonic pulses can be perceived. My home office where I'm sitting right now is on the flight path between Detroit and Lansing for

helicopters. The Governor comes in and out of this area all the time. I can hear that helicopter coming thump thump thump of its blades long before it's audible.

I've had many people who were combatants in either Vietnam or the Iraq wars who said they can also feel infrasound long before it's audible. With people --

I wrote a paper in 2012 often sick building syndrome, the other evidence, when people are in large buildings and the large high-rise buildings, knowledge worker high-rise offices, if the fan is a little bit out of balance, it causes a pulse and people begin to make the same complaints.

Acousticians who have dealt with these low frequency problems over the years have no problem understanding why people in homes in wind projects are having complaints. It's the acousticians who have not dealt with that who seem to be causing the confusion.

Q. Thank you, Mr. James. I want to switch topics now away from infrasound and focus -- talk a little bit more on your prefiled testimony, page 3 and the ANSI standard ASA S 12.9 and this notion of modeling the community's response to a new project.

And I think we heard some testimony earlier from Mr. Hessler so if you could just explain how that concept ties into this project.

A. Well, there are standards that we follow as acoustical professionals to try to guide our work. One of them is the standard ANSI ASA -- I'm reading line 69 of page 3, S 12.9 part 4, noise assessment and prediction of long-term community response.

This is a standard designed, for example, when I was designing noise for new automotive plants that I would refer to as a way to determine what would be the type of levels that would be acceptable.

That standard includes a caution in part 4 of appendix F that says F 3.4.4 "in newly created situations especially when the community not familiar with the sound source in question higher community annoyance can be expected and that difference is worth up to 5 dB."

Also if there's in quiet rural communities there's a greater expectation for piece and quiet worth 10 decibels. And if you take the two factors and for a project like Prevailing Winds both would apply what this is saying is that guidelines that would be compatible in the Suburban environment for example 45 dBA need to be reduced either by 10 or 5 dB to result in the same level of annoyance for a quiet rural environment.

And it's this part of -- it's this part of our professional standards that seem to be routinely ignored by people like Mr. Howell. We can't quibble -- we can't

equate annoyance potential for a community that is rural, residential to one that is more adjusted to noise. If people come to the wind turbine project, then they have no expectation of quiet. But they move there with the expectation of peace and quiet. The project's coming to them. Therefore, the burden should be on the project developer to not increase annoyance.

And levels of 40, 45 dBA, as I show in my testimony with the Health Canada will result in about one out of every 10 people -- one out of every 15 people people being highly annoyed. And highly annoyed means they're annoyed enough that over a long-term we have health effects, whether the annoyance is due to sleep or due to dizziness or nausea, whatever the high annoyance may be, the result is that over periods of weeks or months it leads to deteriorating health.

And that's what this whole section of ANSI is trying to avoid. When you have people whose live style is for quiet -- they sleep with their windows open. They enjoy the outdoors, then a new noise source that may have been more than acceptable in an urban environment or Suburban environment becomes a serious source of complaints.

Q. And have you seen the ambient measurements taken for this project area?

A. Yes, I have.

Q. And what are the -- what's your opinion in terms of this area and the ambient measurements of the area?

A. Well, I looked at the table that Mr. Howell presented. I know he summarizes it as ranging from 21 to 45 dB. And the only columns on those that are of significance for background sound are those labeled L90, the 90th percentile. The LEQs are of little use for anticipating annoyance. But he says the range is 21 to 45.

Well, 45 dB is an outlier. There's no way that a normal, rural community background sound would be that high. But if we look at the table for trends we can see that even at 10 o'clock in the morning, 5 o'clock in the afternoon, and at midnight the sound levels in most of those measurement sites were between 22 dB and maybe 28, 29 dBA. And that's what I find in rural communities.

The other thing is that that includes the sound of normal wind. Not high winds. And then I heard Mr. Hessler this morning talking about wind noise masking wind turbines. That's not the time when people have their complaints. They complain about it when it's a quiet night, no wind at the ground and the wind turbines overhead are whooshing away.

So this background sound level issue is critical. We know that if -- we know that if the project was

designed to not increase that level significantly then we'd have few complaints but we see a project here that looks like it's going to raise the levels anywhere from 10 dB or higher at many of these homes and that is -- that is just a prescription for complaints once the project is permitted and operating. There will be complaints.

Q. And just to be fair, you've never been to the project area, have you?

A. No, I haven't but I've been to many similar projects in Iowa, Illinois, Indiana. All over the -- principally east of the Mississippi. But I've also been involved in projects out in Oregon. And in many of these cases because they were parts of formal proceedings I was privy to the data that the opposing parties' acousticians had taken and able to re-analyze it.

And based upon what I have seen in those studies and what I can see about Prevailing Winds, I think I have a reasonably good understanding of the Prevailing Wind project.

Q. And you said there was no way that one measurement was 45 -- and to be fair to Mr. Howell you don't know exactly what was there next to that measuring tool. There could have been a grain elevator or something like that. But you're exaggerating when you say no way;

right?

A. Well, no way that that's a background sound. A truck could have driven by that had a bad muffler. When we're taking averages with a sound level meter a single loud noise has a very significant impact.

So let's say the sound level was 30 and a truck drives by at 55 but it's only there for a minute, that could easily give you a 45 average over the limit or an L 90 could mean that they parked the truck and was there for the full 90 percent of the time.

Either way a 45 dBA sound level at -- in a rural community means that something not related to the background sounds -- background sounds are those things you hear from a distance they're not the things up close.

They're when you walk outside at night you can hear the barking dog in your neighbor's farm a quarter mile or a half-mile away. Those sounds that you hear are the background sound and that's what our auditory system uses as the basis for assessing annoyance. It's always comparing the sound it's hearing to those quiet periods. And that's why when you put a noise source into a quiet community you can expect complaints.

Q. And the question was raised earlier about whether or not once a noise source is introduced to a quiet area if the area will just get used to that noise source. Can

you respond or answer that question?

A. Yeah. I can respond to that. I'll first respond with a study that was done in Britain back in the 2000s in which they found that given time, complaints don't decrease. They increase. Or the people become so resolved to the fact that no one will listen to their complaints that they what I say suffer in silence. Or they abandon their homes.

Ontario where there are many projects designed to meet a 40 dBA criteria now have abandoned homes all over the rural communities because people have just left them. Or they were elderly and when they passed away the family just left them to deteriorate.

Having the experience of dealing with people who are the -- who are living in wind projects and who find something objectionable, I call them the complainant, has made me really sensitive to how the ANSI standards about expectation of peace and quiet come into play. And so -- I'll see if that answered your question.

Q. Thank you, Mr. James.

Were you listening in when Mr. Hessler opined on the number of people who have complained about infrasound or complained about the symptoms that they believe were caused by infrasound and that he believes that the number of people who -- you know, who have that sensitivity to

infrasound is very small? Did you hear that testimony?

A. Yes. Yes, I did.

Q. Do you want to respond to that?

A. Well, many of the projects that I've studied are projects that Mr. Hessler and his father developed. And while he may not be aware that complaints occurred, I am constantly in contact, usually as the recipient of e-mails saying here's another day when I couldn't take it.

What happens in the communities -- in the Wisconsin communities in the middle of the state have had wind projects now for almost 10 years. A, the complaints have not stopped. B, the complaints have increased. And, C, the reason why nobody does anything about it is once a project is permitted no one has the funds to contest it.

In Brown County, for example, they declared a 2 and a half mile radius around Shirley Wind as a human health hazard. That's a Wisconsin legal definition for an area that has a problem and they want to notify the public.

When the operator of Shirley Wind was asked to respond to that they just denied that there was any problem. That denial has gone on now for almost eight years leaving the Brown County board of health having monthly meetings on noise and concluding that even the city of Green Bay and the town of -- the County of Brown

do not have the funds to pursue a lawsuit against the utility.

So what answer is there? The answer is it needs to be done right the first time. Once that project is permitted, if the complaints occur, there is no solution that is economically viable, and the I am balancing of funding between the operators and the local communities or for that matter a complainant trying to file a lawsuit is so unbalanced that there will be very little chance of success.

Get it right the first time or you live with it forever.

Q. And have you seen how the Applicant wants this project to be measured in order to comply with a 45 dBA limitation? Have you seen that?

A. I don't know if I remember. I heard Mr. Hessler talking this morning about several weeks worth of measurement and an average level or something like that.

Q. Yeah. The measurement is over a two week level.

A. Yes. That completely misses the point annoyance. Is not about a long-term average --

MS. SMITH: I'm going to object. I'm not sure what the witness has seen what is being asked. And I would also say is going far beyond the scope of the Direct Testimony.

MR. DE HUECK: I was thinking the same thing, that we're having new Direct Testimony introduced on today's date. Though I appreciate you fleshing out some of the unanswered questions just as the Applicant does when they call a witness as well. This one just talks a lot more.

So just keep in mind that we don't need new filed testimony today orally. And, additionally, if you could clarify how sound will be measured for this project before we go any farther.

Q. Do you have access to Exhibit A 33, the PUC's web portal in front of you?

A. I will pull it up here. Prefiled exhibits. It's A --

Q. 33. It's proposed condition --

A. A 33. Okay. Proposed conditions.

Q. Yep. Number 27. If you could read that quickly, please.

A. Okay. That was basically what I understood.

Q. And if you could explain whether you believe that's an appropriate way to measure any limitation on noise and why or why not.

A. That is not an appropriate way to measure wind turbine noise. The reason being that if you measure over a period of at least two weeks the average level will

always be low because there's periods when the wind turbines don't operate.

And the condition that we're trying -- or the characteristic of wind turbines that cause annoyance have nothing to do with the long-term average. They have to do with short-term fluctuations. If for example we did a long-term average and it came out to 40 dBA Leq but we then looked at how the sound fluctuated around that, we would see that there were periods when it might have been 55, periods where it might have been 35. It's these fluctuations above and below the average that cause the annoyance, cause sleep disturbance and are the root of the complaints.

So using a long-term measurement as a criteria is essentially an open door to the project creating annoyance and there being no method whatsoever then to ask for mitigation because over a two-week period it will always average less than 45, particularly if we're looking at a project that was designed where we now say the maximum levels are 42, let's say dBA Leq.

It's the fluctuation that is important, and that's why in my testimony I referenced the use of Lmax or an L10 or some other measurement that looks at the peaks. When someone describes a wind turbine -- and Mr. Howell did -- a whooshing sound.

A whoosh when you describe it means that there is a sound that rises and then falls. What we should be trying to do is eliminate that whooshing sound by controlling how much it can rise. And in our Michigan cases which I think Dr. Punch referenced we said 45 dBA.

Q. I think you've answered the question.

And I've got to push back on you here a little bit because if you read Condition No. 27, it actually I think calls to not take into account when the wind turbines are operational.

If you can look at line 4.

A. Yes, it does. But wind turbines operate over a broad range.

Mr. Hessler, for example, in his Naroof (check) document said that measurements will be plus or minus 5 dB around the predicted mean. So there will be periods during that two weeks where that wind turbine -- let's say it was 40 -- is running at 35, and there will be periods where it's running at 45. And the complaint times are when it's running at 45, not the average over those times.

If we were going to use an Leq or an average as a criteria, it should be a short-term average, a 10 minute average, because anything else is not looking at the characteristic we're trying to control, which is the

fluctuating low frequency noise.

MR. ALMOND: Thank you, Mr. James. I don't have anymore direct for you. We will turn this witness over for cross.

MR. DE HUECK: Mr. James, I'm now going to turn you over for cross-examination, and we'll begin with the Applicant, Prevailing Winds.

THE WITNESS: Okay.

MR. DE HUECK: We're just going to move our video camera over to the attorney who will be questioning you.

(The camera is adjusted.)

THE WITNESS: I have no audio on this end.

MS. SMITH: I think we're all just very quiet Mr. Hessler -- or Mr. James. I apologize.

CROSS-EXAMINATION

BY MS. SMITH:

Q. Mr. James, my name is Mollie Smith. You will see me. I'm raising my hand, if you can see me. I'm over here.

Do you have anyone in the room with you?

A. No, I don't.

Q. And do you have any documents in front of you other than your filed exhibits or the filed exhibits in this case?

A. No, I do not.
Q. You haven't conducted any acoustic modeling related to the Prevailing Winds project; is that correct?
A. No, I have not.
Q. And I would -- that was not part of the scope of your work why you were retained?
A. No, it was not.
Q. And you also did not conduct any analysis of existing sound levels at the project site; is that correct?
A. That is correct. I relied upon the information from Mr. Howell.
Q. And you did not conduct any site specific surveys of either low frequency or infrasound for the project area. Is that also correct?
A. I relied upon the information from Mr. Howell's reports.
Q. In your testimony you indicate that the purpose of your testimony is to provide your opinion regarding appropriate thresholds for audible and inaudible wind turbine sound at nonparticipating properties; is that correct?
A. That would be fair to say, yes.
Q. So given, as you just noted that you didn't conduct any site-specific studies, you're relying solely on the

information that's either provided by others in this Docket -- you're not relying on your own data for the project; correct?
A. As I explained earlier, I have studied many projects similar conditions with similar wind turbines, and I relied upon that plus Mr. Howell's data.
Q. Okay. In your testimony you indicate that you believe the noise limit should be imposed at the property line; is that correct?
A. That's correct. The reason for that is so that the --
Q. You did not cite -- excuse me.
You didn't cite any specific data to support that, did you, in your testimony? Did you cite any specific data in your testimony to support that statement?
A. I stated that -- yes, I did, in my testimony.
Q. Can we go to your testimony, please.
MR. ALMOND: Can the witness be allowed to answer the questions without being interrupted.
MR. DE HUECK: Everything's fine as is.
A. Page 6, line 174?
Q. Yes. And so I'm looking at the first lines -- 175 through 177. It says "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."
There's no citation here for any source to support that statement, is there?
A. Just my belief that I've grown up in the United States where property rights are protected by the government.
Q. So that's your personal opinion?
A. I think that's personal and legal.
Q. You're not testifying as a medical expert, is that true?
A. That's correct.
Q. And you're not a licensed physician. Is that also correct?
A. That would be obvious, yes.
Q. And you are not testifying as an economics expert. Is that also true?
A. That's correct.
Q. And you're not testifying as a psychology expert. Is that also true?
A. Only to the extent that acousticians are cross trained in both health and psychology because otherwise when you investigate complaints you are hampered.
I have 45 years of investing complaints, and I've

learned a lot about people and psychology that would not be tossed in a court. So, yes, I have some background, but it's experience.
Q. It's experience. You're not a licensed psychologist?
A. That's right.
Q. And yet in your testimony you provide statements regarding health effects from wind turbines. Is that true?
A. That is correct. Because as an acoustician I've been trained to read medical journals to interpret them for my purposes.
Q. Object. I didn't ask -- you offered health effects testimony in your written testimony; is that true?
A. Only those within the scope of my profession.
Q. Are your opinions based on complaints that you have heard from people?
A. My opinions are based upon complaints and my own personal experiences.
Q. And again, you're not a medical doctor; is that true?
A. That's true. But I don't see the relevance to your question.
Q. So you have not conducted a medical examination on any of the people that have provided complaints to you;

is that also a fair statement?
A. No. But I've reviewed the medical records that the doctors provided.
Q. I only asked you if you --
Did you rely on other people's work for this as well, other people's studies for your opinions?
A. Yes. The reports from medical doctors who have examined my clients.
Q. Would you agree that anyone who is relying on other people's work that the -- what they're relying on has to also be credible?
A. That is true. But that's the -- that's the purpose of an expert to make that decision --
Q. I'm just going to ask you, Mr. James, if you can just answer my question because I don't -- you'll have your opportunity to elaborate if your counsel so chooses to ask you additional questions.
You provided some exhibits with your testimony; is that correct?
A. That is correct.
Q. And I believe -- and I may have not the same numbering so I will try to look at the versions that are online. Mine are sort of 5 and 6 to your testimony, which may be -- I'll see if I can find yours.
So I think it is listed as maybe I 1 E and I 1 F.

It may also be 5 and 6 on yours. I have two different labels.
A. Okay. Just give me the titles. I'll be able to go from there.
Q. Let's see here.
So I believe that 5 -- what I'm looking at is -- one was one that you referenced previously with the colored charts, so I think that was the last exhibit to your testimony.
A. Okay.
Q. Then the one right before that one, which also has a wind turbine and a chart.
A. Those are the two you're looking at now?
Q. Yes.
A. Okay.
Q. Neither of those exhibits address health effects; is that correct?
A. They explain the --
Q. Do they address health effects?
A. No, they're not on health effects. No, they're not.
Q. Okay. Thank you. And if you look back one exhibit, so that would be 3 or D, I believe -- so this is a possible criterion for wind farms.
A. Okay.
Q. That also does not address health effects, does it?

A. Indirectly it does.
Q. It does not directly address health effects, does it?
A. The recommendation from Dr. Schomer included the consideration of health effects. He mentions the Health Canada Study, which is about health effects --
Q. Does this paper itself address health effects? Not the citations? Does the paper itself address health effects? Do they offer any opinions on health effects in this document?
A. Without having to read it very carefully, I'll say it was not directly about health effects. It was about the criteria needed to prevent them.
Q. If we look then at the noise wind farms article so that would be 2 or B to your --
A. Okay.
Q. If you could turn to the last page in that article. And I -- hold on. I think it would be actually page 13.
A. Yes.
Q. Make sure I'm looking at the correct one here.
So if we look under conclusions at the -- I'm going to read the last sentence of the first paragraph under the conclusion. It says, "Unfortunately then for policymakers there appears to be no proportional relationship between wind turbine noise levels and health

as these outcome factors will be influenced by characteristics associated with both the noise and the listener."
Is that accurate?
A. That is an accurate way of stating a complex set of relationships, not just --
Q. I'm just asking if that is an accurate recitation of the statement in the article.
A. It can't be answered yes or no.
Q. Are those the words on the page?
A. Those are the words on the page, yes.
Q. And if you'll turn then to Exhibit 4, this may also be D. This is called a theory to explain some physiological effects of the infrasonic emissions at some wind farm sites.
A. Okay. I'm going to that now.
Q. And if you'll look at pages 1,364 I think it is, Section 6, it says, "Additional research and data collection recommendations."
A. Okay.
Q. If you look under that it says, "research to date does not tend to just study the effects on humans reported anecdotally in what is probably a minority of wind farms."
Is that an accurate statement?

A. I think Dr. Schomer believed that at the time he wrote the paper. Since then he's seen Steve Cooper's --

Q. I'm just asking about the --

(Discussion off the record.)

MS. SMITH: Mr. de Hueck, for Cheri's sake and mine, could you direct the witness to please answer my questions.

MR. DE HUECK: Yes.

Mr. James, I know you want to elaborate on every single question that's asked of you, but in order for our court reporter to adequately capture this, we can't talk over each other. And I believe Ms. Smith would just like you to specifically answer her questions as asked.

Thank you.

THE WITNESS: Okay.

Q. Mr. James, in that section under additional research and data collection recommendations they're actually making recommendations for additional research to do regarding reports; is that correct?

A. That is correct.

Q. And they provide even a test case in their Appendix A; is that true?

A. That is correct.

Q. Mr. James, you've been retained as an expert witness in other proceedings; is that correct?

A. That is correct.

Q. I believe you mentioned that you participated in a case in Oregon; is that true?

A. That's correct.

Q. So would that be Williams versus Invenergy, LLC?

A. That is correct.

Q. I'm going to -- Ms. Agrimonti is going to send you -- and maybe we can hand this out too.

Give us just a second, Mr. James. We're just handing out -- and Ms. Agrimonti is sending to you what I'm referencing as Exhibit A 36.

And, Mr. James, if you can let me know when you receive it.

A. I have it up in front of me.

Q. Okay. And this is an Opinion and Order from United States District Court, District of Oregon case; is that true?

A. That is correct.

Q. From 2016?

A. That is correct.

Q. In this case were you excluded from testifying regarding the causal health effects from wind turbines?

A. I was excluded from testifying to the cause and effect of wind turbines only to the extent of not having supporting literature because we weren't able to submit it.

Q. Can you turn to page 11 of the case.

A. I assume these are numbered sequentially?

Q. Yes. I believe it's in the lower right-hand corner that you'll see the number.

A. Yes.

Q. And if you'll look at the very last two sentences of the page -- so the initial -- you'll see a 13. It says James. And that James, is that you that it's reference?

A. Yes, it is. Yes.

Q. I'll read the bottom. It says, "He has a long career studying the noise and sound pressure produced by industrial wind turbines. However, he is not a doctor or epidemiologist. As a result, he does not have the training to opine that the infrasound and audible noise created by wind turbines activates physiological mechanisms in the body which produce adverse health effects."

Do you see that language?

A. Yes, I do.

Q. And we were discussing the information that had been submitted. The Court also noted that the documentation that you were relying on for your opinions was also not credible; is that true?

A. I don't -- I don't remember that specifically. Can you point to that?

Q. Certainly. So if we look first at -- let's stay on the same page. I believe you had referenced in your earlier testimony a Dr. Kelly; is that true?

A. That's right. I referred to him earlier in my testimony today, Dr. Neal Kelly.

Q. And so if we look down at the bottom of page 11 over on the left-hand column towards -- at the very bottom, the bottom paragraph, it says, "However, like James's other sources, the Kelly study has significant scientific shortcomings. First, Kelly takes data from only seven subjects. He admits that the experiment would have to be repeated with a much larger number of evaluators population to confirm his results as scientific knowledge. Moreover, there's no evidence that Kelly's study was published in a reputable scientific journal or that it was subject to any manner of peer review."

And I'll skip down to the last sentence. "The study does not support the proposition that wind turbine infrasound is capable of producing broader adverse health effects, including anxiety, panic attacks, and sleeplessness."

Is that accurate?

A. That's what it says.

Q. And if you'll turn back to the prior page, there's a

reference to the Cape Bridgewater study as well. And I believe that's on page 10. Do you see that?

A. **That is correct. Yes.**

Q. If you look at page 9, it also addresses the Cape Bridgewater study and Mr. Schomer's review of the Cape Bridgewater study on pages 8 and 9. Do you agree?

A. **I agree there's that -- they're talking about it but what are you pointing to?**

Q. If you look at the bottom of page 8, it says "The Court agrees with defendants that the Schomer documents do not represent reliable scientific knowledge which James may use as a foundation for his expert conclusions."

Is that accurate? It's at the bottom of page 8.

MR. ALMOND: Objection. Vague. Are you asking if it's -- the statement's accurate, or you're accurately reading the statement or --

MS. SMITH: Yes. I apologize. I should be clearer.

Q. Am I accurately reading the statement on the bottom of page 8?

A. **You're accurately reading it. I don't agree with the Court's agreement, but that's fine. Dr. Schomer is the Emeritus Director of the Acoustical Society of --**

Q. I think that's all. I just needed to know if I read

it correctly.

Mr. James, have you been excluded or had your testimony in part excluded in any other cases?

A. **Not in any significant manner other than issues where it treads into medical.**

Q. So any -- would it be fair to say that you have been disqualified as an expert from testifying regarding health effects?

A. **Only those that are medical. Not health effects that are visually confirmable.**

Acousticians have to be able to listen to the complaints --

Q. I'm just going to stop you there.

MS. SMITH: And I would say that at this point I would move to strike any testimony by Mr. James regarding health effects attributable to wind turbines.

MR. DE HUECK: I'll allow Mr. Almond to respond and Staff if you so wish.

MR. ALMOND: Yeah. In Mr. James's Direct Testimony, written Direct Testimony, he discusses an acoustician's responsibility to be aware of vague health effects -- the general health effects caused by certain wind turbines, facilities, et cetera when looking at projects.

Specifically he talks about -- I mean, it's all

throughout his background in his prefiled testimony. Certainly he can't make any medical diagnosis. He's not doing so here. I don't think he's given the opinion that he's making any diagnoses or anything like that.

So I'd need to know exactly what opinion it is or what statement Mr. James has made that Ms. Smith is looking to strike, I guess.

MS. SMITH: Mr. James is making assertions of a causal relationship between wind turbines and health effects. He is not qualified to do so. He is not --

As his own testimony, he is not a medical doctor. He's not an epidemiologist. He's not a psychologist. There's no basis for him. The literature he's relying on is not supportive of that either, as we're seeing. He doesn't have any basis to make those statements.

MR. DE HUECK: Go ahead, Staff.

MS. EDWARDS: As much as I would like to speed it along, I would argue it goes to weight, not admissibility, and it's an issue that's -- I would intend to brief in my prehearing brief -- posthearing.

MR. DE HUECK: Just in terms of Mr. Fuerniss Mr. Jenkins and Ms. Pazour, I'm assuming you're in agreement with Mr. Almond?

Ms. Smith, I'm going to agree with you. He

should not be testifying about any health effects or rendering any expert opinion regarding medical causation or -- along the lines of what you've stated.

However, I'm concerned what is it that we're going to strike and who's responsible for pointing that out? Certainly it's not Cheri to go back through the transcript and strike it out. So how do we actually deal with figuring out what statements need to be stricken?

To some degree I'd like to allow some of the exhibits he relies on because they're based on infrasound. Not necessarily saying I want to allow it to show that it's causing health effects, but the guy's an expert in infrasound and measuring that type of stuff as an acoustician -- thank you.

MS. SMITH: I can address the exhibits.

From my read of the exhibits, I don't believe that those would support the causation assertion anyway. So to the extent that I'm not -- I don't have a problem with the exhibits themselves coming in, but his testimony -- and I would be happy to propose in a written format -- take his testimony and strike the portions that I believe should be stricken and provide that tomorrow.

MR. DE HUECK: Let's do that.

MS. SMITH: Would that be appropriate?

MR. DE HUECK: That would be appropriate. So

I'm going to go ahead and sustain your objection and your motion to strike, grant that, and we'll figure it out at that point in time.

MS. SMITH: All right. Thank you.

MR. DE HUECK: And then also I'd like to prohibit any -- oh, Commissioner Hanson.

COMMISSIONER HANSON: No. I was waiting for you. I was just signaling you that I had something to say pertaining too before you made your final decision here.

I think that he certainly should be allowed to provide us with his opinion of observable health effects. Certainly not any medical. And I'm parsing it here, but even I would be able to say that Commissioner Nelson was obviously happy to hear something because that's observable.

I wouldn't be able to say what physical reaction he had within his body, any medical effects from it and hearing or things of that nature, but anyone can talk about the health effects that are observable, readily observable.

So I know that makes it more difficult.

MR. DE HUECK: It doesn't make it too much more difficult. I just don't want to get into the gray water of allowing an expert testifier to enter into lay witness

testimony and start elaborating on matters of common knowledge because that's not why he's been here to testify.

COMMISSIONER HANSON: Excellent.

MR. DE HUECK: So, with that, where did we leave off? You're in the middle of cross-examination.

MS. SMITH: That probably concludes my cross-examination at this point.

MR. DE HUECK: So we'll move over to Mr. Fuerniss. Did you have cross-examination?

MR. FUERNISS: No.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: No.

MR. DE HUECK: Ms. Pazour?

MS. PAZOUR: No.

MR. DE HUECK: Staff.

MS. EDWARDS: Yes.

CROSS-EXAMINATION

BY MS. EDWARDS:

Q. Earlier you stated that you were discussing I believe it was somebody else's study, that there were other types of infrasound from wind that needed to be parsed out.

Did I understand that right?

A. The term I used was pseudo noise, I believe. When air -- microphone on a sound level meter is very, very sensitive. If air moves over that microphone and causes a false sound, pseudo noise.

That's why we put these foam balls on top of the microphones, to try to block that wind. Infrasound goes right through the foam balls. So any movement of air around the microphone generates a false signal, particularly in the infrasonic range.

So when they're measuring outside even after they take all of their cautions with foam balls, it's very common to see no difference between wind turbine on or off just because what they're really measuring is the air moving over the diaphragm.

And then Mr. Hessler, I think, agrees with me on this. The proper place to take an infrasound measurement if you want to avoid that is inside the home where the complainant says when I sit in this chair I feel these sensations.

Q. Okay. Earlier you stated that one out of 15 people are -- and correct me if I misstate this. Are at risk of being annoyed; is that correct?

A. Yes. The Health Canada Study found that when the model sound levels were 35 dBA and below, 2 percent of the population were highly annoyed. Between 35 and 40,

10 percent were highly annoyed. And between 45 and above, 14 percent and higher.

That's where I got my numbers from and that's from the Health Canada Study and there was a chart in my testimony graphing those results.

Q. Okay. So you anticipated my next question and answer which was where did the number come from.

Would you say that the majority of your experience with wind turbine noise and its effects on people comes from firsthand observations and measurements at operational projects?

A. For my own?

Q. Correct. Firsthand.

A. Yes. Yes. But I've corroborated that. I have a number of colleagues who do similar work and we compare our notes, we compare our findings and we compare our methodologies.

Q. Have you ever --

A. And we corroborate each other's work.

Q. Okay. Have you ever conducted a sound monitoring survey of at least one week at an operational wind project?

A. No. Because I find it pointless. If you -- if you aren't standing at the microphone -- or standing in the area where the microphone is located so you can hear at

your own ears -- that's called an observed measurement -- then you have no idea what caused the high as, the lows, the in-betweens.

Unobserved monitoring, which is what is used for two week measurements, requires an awful lot of guesswork afterwards. Whereas, if you're on site and you're measuring the sound, you have your own senses to corroborate the meter's measurements. You know whether there's wind. You know whether there's insects. You know whether a car went, by dogs barked. And, therefore, observed measurements are the preferred measurement in acoustics, as codified in ANSI 12.93, measurements with an observer present. And I focus on that kind of measurement.

As to whether that measurement represents other conditions, I rely upon operational data for the noise source, whether it's a wind turbine or a machine in a factory, to let me know other times when that noise might have been in a similar operating mode.

Q. Have you ever worked on a wind turbine project for any group or individual that was not opposed to or complaining about the project?

A. No. And that is because when I wrote my first paper in 2008 the wind industry decided I was persona non grata. They don't hire consultants that recommend 35

Leq. I don't even get the offers.

Q. Thank you.

On page 7 of your Direct Testimony you refer to a sound study that was carried out at the Shirley Wind Farm in Brown County, Wisconsin.

Are you familiar with what I'm talking about?

A. Oh, yes. That was at my client's home.

Q. You indicated that this same study alluded to by Mr. David Hessler who just testified for PUC Staff in his Direct Testimony -- is that correct?

A. That is correct.

Q. You --

A. That's the same study -- when he made the suggestion to the Public Service Commission that a study be done my clients contacted me, the attorney for them contacted me, and we developed the protocols and we selected the acousticians and Hessler & Associates is one of the companies that I recommended be involved in that test along with Schomer, Walker, and Rand.

Q. You also indicate that you -- you also indicate that you essentially orchestrated the study and developed the test protocol for it; correct?

A. Yes. The test protocol was based on my 2011 or 2012 paper showing the need for certain types of instruments and measurement techniques to detect the infrasound. I

was also -- I was also appointed by the PSC to do a peer review of that test, and I submitted that to the PSC with data showing the pulsations in all three homes, although strongest at the home R-1, I believe, the N's farmhouse that Mr. Hessler also focuses on.

Q. You just said you were appointed by the PSC. You were hired by the Commission?

A. Part -- yeah. Part of the agreement between the PSC and my clients to have access to their house was that I have access to all of the data from the test that Schomer, Hessler, Rand, and Walker conducted and have that for my own review and then report back to the PSC on what I found.

Q. Was the PSC your client?

A. No. The client was the Intervenors but the PSC was the coordinator for the -- I guess for initializing the project. And my clients would not allow anyone in their homes unless I had an opportunity to review the work of the study team.

Q. But you did not actually participate in the study; correct?

A. No. Because since they were my clients I had already done testing in the homes. I knew what would be found. It would have been inappropriate for me to be one of the testers. Everyone would have said it was biased.

MS. EDWARDS: Thank you, Mr. James. No further questions.

THE WITNESS: Okay. Thank you.

MR. DE HUECK: Okay, Mr. James. This is where we go to Commission questions, meaning the Commissioners get to cross-examine you so while Katlyn comes up here to move the camera down to Chairman Fiegen I'll just go ahead and kickoff with the only question that I have.

And it is you've testified a lot and reported to a lot of commissions and governments across the United States. You've done that in situations such as this when the wind farm has yet to be built; correct.

THE WITNESS: That is correct.

MR. DE HUECK: And so are you aware of any Commission or government that has created a condition to encapsulate your theories on infrasound?

THE WITNESS: Infrasound is still something that hasn't been addressed in any regulatory setting.

And there's a reason for that. Before we started putting wind turbines in quiet rural areas there was never a source of infrasound that caused pulsations so it's not studied. It hasn't been studied. The funding is not available and it is just now as with Mr. Cooper's work we're beginning to develop the methods where we can duplicate the sensations in a laboratory.

It's very much an unstudied area, but it's one that from my point of view should be a major concern since the people who are affected are severely affected.

Some of my clients, for example, the people that owned the house that Mr. Hessler tested in, have left it. That house has sat vacant for years. And they only return when there's a need to do another test.

MR. DE HUECK: Okay. Thank you.

So to date you're not aware of any permit being denied based on infrasound?

THE WITNESS: Not infrasound specifically.

MR. DE HUECK: Okay. Thank you. And now I'm going to move over to Chairman Fiegen to allow her to cross-examine you.

CHAIRWOMAN FIEGEN: So it seems like you have been in the field for a while, although in the U.S. -- you know, wind development has really increased the last, I don't know, five to 10 years. I mean, if you look at the chart, it certainly has increased quickly. Yet there's not a lot of research done and so do people mostly -- do people in the U.S. mostly look at research in foreign countries and has -- and I know I can't introduce new evidence so -- yeah. I guess that's my question.

THE WITNESS: I guess to your first question

about wind turbines are new, yes, they're new. But because of serendipity and a number of other factors, I've been intimately involved in many of the early wind projects in Maine, New Hampshire, Vermont, out in the east, and have tracked at what's happened at those. Also in Wisconsin we started a wind project in 2008 the one that Mr. Hessler and his company worked on.

So my experience I think is somewhat unique. There's three other acousticians in the country that I would say have similar experience. But all of this has been funded by local families. There is no research money available to fund my work. Steve Cooper is in the same boat. His whole lab and everything else was funded out of his own money.

Research money doesn't go to people who have ideas that may inhibit current government policies and with the current government policy promoting wind the chance of getting funding for the kind of work I do is nil so that also means that there's limited research available.

CHAIRWOMAN FIEGEN: Okay. Thank you.

MR. DE HUECK: Mr. James, up next will be Vice Chairman Hanson.

THE WITNESS: Okay.

COMMISSIONER HANSON: Good afternoon, Mr. James.

THE WITNESS: Good afternoon.

COMMISSIONER HANSON: I want to look at the witness box when I'm talking to you.

On page 5 of your prefiled testimony online 153 you state, "While it may appear that the difference is only a few decibels, it is important to remember that a 3-D B change in sound levels represents a doubling or halving of the acoustic energy."

So obviously to a layperson -- and we've had these in previous wind dockets, discussions of a variety of different dockets and projects. However, it's always curious to me, in your example then of moving down to a 40 dBA you state that it's equivalent to turning off half of the wind turbines in a project designed to meet the 40 dBA.

If three dBA change is doubling or halving, what is the -- going from a 45 to a 40 dBA? Do you know that?

THE WITNESS: Well, it's 5 decibels. It could be the equivalent of somewhere between a quarter, maybe a third. These are logarithms. I can't do them in my head, but it would be a very significant change.

And that's why these debates get so heated between a 40 or 45 dBA limit. It represents a big change in the number of wind turbines that can be put into any given area of a project.

COMMISSIONER HANSON: Well, you just stated that it would be a change of about a quarter?

THE WITNESS: It would be about a third of the wind turbines. Let me give you a simpler example.

If I have a noisy fan in front of me and I have my sound level meter and the noisy fan is 40 dBA and I have another noisy fan right alongside of it and I turn that on, then the sound level's going to go up 3 decibels to 43.

If I started out with four noisy fans and they were 45 and I cut them in half, turned two off, then it would drop to 43. So when we talk about small changes in decibels we're talking about big changes in acoustic energy. And that's the point I was trying to make.

And it's also why I think the answer to this is having nonparticipants negotiate agreements in easements and get compensation for the noise pollution.

There's no easy way to site a wind turbine at levels that are going to satisfy everybody. So the proper method in my mind is to set criteria that are safe and then allow monetary negotiations to occur for easements.

COMMISSIONER HANSON: Okay. Now thank you. I understand that. But I'm not quite following. I thought originally you said a change of 45 to 40 was a quarter.

And then I believe you said that it was a change of a third -- of turning off one-third of the machines. Am I hearing you incorrectly?

THE WITNESS: Well, like I said, the relationships are logarithmic. So as long as we move in 3 decibel moves, it's easy to estimate but when you have a 5 dB, I'd say that's harder. I would say it's equivalent to turning off one out of every -- one-third -- that would be equivalent to turning off about two-thirds of the machines to drop 5 decibels. Or to increase the setbacks greater, which is really the answer. To increase the distance.

COMMISSIONER HANSON: Okay. Intuitively I'm having a little bit of a challenge with that because if you're shutting off -- did you just say two-thirds of the machines to turn off 5?

THE WITNESS: To have an equivalent drop in sound level -- or to have a wind project -- the average sound level over the whole wind project because we're talking about not just one location but the whole project, to get a reduction of 5 decibels would require turning off about two out of every three of the machines. And then not being measured -- not taking a measurement right near one of the currently operating machines.

My point -- my point in that statement was to

show how difficult it becomes to put wind turbines into rural residential areas as the limits are reduced unless there is a safety valve to compensate people for the noise and allow them to enter into separate negotiations for an easement across their property.

COMMISSIONER HANSON: Thank you. And I -- I appreciate your clarifications and explanations as you've gone through this. However, if you're at 45 dBA and you decrease by 5 to 40 dBA and in order to accomplish that you have to eliminate two-thirds of the machines, that means one-third of them are creating the 40 dBA. And I know -- I understand it's not quantity there necessarily. One machine could produce 40 dBA.

THE WITNESS: If you're close to it.

COMMISSIONER HANSON: Correct. But you're also saying that you're eliminating those that are closest to the receiver by --

THE WITNESS: In my example I wasn't being that precise. I was trying to give an example of the over all magnitude of the problem of putting a large number of wind turbines into an area and why a couple decibel difference in the criteria makes a big difference to the Applicant.

COMMISSIONER HANSON: Thank you. And you're certainly not advocating that the Applicant should remove

two-thirds of their machines.

THE WITNESS: No. I'm advocating that those machines that are up -- in the model we see some levels about -- above 40. But they seriously look at getting those levels down into 40. And that for the people who are in the impacted range that are nonparticipants, that they work out easement agreements.

COMMISSIONER HANSON: I understand that. Thank you for your participation and information. Appreciate it.

THE WITNESS: Okay. Thank you.

COMMISSIONER NELSON: Mr. James, this is Commissioner Nelson.

I understand that you heard most of Mr. Hessler's testimony this morning; correct?

THE WITNESS: I heard probably 80 percent of it, yes.

COMMISSIONER NELSON: Did you hear the portion where he explained to me that from his perspective it is very, very very difficult to measure infrasound?

THE WITNESS: Yes. But he's been doing that with instruments with microphones.

As illustrated in the example I gave and described earlier with all the blue lines and colors I've moved over to using a micro barometer which is much less

sensitive to air movement et cetera and it makes it much easier to get clear readings.

With the right instruments infrasound is easy to measure. With the standard acoustical instruments it's very complicated and very expensive.

COMMISSIONER NELSON: So we've been talking about this whole issue of the test or study of the Shirley Wind Farm and you developed the testing protocols but apparently he didn't use your testing protocols; is that correct?

THE WITNESS: No. No. They followed the testing protocols exactly and that was to use infrasonic rated microphones, make recordings and use what's called narrow band analysis to do the subsequent analysis of that data. And they executed the methods that I had recommended exactly.

COMMISSIONER NELSON: And so why didn't you recommend using the micro barometer.

THE WITNESS: Because at that time I wasn't aware that it was a much less expensive tool. It became clear to me after that when I had calls from people to come do testing that I needed a different way. So doing some research into how other fields of science test infrasound particularly for weather detection, tsunami detection, et cetera that micro barometers are available.

They're highly reliable, very durable and relatively inexpensive and not subject to the same artifacts that a microphone was.

COMMISSIONER NELSON: So help me understand just a little bit about how a microbarometer works. I understand a typical barometer measures pressure.

THE WITNESS: That's correct.

COMMISSIONER NELSON: And so a microbarometer does the same thing.

THE WITNESS: Except that it measures the little ripple -- the pressure you see when someone says the pressure outside is X inches of mercury is the overall pressure.

A microbarometer is designed to measure the little ripples that occur at that pressure level. It's a variant on a standard barometer with the exception that instead of measuring the overall pressure it just measures the rapid pressure changes as a breeze goes by, for example, or a pressure pulse from a wind turbine is picked up. And it has very little sensitivity to audible sound, literally no sensitivity to audible sounds.

It's measuring the pressure changes that rise above and below the barometric pressure at any given point.

COMMISSIONER NELSON: In the charts you were

pointing out to us very early on in your discussion I will be honest when I saw those exhibits when they were initially submitted they looked Greek to me so I didn't study them.

Now that you've explained them I'm going to go back and study them and if I remember correctly, one of the axis on there talked about different frequencies; is that correct?

THE WITNESS: That's correct.

COMMISSIONER NELSON: And so does the microbarometer test various frequencies and if so what frequency range?

THE WITNESS: The microbarometer I'm using tests between 0 and 20 hertz.

COMMISSIONER NELSON: So you can identify the specific sources of the infrasound that you're testing; correct?

THE WITNESS: That's right. Because -- and it's only because wind turbines turn at the same RPM which means the blade moves in front of the tower at the same point.

Usually within the wind project they operate at similar RPMs. And when you take the microbarometer readings and you compress hours worth of this data and plot them as I have, what you get are these horizontal

lines that show the specific frequency -- or the specific rotation speeds of the wind turbines and in this particular case I think that was .7 hertz. .7, .75 hertz.

COMMISSIONER NELSON: So what is the scale of measurement of the infrasound?

THE WITNESS: Well, the scale of measurement's on the right-hand side. That's in decibels just like we would measure other sounds but without any A-weighting without any G-weighting, without any filtering of the sound we're just looking at all of the sounds 0 to 20.

The analysis method called Fast Fourier Transform, narrow band analysis, allows us to take that long string of pressures -- it samples 50 times a second, and convert it into frequencies as we can see depicted in the chart in the upper right-hand corner. We can see the little graph with the spikes and then the arrows pointing to where those traces are in the spectrogram.

And it is only by using these kind of tools that you can detect those pulses. Not that the pulses are that faint because they're up in the 50 -- maybe 50 to 60 dB range. But those are sufficient as -- as Steve Cooper's study presented, those are inaudible but some people will pick those up and feel a pressure pulse or they'll get a migraine or they'll get dizzy. They will

have these symptoms that can't be explained --

Excuse me. Turn those off.

Can't be explained by normal audible sound effects.

COMMISSIONER NELSON: And I'm not looking for a medical conclusion because I don't think you're qualified to do that, but of individuals that you have observed that have made these type of complaints and where you have measured the level of infrasound in their home, what level of infrasound have you associated with complaints.

THE WITNESS: When the average sound pressure level of the tones gets over 50 dB then we see people with serious complaints. The most sensitive people can respond at 40 but I'm talking about average.

Remember I said it's a pressure pulse so if we have a wind turbine blade coming down and it creates a pulse, there's a high-rise much above 50 -- in fact let's say the average was 50. The pulse would probably be 65 to 70 and then a long period without anything. So the average doesn't look that high. It's the peak or the crest of the pulse that's triggering the physiological response.

COMMISSIONER NELSON: And so, again, so the pulse at 50 dB is where you have received or observed complaints; correct?

THE WITNESS: Yes. Yes. There are some that are very sensitive who even at 40 average will have complaints, but when it gets to 50 people start complaining. And in homes where you get over 60 they start talking about leaving their home when it's over 60 by any significant amount on a regular basis they will leave their home and it's because they just give up.

COMMISSIONER NELSON: Thank you. I appreciate going through that discussion.

I want to shift now to the dBA measurements that are being proposed for this wind project. And you indicated that -- and you explained why you don't believe a two week measurement works. You've suggested a 10-minute average. Is it correct that you would only do that 10-minute average when the turbines are at full speed.

THE WITNESS: That would be the point of making the measurement, yes. That's why the -- Mr. Hessler was asked this morning about an on/off test. The proper way to take a test of a machine like a wind turbine is to find an ANSI S 12.9 Part 3 compliance test, and on a day when the wind turbines are operating at full power and there's no wind at the ground -- this is a stable atmospheric condition. It's very common in the Midwest, the national renewable energy labs has done studies in

prairie states saying it's roughly two out of every three nights where this condition occurs with calm winds with high upper-level winds. So the wind turbines running but there's no leaf rustle to mask them.

You take that condition. You have the wind turbines operating. They're turned off. Another reading is taken and as long as there's a 6 decibel or so difference between the on and the off, you can be fairly sure in saying that the on condition measurement was the wind turbines not background sound. If it's over 10, then it's absolute, if there's a 10.

And as long as we have Mr. Hall's data showing that levels in the community are 22 to 28 at night, if the wind turbine sound was 40 and it was turned off I would expect the sound then to drop to 28 and we would know then the contribution of the wind turbine without any concern over whether other things had contaminated or affected the sound.

There's operational data, SCADA data S C ADA, that I have used in hearings where I can correlate my readings with the exact operating mode, the speed, the blade angles, the power output, et cetera, and all of that can be brought to bear for a simple on/off test to make sure that the test is fair and assesses only wind turbine noise and not other types of noise. And it can

all be done in one night, not two weeks.

COMMISSIONER NELSON: But from what you're explaining to me it's got to be the right night and nobody really knows when that is going to be; correct?

THE WITNESS: That's right. It may mean that we set up the instruments and we have to spend some evenings waiting for the conditions to be right, yes. But that's still a lot less time than two weeks.

COMMISSIONER NELSON: The condition that you described, windy up above, still down below, so I'm a South Dakotan for my entire life. Wind in South Dakota -- we've got a windy state. Is the phenomenon that you described, is that something that occurs everywhere? Because I know that wind is not the same everywhere.

THE WITNESS: It's a phenomena created by solar heating. Let me explain how that happens.

During the day the sun warms the ground. The warm ground causes air near it to rise and this mixes with the upper-level winds creating a smooth gradient. The wind speed increases. The more you go from the ground up the wind speed goes up.

At night when the sun goes down the ground cools. Now we have cool air at the bottom, warm air up above and cool air sinks so we have this layer of maybe

100 feet deep. Sometimes less than that. Sometimes you can see the top of the trees wiggling but there won't be enough breeze at the ground to induce leaf Russell.

The National Renewable Energy Lab study and I think one of the places they did the test was South Dakota, either that or one of the other plain states showed that that occurs about two out of three nights during the warm season. And it is a characteristic that meteorologists in other cases where I've testified have agreed. And in acoustics we use that condition as the best test condition.

For example, the model, the ISO model that Mr. Hall used for his prediction makes the assumption that the weather conditions are calm wind at the ground and if you'll read it, it will say a stable atmospheric environment. That is the ideal condition for testing noise and that is what I'm saying would be the condition for testing wind turbines knowing from my own experience and from what I have learned about meteorology over my 45 years that there will be many nights when the wind turbines will be at full power even though the wind at the ground level is moderate.

COMMISSIONER NELSON: I think the last -- and I appreciate that discussion. I think the last question. You made the statement in relation to infrasound and you

said, and I think I quote this correctly, "it's unstudied but a major concern."

How can we make sound decisions on something that is unstudied?

THE WITNESS: You can't. All you can do is -- the precautionary principal says that we err on the side of safety. If we know that we have people complaining about the distances of a mile and a quarter or two miles, then we have to take that into consideration until the science those us that that isn't a problem.

And this is something that's always baffled me. Why are the project -- why are we permitting projects near homes when there's still other areas where we could have wind turbines out at greater distances while the research goes on.

So my position has been under the precautionary principal that until we know enough about why these problems occur, that we should be more cautious in allowing wind turbines near residential homes.

COMMISSIONER NELSON: Thank you.

MR. DE HUECK: Commissioner Hanson.

CHAIRWOMAN FIEGEN: Go ahead. I have one more question whenever.

MR. DE HUECK: We'll go down to Commissioner Fiegen. And I'll just announce for the room Cheri really

needs a break. She's been at it for a long time. So when we're done with Commission questions we're going to take a recess.

CHAIRWOMAN FIEGEN: In your testimony, Mr. James, your written prefiled testimony, you talk about Michigan and Ohio and a noise trespass.

Have they used that in relation, the noise trespass in Michigan and Ohio?

THE WITNESS: In Michigan, yes. A number of communities have passed ordinances that encourage that to happen. Basically encourage -- they set restrictive limits, 45 not to exceed, for example. That's an Lmax. And then they let the developer negotiate with the landowners for easements.

CHAIRWOMAN FIEGEN: And they haven't used it in Ohio.

THE WITNESS: I don't know. Ohio's still arguing over things that -- actually in a case that Mr. Hessler and I were involved in called Buckeye Wind back in the early 2000s. They're still arguing over that case.

CHAIRWOMAN FIEGEN: Thank you.

COMMISSIONER NELSON: My apology to Cheri. I have another couple of questions.

Help me understand how infrasound dissipates

over distance, if it does.

THE WITNESS: Infrasound is a -- I'll call it infrasound is not absorbed by air. The energy infrasonic rate is not absorbed by air as the audible sounds are.

The farther you get away from a high frequency noise, even speech, not only is distance a factor but that energy's being absorbed by ear molecules.

Infrasound doesn't do that. Infrasound isn't blocked by physical things, for example. It goes through a house as though the house wasn't even there. And I believe that Mr. Hessler's work at Shirley Wind showed that the levels outside the house and inside were almost roughly the same.

Infrasound is a particularly long propagating. But elephants for example in Africa use infrasound to communicate, a deep bellow. And they can communicate over hundreds of kilometers. We use infrasound to detect distant nuclear bombs, for example. The micro barometer that I use is used by the U.S. government with detectors to detect when bombs are set off halfway around the world.

An infrasonic pulse if it's sufficiently strong enough can go around the world and have almost as much intensity as afterwards. There's anecdotal evidence when

Krakatoa erupted microbarometers all over the world went off and they showed the echo of that eruption propagating around the earth several times. So infrasound is just one of those things that is hard to stop.

And even though wind turbines aren't like a nuclear bomb, the sound is more than sufficient to propagate miles. I have measured infrasound tones at distances of 6 miles. I have colleagues who have measured in the distances of 50 miles. Where you can clearly see the tones that we see in my examples.

And, again, this depends on how many wind turbines. One wind turbine isn't going to be detectable 50 miles away. But a bank of 200 wind turbines will be clearly distinguishable at much greater distances than the single one. And when we start talking about these projects getting larger and larger we get to the point like we have up in Ontario where there's no place within southern Ontario where we can't put up a microbarometer and detect wind turbine tones.

COMMISSIONER NELSON: So when you measured infrasound at 6 miles what was the level?

THE WITNESS: It was down around 40. Average 40.

COMMISSIONER NELSON: And so presumably as you would move further out it would ratchet down and at some

point hit zero.

THE WITNESS: No, it doesn't hit zero. It just blends into the other infrasound that's there. I mean just the fact that the earth is rotating and friction in the atmosphere produces some infrasound. So you get to the point where there's a background infrasound even when you don't have wind gusts and other things triggering it. But at this point when I'm asking what is the distance we should be concerned of, the board of health in Brown County, which has debated this for eight years now basically has said that the radius of the human health hazard is 2 and a half miles around the wind project. And that seems to encapsulate most of the people who are sensitive and it takes people who are really sensitive beyond that, one of which I have an example in my exhibit, to sense it. But for practical purposes, any time you're within a mile is going to be very significant and even at 2 and 2 and a half miles we'll have people who if they are sensitive will report those sensations. Whether it triggers, you know, an adverse reaction or not depends on them. I have an acoustician friend Dr. Malcom Swinbanks who has published papers about his own sensitivity. And he uses his sensitivity to infrasound pulsations as an expert for the U.S. Department of Defense in protecting our military against infrasound.

Because he can feel it, he doesn't have to look at his meter to know whether it's present.

I know three other acousticians who also can sense these pressure pulsations. It's not as rare as Mr. Hessler might like to make it out. If my limited number of acousticians friends include three that are using it as tools, then it's more prevalent in the population than we might expect.

COMMISSIONER NELSON: Thank you.

COMMISSIONER HANSON: Mr. James, all of the positions and thoughts and premises that you're using seem to boil down to a conclusion, and I would like to read what I believe is your conclusion. I've written that down, and I -- it may be a little bit lengthy, but I'd just like you to pause and wait until I ask you if that is correct or not.

You're obviously a strong supporter of property rights. And on page 6 line 174 there's a question pertaining to that. And all this seems to boil down to your position that sound levels that are generated from the wind turbines may not exceed the ambient sound level existing at the property line of nonparticipants unless the utility developer operator is willing to provide compensation for the what you call noise trespass -- or the what I would call sound as opposed to noise; is that

correct?

THE WITNESS: That's close. You're probably -- you're probably right sound trespass but noise means unwanted sound. If a person didn't bother them, then it wouldn't be a trespass.

What I'm concerned about is uncompensated easements. And when we begin to have government bodies set a standard that goes to a home, not to the property line, it results in uncompensated easements. And that's what concerns me.

COMMISSIONER HANSON: I'm a strong believer in property rights as well. But there's -- and semantics aside from noise and sound, when you get into something of that nature, does my air conditioning unit outside my house, do I need to compensate my neighbor for the noise that that creates or the airplane that flies overhead or the street construction work or on and on and on that take place throughout the world daily in everyone's life.

I mean, that just seems so extraordinarily unworkable and unrealistic. It's when the noise is -- is really in a trespass sense. And I know you're trying to get to that point, but I just don't see that you're reaching that.

THE WITNESS: You know, I -- I understand the issue of air conditioners but let me use that as an

example.

The air conditioning industry since I was a young kid back in the '50s has done extensive work in making the sound of an outdoor air conditioning condenser compatible with community noise standards or community lifestyle.

When I bought my new air conditioner a couple of years ago it came with all sorts of noise data showing the impact on my neighbor and how that impact would be acceptable. Also in my community there are other sounds at night that raise the level up to about 30, 35 dBA. So my expectation here is that the -- my neighbor if they put in a wind turbine -- or an air conditioner will also put in one that has been designed to be compatible with the acoustic environment of the community.

Wind turbines haven't been designed for that. Wind turbines are still in their early years. That doesn't mean that some day they won't have one. It just means that right now a wind turbine is like an old air conditioner in 1950 with a noisy fan or noisy pump and other mechanical sounds, that until they can design wind turbines that are more compatible with being close to homes, they should put their hardware out in areas where people aren't there. Or if a person willing to accept the noise compensate them.

In my career with workers, there are a number of jobs where the noise was unbearable, but my employers -- or my clients who were their employers would pay them extra and they would take that extra money as compensation for the noise.

People have a -- people have a right to privacy, but if you say are you willing to exchange it for X number of dollars a year, there willing to do it. And that allows each property owner to participate in the process to the extent they want. And that's why I kind of lean towards it.

COMMISSIONER HANSON: Thank you.

THE WITNESS: Yeah. If wind turbines were air conditioners, it may be different.

COMMISSIONER HANSON: Thank you, Mr. James. I understand that we have moved a great deal with, for instance, automobiles or -- you can hardly even hear them when you're standing right next to them.

THE WITNESS: That's right.

COMMISSIONER HANSON: And there's been a great deal of -- however, you would have to accept that there have been significant advances in the wind turbines of today as compared to 20 or 30 years ago. I won't take exception with your premises and argue those premises that's up to the other folks here. But I'll give it as

much weight as I can to what you've said where I feel that it's justifiable to do so. So thank you for your presentation.

THE WITNESS: Okay. Well, thank you.

MR. DE HUECK: We will recess until 4 o'clock.

(A short recess is taken.)

MR. DE HUECK: We are back in session.

Mr. James is on the witness stand.

Mr. James, you're still under oath. We finished with cross-examination first round. We're going back to Mr. Almond for redirect.

REDIRECT EXAMINATION

BY MR. ALMOND:

Q. First question, Mr. James. Have you ever been permitted to testify in the United States Court to give opinions on noise generated by wind turbines' effects on people?

A. Yes.

Q. And can you provide a citation to the Commission of what that case was?

A. The case --

Q. Maybe not the citation but can you tell us the case name and where it was located at?

A. Yeah. The case was here in -- well there's been many cases where I've been qualified but there's one

where I went through a Daubert hearing in a court here in Michigan. It was McBain, Michigan I can get the specific reference for the record later I don't have it in my hands but in that case I was -- after the Daubert hearing I was qualified as an acoustician.

In fact, if everyone would turn to my Exhibit 1, my bio materials, I have the exact quote from that decision on that page so that people can follow along. It's the page bio materials for Richard R. James, November 8, 2017.

At the bottom of that page there is a table showing some of the example qualifications and at the very bottom is the Michigan court case where I went through a Daubert hearing, and the judge concluded that I was an acoustician with expertise in measurement of wind turbine noise and its effects on people and I was qualified to opine that the Plaintiff's symptoms were caused by the Defendant's wind turbines after that special Daubert hearing.

In Alberta, Canada I've also been simply qualified to speak to not only the noise but also human response to noise, and that is the typical qualifications that I have been granted in other jurisdictions.

Q. And what was the name of that Michigan case?

A. I will have -- it was -- I remember my clients'

names. If you want -- let me pull it up here. I can get it.

Q. Well, no. Let's not do that. Unless the Commission would like him to.

MR. DE HUECK: Just provide it to us later.

Q. We'll just provide it later. Okay?

A. I will.

MR. ALMOND: I don't have any other questions for you, Mr. James.

THE WITNESS: Okay. Thank you.

MR. DE HUECK: Mr. Fuerniss, any cross-examination based on Commission questions?

MR. FUERNISS: No.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: No.

MR. DE HUECK: Ms. Pazour.

MS. PAZOUR: No.

MR. DE HUECK: And Staff.

MS. EDWARDS: Briefly.

RECROSS-EXAMINATION

BY MS. EDWARDS:

Q. Can you turn to Staff Exhibit S-5? Do you have all the exhibits in front of you?

A. I will get them up here again. Let's see. Staff exhibit -- S 4, S 5 additional data requests.

Q. Yes. S 5.
A. **Okay. Opening it up here. I think everyone else is opening it too because it's slow to respond.**
Q. Just let me know when you get there.
A. **I will. It's opening slowly.**
Okay. I have the document open.
Q. Okay. And I would like to?
A. **Which page?**
Q. Direct your attention to page 8 of 27.
A. **Okay. Is that 2-8? Or 2-7? Is that the page with question 2-7?**
Q. Right.
A. **Or 2-8.**
Q. I'm looking at the question before that which would be 2-6 but I'm looking at the answer so --
A. **Okay. Okay. Okay. I believe that was the response by Dr. Alves-Pereira.**
Q. Correct. And do you see at the very end there where she responded that there are currently no scientifically valid studies providing numerical data on safe distances that can effectively protect families against ILFN contaminated homes?
A. **That is very true because acousticians have ignored low frequency and infrasound since the '70s when I started out and they concluded that audible -- A-weighted**

sounds would be the focus of regulations. We've underserved the communities by ignoring the low frequency end of the spectrum.
Q. How could you set a limit if there's no statistically reliable data?
A. **Well, to be very honest, the same way we set the criteria back in the 1970s. Acousticians who were familiar with different types of problems got together and pooled their data and came up with, for example, the EPA has an L D N on 55 for urban environments. It was based upon consensus among acousticians and their experiences in the field. And acousticians have plenty of experience with IFLN but governments don't because they've all focused on dBA criteria.**
Q. Okay. You testified, and I don't remember in response to which Commissioner question that there's nowhere you can go in Ontario and not be subject -- or not be able to pick up infrasound; correct?
A. **I said southern Ontario. Basically if you go from the western edge of southern Ontario on lake Huron over to the east of Toronto along Lake Eerie any area along there there is I think 1,700 wind turbines in that area. Anywhere in that area you will measure the tones from wind turbines as long as you don't have such high wind levels, et cetera, that they mask them.**

Q. And earlier you testified that 15 percent of the population would be susceptible to infrasound. So would not then 15 percent of the population of southern Ontario be ill?
A. **No. That was 15 percent were subject to the audible sound. 15 percent found levels of 40 Leq and higher were susceptible.**
In my -- let's look at Shirley Wind. When Shirley Wind -- when the Brown County Health Department began to explore it the initial complaints were three families. By the end of their investigation they had 70 families that had reported either audible sound or infrasound related symptoms. And this was for a small project with eight wind turbines in a relatively small dairy farming community.
So what is the percentage that are affected? We don't know. Health Canada, for example, their study found that at one and a quarter mile -- so we're talking 2 kilometers they asked people within that distance if they had tinnitus, ringing in the ears, migraines, dizziness, et cetera. Well, we know that the general population -- that the percentage of the general population with dizziness and tinnitus, et cetera is roughly around 1 out of 10 people, and yet at a mile and a quarter from the wind turbines in the Health Canada

Study they were reporting 20 percent and higher prevalence rates.
They couldn't explain what caused it. They tended to ignore it. But I used to say a mile and a quarter was a safe distance. Safe meaning safe. Now I can't say that. The Health Canada data calls it into question because we can't explain why these symptoms of low frequency noise, tinnitus, migraines, pressure pulsations, et cetera, nausea are so prevalent at that distance.
Audible sound would have died off by a mile and a quarter. It would only be the low frequency and infrasound that's present in those homes. So the more with learn about the problem the more we begin to see that even what would be considered large setbacks may not prevent some of the complaints.
MS. EDWARDS: Thank you. No further questions.
MR. DE HUECK: Any Commission follow up?
Okay. Commissioner Nelson has a question for you.
THE WITNESS: Okay.
COMMISSIONER NELSON: Earlier I asked you to try to explain dissipation to me. And I understood your answer.
So it would appear that the dissipation of

infrasound would occur uniformly over distance since there appears to be no impediments to it. Is that accurate?

THE WITNESS: Yes. It -- it -- it propagates with very decrease in sound level over great distances, which is an advantage if you're an elephant trying to communicate to another elephant but it's a disadvantage if you're looking at a noise source that produces infrasonic pulses because that problem propagates much farther than the audible sounds.

COMMISSIONER NELSON: So how many -- since it dissipates at a uniform rate over distance, how many dB does it decrease per mile?

THE WITNESS: Well, it -- again, it -- sound drops off proportional to the distance. If we're talking about audible sound.

COMMISSIONER NELSON: No we're not talking about audible sound. We're talking about infrasound.

THE WITNESS: Well audible sound decreases at 6 dB per doubling of distance. Infrasound is more like 1 or 2 dB per doubling of distance.

And in my tests I kind of lean towards the 2 mile, mile and a quarter as the separating difference between a lot of people, a significant number, let's say 10 percent, having complaints and after that it becomes

much more spotty.

COMMISSIONER NELSON: Let me delve into your answer 1 or 2 dB per doubling of distance.

So between 5 feet and 10 feet it reduces 1 and 2 -- 1 or 2.

THE WITNESS: Yeah.

COMMISSIONER NELSON: That doesn't make sense.

THE WITNESS: Well, let's say it starts out at 100 at 1 meter away. And I'll use meters because it's smooth. 1 meter away it's 100. So at 2 meters it will be let's say 98. At 4 meters it becomes 96. At 8 meters it becomes 94.

And so you can see that as we get to a significant distance like 500 meters it now in order to get another decibel of reduction we've got to go 500 more meters.

COMMISSIONER NELSON: Okay. So I understand that math. And so then my question is is it 1 or is it 2 decibels? That's a big difference.

THE WITNESS: Yes. It depends upon the atmospheric conditions, and it depends upon the surface conditions but -- and that's why I say 1 or 2. Because it -- depending on where you're measuring, it could be either.

But for the levels emitted by wind turbines the

infrasound is significant enough to trigger the sensations of the distances of a mile and a quarter to two miles in those sensitive individuals.

COMMISSIONER NELSON: Have you measured infrasound -- the level of infrasound at a turbine?

THE WITNESS: Right at a turbine it wouldn't be very high and that's because the sound's occurring up above and it's radiating out.

I mean, a wind turbine the sound is radiating off the blades and, therefore, when you're close to it -- actually one of the quietest places near a wind turbine is right at the base of the tower.

COMMISSIONER NELSON: And I understand that. So at what distance would the infrasound be maximized?

THE WITNESS: It becomes more repattable (check) when we're out at distances let's say a thousand feet. And for a one hertz infrasonic tone it takes a thousand feet for the wavelength to form. So within that you can get numbers -- within that distance the numbers can vary all over but as you get a little further away the wave form is fully developed and the propagation becomes somewhat measurable.

But it depends on how it's reflected off the ground, how it's reflected off the ionosphere and other atmospheric conditions. And it's very variable. Low

frequency noise problems are hard to trace because of these issues.

And wind turbine sounds fit into that category. One day it could be perfectly fine. The next day it could be much noisier just due to -- I'm assuming they're operating the same. Just due to how the atmospheric boundary layers are reflecting the sound.

COMMISSIONER NELSON: So I'm going to ask have you measured infrasound 1,000 feet away from an operating turbine?

THE WITNESS: Yes. Multiple times.

COMMISSIONER NELSON: And what level would you typically find there?

THE WITNESS: Probably in the 60s to 70s average with peaks up around 85. That was my first paper was at that distance.

COMMISSIONER NELSON: And what would cause the distance between it being 60 or it being 85?

THE WITNESS: Well, the 60 is the average, but remember a pulse and then quiet so what we're doing is we're averaging a very large short-term sound with a lot of quiet after it so that average drops down. But it's the peak of the pulse that's causing the sensations.

COMMISSIONER NELSON: Right. And I know you explained that already so I assumed that the numbers you

were giving me were just the peak numbers. So 85 would be the peak?

THE WITNESS: Yeah. 85. Whereas the average would be 50 to 60.

COMMISSIONER NELSON: Thank you.

MR. DE HUECK: Reiss, any redirect after Commissioner Nelson's question?

No.

Mr. James, thank you for your testimony --

MS. SMITH: Excuse me, Mr. de Hueck, I got skipped, and I didn't want to interrupt.

Is it okay? I just have one question.

MR. DE HUECK: Yep.

RECROSS-EXAMINATION

BY MS. SMITH:

Q. Mr. James, you had previously talked about the Shirley Wind Farm in response to some of the questions that you were asked; is that correct?

A. **That's correct.**

Q. And you mentioned that the board of health declared the wind farm a human hazard. Is that true?

A. **The exact term is human health hazard.**

Q. Human health hazard.

Are you aware that that designation was rescinded in 2015 due to insufficient evidence of a link between wind

farms and people's health issues?

A. **No. I'm not. In fact, 2015 the --**

Q. I just asked if you were aware of that.

A. **I'm aware that it was not rescinded at that point.**

Q. Was it ever rescinded?

A. **No. The board has maintained that in spite of efforts to have it rescinded.**

MS. SMITH: I have no further questions.

MR. DE HUECK: Thank you for your testimony, Mr. James. That will conclude it.

MR. DE HUECK: I'm going to turn to Mr. Almond to call his next witness.

(A short recess is taken.)

MR. DE HUECK: EL18-026 is back in session. Mr. Almond, you may call your next witness.

MR. ALMOND: Intervenors call Jerry Punch.

MR. DE HUECK: Good afternoon, Mr. Punch. My name is Adam de Hueck. I am the Hearing Examiner in this matter. I'll be swearing you in today. Are you ready?

THE WITNESS: I'm ready. Thank you.

(The oath is administered by Mr. de Hueck.)

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Why don't you introduce yourself to the Commission and give a brief recap of your education and experience.

A. **Well, I'm an audiologist. I have two higher degrees, a master's degree in hearing and speech science from Vanderbilt --**

MR. DE HUECK: Can you slow down a little bit for the court reporter and identify yourself.

A. **I'm Jerry Punch. I live in open us, Michigan where I'm seated right now. I appreciate the opportunity to not to have to make the trip to South Dakota by the way.**

I have been an audiologist since 1967 so I have really about 50 years experience as an audiologist. My educational background is with a master's of science degree in hearing and speech sciences from Vanderbilt university and a Ph.D. in audiology from Northwestern University. I've been a teacher, a clinician, a researcher, an administrator in a number of settings, mostly academic settings.

The last 20 years 21 years I've been at Michigan State University. I retired from that position, from the faculty there in 2011.

Would you like me to go into the issue of how I got involved with wind turbine noise at this point?

Q. Sure. Why don't you explain how you got involved.

MR. DE HUECK: Mr. Punch, this is the Hearing Examiner. I'm going to interrupt you for just a second. When you look down we can't really see your lips so if

you can either back up while you speak or alternatively if you can adjust your camera down.

(Discussion off the record.)

Q. First why don't you just -- what is an audiologist?

A. **Well, audiology is the study of hearing and hearing disorders essentially, hearing loss. Much of my work has been involved, particularly my research has been involved with hearing aid research with diagnostic testing to quantify the amount of hearing loss in people.**

As I say, I've been certified as an audiologist and still am since the 19 -- late 1960s. I've done a lot of clinical work with patients. As someone already mentioned in the previous testimony, I basically -- I'm losing my train of thought already. It's not that time of day for me.

Basically what I was saying is wind turbines is kind of a new area. I got involved in about -- excuse me. In 2008 or 2009 when, in fact, Rick James asked me to go to a wind project in lower Michigan. It was in the thumb area of Michigan where a family was abandoning their home or leaving their home at night to be able to sleep because of the turbine noise.

By the way, my affiliation with Rick has been over many years. When I was chair of the department for about six years I actually hired Rick as an as an adjunct

instructor to teach a couple of not courses but give a couple of lectures in a hearing conservation course, a graduate seminar in hearing conservation at Michigan State University.

And so Rick and I had known each other for sometime before 2008 or '9. So we basically -- I went there thinking I'm not sure what my role is here. I'm an audiologist. I understand sound. They were complaining of the noise. And I've had a lifelong interest or career long interest in occupational hearing loss and in community noise so I thought it would be interesting. I was thinking about retiring in a few years and I thought, well, this is something of interest to me. I could possibly become involved if it seems important to do so or interesting.

And the family, we just interviewed them, more or less, informally. Two daughters, two teenage daughters, again, they were leaving their home at night to sleep in a hotel or motel. And I came away actually thinking honestly that what's the problem here? I heard the turbines. They were moving somewhat during the afternoon that I was there. I felt a little bit of sensation. It didn't feel that strange at the time. I was only there, as I said, a couple hours or so, three maybe. And I came away thinking, well, I need to understand -- I want to

understand what's going on. So I rented -- rented. I checked out a book from the library, Paul Gipe's book on wind energy, Wind Energy Comes Of Age. And it was fairly favorable toward wind energy. It did not -- it barely mentioned noise, though, as an issue, and the book was based a lot on the information that was available from the wind turbines that had been installed in European and I think Scandinavia countries and so forth and California at that time by the time had become involved with wind energy.

So not getting a whole lot from the book in terms of an explanation of what the family was complaining about, I began to search the literature, first the internet and then some other sources of let's say journal articles and so on, and I ended up writing an article. Rick was a co-author on the article along with a student we involved in our measurements and writing the report.

The study was published in Audiology Today, which is basically a monthly magazine of the American Speech Language Hearing Association in the summer of 2010, I believe. And so as a result of that, I was asked to chair a group in Michigan, which now the Department of Energy essentially in the state to develop --

My audio died. Are you hearing me?

Q. Yes.

MS. SMITH: I'm sorry. I'm kind of wondering what the question is because I don't think it's quite -- I'm sorry. I don't know where this started.

Q. I think we were just kind of rambling a bit about your background there, Dr. Punch. So let me try to hone you in here.

Did you file -- or did you prepare prefiled testimony in this matter?

A. **I did.**

Q. And is that what has been marked as Exhibit I-2?

A. **I'm looking at my list here I'm sorry I didn't become acquainted with this earlier. I-2.**

A. **Yes.**

Q. And do you have any changes or corrections you want to make to that testimony?

A. **No, I don't.**

Q. And along with that testimony did you include two exhibits which were your CV and then an article written by you and Mr. James?

A. **I did, yes.**

Q. And you also provided some responses to some questions asked by PUC Staff; is that correct?

A. **I did, yes.**

Q. And I'll represent to you that that those are on Exhibit I-34, specifically Intervenors Responses to

Staff's Second Set of Data Requests to Intervenors.

If I were to ask you those same questions that are asked in your prefiled testimony as well as the questions asked by PUC Staff and Intervenors Responses to Staff's Second Set of Data Requests to Intervenors, would you provide the same answers here today?

A. **I would, yes.**

MR. ALMOND: At this time I would move for the admission of Exhibit I 2 as well as Exhibits I 2 A and I 2 B.

MR. DE HUECK: Do you have an objection?

MS. SMITH: Can we revisit this after cross?

MR. DE HUECK: Certainly.

MR. ALMOND: I think the process we used previously was to admit it and have her move to strike it.

MS. SMITH: If you would like to do it that way, that's fine by me.

MR. DE HUECK: You're right. Yes. Okay. So, Staff, do you have anything to add?

MS. EDWARDS: I have no objection.

MR. DE HUECK: So we're going to go ahead and admit the exhibits and testimony.

(A short recess is taken.)

MR. DE HUECK: Okay. We're back in session.

The court reporter is all squared away so we can continue.

Q. (BY MR. ALMOND) Dr. Punch, did you have the opportunity to review Dr. Roberts's prefiled testimony in this matter?

A. **Yes, I did.**

Q. And do you recall Mr. -- Dr. Roberts's prefiled testimony him stating that he's not aware of any reliable evidence providing any link between infrasound and adverse health effects?

A. **I did. Yeah I do.**

Q. Do you have any response to that claim?

A. **Well, I heard him say I'm not aware at least three times with respect to that question. Or I read that.**

There's I think mountains of evidence as we provided in our article, the 2016 article, that included as exhibit -- I've lost the numbers here but my second exhibit.

You've heard testimony and I would agree with it that from Rick especially that there's lots of field evidence. There's lots of anecdotal evidence. There is some evidence in the literature -- like Dr. Roberts made the point that only epidemiological evidence is useful in drawing conclusions about causation between wind turbine noise and adverse health effects.

He also said paradoxically that -- when asked how likely is it that -- and I'm paraphrasing. How likely is it that such epidemiological studies will be done in the future. And he said not very likely. And I think I agree with this in the sense that they're expensive, they require a lot of preparation, government funding and Mr. James has already responded to that issue of there's just not government funding available for that kind of research.

So my point is we have to take what we have. Just like the Bradford Hill criteria doctor that is -- Sir Austin Bradford Hill who addressed the medical society in Britain in 1965 listing nine criteria which include experimentation but there are eight other criteria that he talked about that it becomes sort of the -- if you will, the Bible of epidemiology, as I understand that. As I understand it. Indicating that we don't need just epidemiological research to answer questions about causations -- causation of disease processes and/or disorders and external patients.

He went through those criteria, but he didn't -- he just named them. He didn't talk about what they are about. And I think he basically ignored the message that I would read into -- or read from Bradford -- Bradford Hill's address, and that is, again, we use what we can to

draw inferences. We use what is available.

Not that we shouldn't do more research. Some of it might be clinical research design. Some of it might be epidemiological. But these studies that will really address the question definitely about infrasound or just even audible sound and things like dose response, how much sound does it take before people really do come down with the various complaints and problems that they complain about.

That was one of my major takeaways from his -- his comments there. He also did talk about -- he basically uses government studies to rely on for his inference or conclusion that there is no causative relationship between adverse health effects and wind turbines. Yet he uses -- he talked about peer reviewed studies. But these government studies he relies on don't seem to be peer reviewed, per se, min the way that he defines per reviewed. So I found that rather unacceptable.

He holds folks like me and Mr. James and others to a standard of peer reviewed epidemiological research to establish those relationships yet he does not really have -- he can't point to specific studies other than the Health Canada study perhaps as others have also done to support his view that there are no relationships, no causative relationships here.

Q. And just I want to jump to kind of your over all opinions and conclusions in your prefiled testimony. You recommended two separate alternative noise limitations; is that correct?

A. **I did yes.**

Q. One was a 40 dBA Leq night outside, the other 40 dBA L A max; is that correct?

A. **That's correct.**

Q. Can you just explain the rationale for those two recommendations?

A. **Well, the 40 dB Leq comes from mostly -- emanates really with the 2009 World Health Organization document on night noise guidelines. And that's the point at which it was said -- it was said -- it was decided and used by the World Health Organization to be a threshold at which there are substantial and nontrivial numbers of people who are affected by low frequency noise.**

They did not study in the 2009 document really wind turbine noise. That needs to be understood. Wind turbine noise has its own specific characteristics. But if 40 dB Leq is needed for protection against things like road traffic noise and airport noise -- or airport noises and other kinds of noises, then because infrasound is a component of wind turbine noise, the 40 dB actually seems to be a conservative threshold to me.

45 I know is the design goal for this particular project, but 40 is really a very conservative goal. It should be lower. And I know Rick James talks about, recommends, 35 dB Leq but I realize the stress that puts on wind companies to build the projects and I'm not really trying to stop them from building the projects. I just want to protect people as much as possible.

Let me point out the 40 dB Leq is the level that -- I was about to get into this earlier, that the task force that I chaired in the state of Michigan some years ago was about to recommend -- that task force was shut down. I won't go into that unless you want me to. But there was some lobbying I think about shutting us down because --

Q. I don't need you to go into that.

A. Okay.

Q. But --

A. All right. So 40 dB is the level that's certainly recommended by the World Health Organization. It is very close to the levels that the -- that Dr. Schomer, Dr. Paul Schomer, has come up with recently based on four different sources of information, data. They recommend 36 to 38 dB Leq.

And he recommends it to be measured over a 24-hour period basically. That is a little different from the

World Health Organization 40 dB level because they recommended that as an annual average, which I think it impractical -- implying by annual that you actually leave the sound level meter out for a year. We don't do that, of course. You take samples over a year.

If I can get down to the 40 dB L E max is an attempt -- and I made this attempt in another case earlier in New York to try to look at the WHO documents, both the 1999 and the 2009 documents.

Q. Can you back up just a little bit from the camera?

A. Sure. I was actually taking a couple notes and trying to read my notes that I just wrote down just a minute ago. Anyway --

Q. Let's not take any notes okay?

A. Okay. All right.

A. Okay. Can I go ahead with my --

Q. Yeah. The 40 dB L A max.

A. 40 dB L A max. If you review the -- even the 1999 WHO standards I think they talk about the 45 dB L A max inside. And again the 40 dB L A max, one, is an attempt to account for all the peaks and valleys that occur in wind turbine noise. Much of it is infrasound. Some of it, of course, is also audible sound.

I think even more conservative number might be in order because we're talking about -- when we talk about

infrasound we're talking about sound that does not attenuate very well and certainly not very rapidly, and as you've heard many times already in this hearing, it dissipates over very long distances.

There's almost no barriers that can stop it. So even if you have your windows closed, it could be as bad inside as outside. And because the World Health Organization dealt with low frequency noises that did not include infrasound, I think an even lower number like 40 instead of 45 dB LAmax would be appropriate to account for the peaks and valleys that do cause the annoyance in real time for people.

And my concern -- and particularly in the 2009 WHO document, the concern there is with sleep. Sleep disturbance.

Q. In addition to noise limitations, you also recommended a 1.25 mile setback. Why is it necessary to have both a noise limitation and a distance setback?

A. Well, a distance setback would be ideal if we could show a really close correlation with the noise levels that people are exposed to at those distances. But because there are differences in terrain even changes in the weather patterns, differences in noise turbine arrays, the way they're arrayed with respect to one another, each other, you can't predict exactly what the

noise levels are going to be from knowing the distance.

But I think the 1.25 miles or 2 kilometers that's been recommended many times in the literature starting with Pierpont in 2009 would be sort of a minimum distance. 1.5 probably better, obviously. Again, trying to give fairness as much as I can be fair to the wind companies, 1.25 seems a rather respectable conservative number.

But because the distance does not correlate very well with the noise levels at those distances, both would be my recommendation. It's not that hard to set the distance as a limiting factor or a minimum distance along with a maximum noise level. But certainly noise level always has to stay in the equation.

MR. ALMOND: Thank you. I don't have any further questions for you at this time and I'll tender you for cross.

MR. DE HUECK: Mr. Punch, we're now going to subject you to cross-examination starting with the Applicant, Prevailing Winds.

MS. SMITH: Dr. Punch I'm just waiting so they can shift the camera over so that you can see me as opposed to others that are watching.

(Discussion off the record.)

CROSS-EXAMINATION

BY MS. SMITH:
Q. Dr. Punch, do you have anyone with you in the room?
A. I don't.
Q. And other than the documents that were filed in this matter including your testimony do you have any other documents in front of you?
A. I had taken some handwritten notes. I'm putting those aside. I'm not using them. I don't have any other notes. I have a laptop to my right with some files I thought I might need, but I think everything is on the exhibit list that we might need.
Q. Okay. Thank you. You mentioned -- you indicated you're an audiologist; correct?
A. Correct.
Q. And you're not an engineer, not a professional engineer. Is that also true?
A. True. True.
Q. And you're not an acoustician as Mr. James is; correct?
A. Not as he is, no.
Q. You don't perform modeling analyses for wind projects, for instance, to determine sound levels?
A. I've never done that.
Q. And you're not qualified to do that; is that correct?

A. **I don't really know, to be honest, in terms of acoustical standards. Probably not. I have certainly done measurements in communities about community noise, race tracks, for example, and public events like concert hauls and so forth. I have made noise measurements part of my training as an audiologist was how to make noise measurements.**
Q. Okay. Are you a licensed audiologist?
A. I am not because I am a retired audiologist I didn't want to pay the $350 a year when I knew I wouldn't be practicing clinical work. Licensing only applies to clinical work, working with patients who have hearing problems.
Q. Certainly. And so have you ever been licensed?
A. I have been licensed the whole time with my career that I was involved in clinical work, yes.
Q. Okay.
A. In a couple states.
Q. Are you licensed to practice medicine?
A. Of course not.
Q. Based on your testimony earlier I understand that an audiologist deals with hearing related diagnoses or treatment. So, for instance, hearing loss treatment. Is that true?
A. That's true.

Q. And so an audiologist can determine if somebody has hearing loss but they cannot necessarily determine or diagnose diseases, for instance, from the ear. Is that true?
A. Well, I think a medical doctor would say we can't diagnose in the sense that we can tell where the lesion -- the site of the lesion is by audiometric testing battery that we can perform, some of which is electrophysiologic, some of which is audiological through earphones and so forth but we can't determine what the actual cause of, say, sensory neuro hearing loss really is.
Many times in reports we put in audiometric results are highly consistent with presbyacoustic hearing loss or noise-induced hearing loss, for example, and that is helpful to physicians in making their diagnosis. But they have additional tests they can perform, including their own physical exam.
Q. So if you -- as I understand your testimony, if you identified an issue, that may be referred to a physician in order to make a further testing diagnosis to determine the actual cause?
A. Yes. We work closely with otolaryngologists, ENT specialists, in that we get referrals from them, and we refer to them with respect to diagnostic and sometimes

treatment issues. If medical or surgical treatments seem applicable, then certainly we refer to a medical specialist.
Q. And as an audiologist you don't have any expertise to diagnose nonhearing related maladies like heart disease or diabetes; is that true?
A. That's true. True.
Q. In your testimony you state that you're testifying as an expert witness regarding the potential health effects posed by noise from the project; is that correct?
A. True.
Q. I believe if you want to turn to pages 3 and 4 of your testimony, do you have that in front of you?
A. What exhibit is that? I do not have it -- I have it on the computer.
Q. Certainly. I believe it is Exhibit 2. I 2. Sorry.
A. **I 2?**
Q. I 2.
A. I 2 A? I'm sorry. Prefiled testimony?
Q. Yes.
A. Okay. Okay. I have it.
Q. And if you look at page 3. 3 and 4.
A. Okay.
Q. I'm looking at lines 58 and 59. Do you see those?
A. 59 ends the question and 60 starts an answer.

Q. Yes.
A. On my -- okay.
Q. That's correct. And, as I understand that portion of your testimony starting at line 60 through 81 you're identifying your qualifications to testify as a health expert regarding wind turbine noise. Is that true?
A. Well, the question was what experiences do I have to qualify me as a health expert, yes. In that sense it's true.
Q. And as I'm looking at your testimony, you indicate that you coauthored an article on wind turbine noise in Audiology Today.
Is that the article you were referencing with Mr. James that you --
A. That was the first article. That's not the same article as I included as my Exhibit 2.
Q. Certainly. You talk about chairing a technical work group. Is that true?
A. Yes.
Q. Testifying before zoning boards and commissions. Is that also correct?
A. I have, yes.
Q. Coauthoring a blog on a website. Is that also true?
A. The article, wind turbine -- well, Exhibit 2 is an article that is published on a website. I called it a

blog. I'm not sure it's really a blog. It's really a -- it's like a journal of the hearing health -- technology and health matters. Okay.
Q. Okay. And then testifying in other matters; is that true?
A. Yes.
Q. And interviewing individuals?
A. I have interviewed individuals, yes.
Q. And then the article that you've coauthored with Mr. James that you do have is Exhibit 2-2; is that correct?
A. Sure. Yes.
Q. So other than your interviews with people where you were interviewing them and asking them about their complaints as you described earlier in your testimony, you're relying primarily on other people's information to have your opinions; is that true?
A. Well, to a large extent I have my own experiences visiting and talking with people and doing some more formal interviewing than I had mentioned earlier.
Q. Okay. As far as -- as far as the people that you interviewed, did you perform medical examinations of those people?
A. No.
Q. And you have identified a number of maladies that

you think can occur due to wind turbines; is that true?
A. Yes. Most of which are documented all of which are documented in the literature.
Q. And that's your -- you reference those on page 5 of your testimony; correct?
A. Are you talking about the symptoms or the complaints or the health problems?
Q. Yes.
A. Okay.
Q. So, for instance, you note sleep disturbance, annoyance, headaches, dizziness, vertigo, nausea, those types of symptoms?
A. Absolutely, yes.
Q. People that don't live near wind turbines also can experience those same health effects. Is that true?
A. Admittedly, yes of course.
Q. And there's multiple reasons why someone might suffer a headache, for instance. Is that also true?
A. Many reasons I understand, yes.
Q. So if someone is seeking treatment for certain symptoms part of the process as we discussed earlier would be to diagnose potential causes of that particularly symptom. Is that true?
A. True.
Q. And you would also rule out other potential causes

so that you can identify hopefully the true cause; is that correct?
A. Yes. And you're talking about individuals. I don't diagnose individuals. I talk -- my work is involved with what I call causation assessment or risk assessment, not individual diagnosis.
Q. No. That would be what a physician would do; is that correct?
A. Individual diagnosis, yes.
Q. And an audiologist does not have the training to rule out nonhearing related symptoms as you've stated earlier; correct?
A. Nonhearing related symptoms? Rule out?
We can take the patient's -- or client's or patient's word for it, like the physicians have to do, that they have a headache, for example, but we can't officially diagnose it.
Q. On page 5 of your testimony you indicate that landowners who participate in a wind project or sign waiver agreements with a wind company are less likely to experience or report negative effects from turbines; is that correct?
A. I believe it is.
Q. So a person's perception of a wind project can influence their reaction to the wind project. Is that

true?
A. Of course.
Q. On page 6 of your testimony you state that you estimate around 15 to 20 percent of exposed residents will experience extreme annoyance and sleep disturbance. Is that true?
A. Right.
Q. You don't site a source for that statement in your testimony, do you?
A. There is no source that says the range is 15 to 25 percent. I was offering an opinion and also an estimate, and that is my estimate.
Q. In your testimony you indicate that you have been retained as an expert witness in the past. Is that true?
A. Yes.
Q. Are you familiar with the case of Williams versus Invenergy, LLC?
A. Yes.
Q. And do you have in front of you what's been marked as I -- oh, A 36?
A. I have it on the list I'll have to find it. I'm sorry. I --
Q. I apologize. It's A 36. It would have been sent to you by e-mail.
A. Oh, I think that was sent to Mr. James's e-mail

address because I'm in his study in his home. I don't know --
Q. I apologize. So do we need to send it to your e-mail now?
A. I have my computer available to do that, if you will.
Q. Okay. We will send it to you.
A. I need to log in.
Q. Okay.
A. Again.
A. I think I have it now.
Q. Okay. If you have it up just let us know when you're ready.
A. It's open. I'll need to be leaning to the right to access it. Okay.
Q. Okay.
A. Okay.
Q. Were you retained by the plaintiff in this action to provide expert testimony on health effects of wind turbines?
A. Yes, I was.
Q. And was your testimony excluded by the court?
A. As I recall, it was. I heard -- I should say I was present to hear Mr. James's testimony, and I think we were -- I know we were involved in the same case, and for

the same reasons my testimony was excluded because of the Daubert hearing issue that we discussed.
Q. Okay. So if you'll look on page 14 of the -- and so the -- as I understand it, the page numbers are on the lower right-hand side.
A. Yeah. I'm almost there.
Q. Okay.
A. Okay. I have page 14.
Q. So if we look under A, Qualifications, do you see that subsection?
A. I do. Yes, I do.
Q. And I'll just warn you Cheri's looking at me so we have to be careful not to talk over each other. Cheri is our court reporter.
I see a line that says, "Punch's qualifications are impressive to be sure." Is Punch you, Dr. Punch?
A. I would assume.
Q. And if you look down at the bottom of the page it says, "However," and then up at the top of 14, "Punch is neither a medical doctor nor an epidemiologist who could opine on the cause of Williams' symptoms solely on the basis of these qualifications. Therefore, for Punch's causation testimony to be admissible he must support his causation opinion with reference to foundational literature which establishes the causal relationship

through the Application of scientific knowledge."
Have I read that accurately?
A. You have.
Q. So if we turn then to page 15?
A. Okay.
Q. And were you -- before I get there were you present for the discussion of the reason -- I believe you said you heard Mr. James's testimony?
A. From another room I was listening on another computer, yes, on the website.
Q. Did you hear the discussion and us read through the reasons why the Cape Bridgewater study was found by the Court to not support an opinion of causation?
A. I have to say I only caught part of that. I'm not fully aware of what was said in total.
Q. If I indicate that Mr. James agreed that I read the portions that were referencing the Cape Bridgewater study and the Dr. Kelly article and Paul Schomer's articles as not being sufficient to form a basis for causation, would you accept that based on what's in the document?
A. I would accept that you --
Q. Read it correctly.
A. I'm accepting that you read it correctly, yes.
Q. I won't repeat those then.
A. Okay.

Q. If we look at then on page 15 at the bottom on the left-hand column it says -- and are you there? I should ask before I start.

A. Am I here? Yes.

Q. It says here, "Neither the Pierpont nor Schomer information constitutes an epidemiological study or shows a significant statistical relationship between turbine generated infrasound and adverse health effects. The third article by Sult and Huller (check) supports its theory of causation by demonstrating some low frequency sounds stimulate hair cells in the cochleas of guinea pigs. However, the Salt and Huller article, like Punch's other exhibits, fail to demonstrate the statistical relationship between low frequency wind turbine infrasound and human health effects."

Did I read that accurately?

A. I wasn't actually reading with you. I have no reason to doubt that you read it accurately. Is that acceptable?

Q. That's acceptable.

And the Pierpont study is the book by Neenah Pierpont called Wind Turbine Syndrome? Is that true that they're referencing?

A. True.

Q. And there's testimony in your -- in your Direct

Testimony you have certain references to Mr. Howell's study on -- the acoustical study that was performed by Mr. Howell. Is that accurate?

A. I did make some comments on that, yes.

Q. Okay. And you made recommendations of certain distances and certain sound levels that you believe are appropriate; is that true?

A. I don't recall whether that was in -- with respect to Mr. Howell's testimony or someone else's, but I think that's -- that makes sense, yes.

Q. And I should --

A. I'll take it as true.

Q. I should restate that you did make those opinions not necessarily in response always to Mr. Howell but of your own determination?

A. That's right.

Q. And as I understood your testimony earlier, you indicated that you had offered a distance of -- a mile distance in addition to a dBA level because you didn't know how you would determine sound at a specific level. Is that true -- or a specific distance. Is that accurate?

A. Yes. I said basically that the two don't correlate always because of differences like terrain and weather conditions and times of year. All kinds of things,

variations, factors, can influence the noise levels that are picked up or expose people to certain noise levels at that particular distance.

In other words, different people at 1.25 may not experience the same noise levels. I didn't quite make that clear earlier, I think.

Q. Are you aware that -- as Mr. Howell did in this case, that it's possible to model in advance the estimated sound levels at specific distances from wind turbines?

A. As I said earlier, I don't do the model but I understand what modeling is about and I understand from other acousticians in addition to Mr. James that modeling is not always accurate.

MS. SMITH: I have no further questions at this time. I would move to strike all of Dr. Punch's testimony. He does not have the qualifications to opine regarding health effects, nor does he have the qualifications to opine regarding acoustical analyses of wind project and appropriate wind turbine levels.

MR. DE HUECK: So from my perspective I'm going to stand by my prior ruling and apply it to Mr. Punch in that he may not testify as to health related effects. However, I think he is allowed to testify as an expert to infrasonic sounds and inaudible noises from his

experience and his training and research.

MR. ALMOND: May I have the opportunity to voir dire the witness specifically related to this court case that she was just referring to, as there's a pretty significant paragraph in there where the Court says -- "Dr. Punch is provided to give an opinion on causation that wind turbines produce audible noise which may disturb individuals and interfere with sleep," which is on page 16 of this court case we're going over that has not been discussed yet.

MR. DE HUECK: Can you point me to where you're --

MR. ALMOND: Page 16 of of the Williams versus Invenergy.

MR. DE HUECK: Where is it?

MR. ALMOND: C, Admissible Subjects of Testimony. Just read that section.

MR. DE HUECK: Yeah. The first sentence, that's what I was trying to say. We're not going to talk about adverse health effects.

MR. ALMOND: Of infrasound and not audible -- or low frequency sound pulses.

That paragraph goes on to say that "Given his expertise as an audiologist, he is qualified to give opinions that wind turbines produce audible noise which

may disturb individuals and interfere with sleep."

MS. SMITH: May I respond? Because nothing that we've discussed here so far indicates that an audiologist tests for infrasound. They test for hearing loss. Hearing has to be audible. Therefore, I do not believe that he is qualified to speak regarding infrasound.

MS. EDWARDS: I'd just like to weigh in that, if permissible, I would like to further voir dire the witness on the same issue.

MR. DE HUECK: Go ahead.

MS. EDWARDS: Thank you. Mr. -- rather, Dr. Punch, are you familiar with the case out of -- or, rather, docket out of New York involving the Cassadaga Wind Farm permit.

THE WITNESS: I am.

MS. EDWARDS: Did you offer testimony in that case?

THE WITNESS: I did, yes.

MS. EDWARDS: Was your status as an expert challenged?

THE WITNESS: I don't think my credentials per se were challenged. I don't recall that they were.

MS. EDWARDS: Was there a Motion to have your testimony excluded?

THE WITNESS: Well, if you have evidence that's

true, your documentation would be better than my recollection. I don't recall it. No. I don't recall it.

MS. EDWARDS: Would it be accurate to state that the Public Service Commission found that it went to weight and persuasiveness rather than admissibility and allowed your testimony in?

THE WITNESS: That sounds consistent with what I recall. But I'm not -- I'm not a lawyer either, and I don't really fully understand the weight of those -- you know, the substance of those labels.

MS. SMITH: I would say that this -- we're really just doing legal argument through the witness because that particular case had a standard where they allowed -- they decided they didn't -- were not going to apply the traditional standards of admissibility and they allowed the witness in and it went to weight.

Here we have been applying the rules of admissibility. They need to be an expert witness in order to testify. Otherwise, anyone could come up and give their opinions regarding articles on the internet, and we've been attempting to differentiate between the two.

MR. DE HUECK: Okay. So still applying a legal standard here is my ruling, and it's similar to what we

did earlier.

He may not talk about adverse health effects as, say, a doctor or another medical professional because clearly he is not. But he has clearly stated that he has been studying audiology for a long long time, and he's got a background and a resume to support that.

On that note I believe infrasound and other inaudible noises go hand in hand with his study, and he's clearly very fluent in that matter, which is beyond someone just someone talking about what they've read on the internet. So I believe his background will allow him to testify in terms of infrasound.

Additionally, I see what Reece has pointed out, and if you read the whole paragraph it makes sense to me. They're not saying that he can medically go on to expound about sleep related health effects but that if he has, such as the WHO, literature that talks about health effects, he's qualified to tell us about those reports and what they said.

MS. SMITH: And just to be clear, as I understand -- I understand with the reading here that noise can cause sleep disturbance -- the relationship between noise and sleep disturbance was allowed by the court in this particular case.

So is your ruling that that's allowable? That's

the extent of what's allowable?

MR. DE HUECK: That would be the extent.

MS. SMITH: Okay. Just wanted a clarification. Thank you.

MR. DE HUECK: So I'm considering it pretty limited testimony, avoiding anything that is assessing the risk of health problems.

MS. SMITH: All right. As long as we're stopped, I will offer that we'll do the same approach that we did before. We will provide our proposed striking redaction of the testimony that's been submitted, and we'll look at the transcript as well.

MR. DE HUECK: Yes.

MS. SMITH: Thank you. I have no further questions then.

MR. DE HUECK: Okay.

Moving on for cross-examination to Mr. Fuerniss.

CROSS-EXAMINATION

BY MR. FUERNISS:

Q. Hello, Dr. Punch. You have referenced the World Health Organization. Is it true that they're currently reviewing their noise standards and looking in particular at noises from wind turbines?

A. That's true. I learned that yesterday.

MR. FUERNISS: Thank you. I have no further questions.

MR. DE HUECK: Ms. Jenkins.

MS. JENKINS: No questions.

MR. DE HUECK: Ms. Pazour.

MS. PAZOUR: No questions.

MR. DE HUECK: Staff.

MS. EDWARDS: No questions.

MR. DE HUECK: Okay. Dr. Punch -- or, Mr. Punch, now we're going to subject you to Commissioner cross-examination. We're going to get you over to Kristie Fiegen.

Before she begins I just have one question.

That Pierpont lady, she came up with infrasound and studied it and published some things. Would it surprise you to know that she had changed her position and determined that wind turbines do not carry infrasound? In other words, she backed off of her former position that you would have relied on in that court case?

THE WITNESS: Well, I relied on a number of things. But it would surprise me, yes. It would surprise me.

MR. DE HUECK: So you have not heard that?

THE WITNESS: I have not.

MR. DE HUECK: Okay.

CHAIRWOMAN FIEGEN: I have none.

MR. DE HUECK: Vice Chairman Hanson.

No questions.

Commissioner Nelson.

COMMISSIONER NELSON: Dr. Punch, your Exhibit 2, which I think has been labeled as Intervenor 2 B, the wind turbine noise and human health paper, on the bottom of page 2 --

THE WITNESS: I'm sorry. Is that Exhibit 2?

COMMISSIONER NELSON: It was Exhibit 2 on your testimony.

THE WITNESS: Right.

COMMISSIONER NELSON: It's been labeled as 2 B.

THE WITNESS: Well, they're numbered by letters and then a number.

COMMISSIONER NELSON: Yep. I-2 B. And if you go to the second page.

THE WITNESS: Okay.

COMMISSIONER NELSON: Bottom of the second page, probably second to the last sentence that starts, "In fact."

THE WITNESS: Just getting to the second page. Okay. Yes. Okay.

COMMISSIONER NELSON: "In fact much research and

some already rendered legal decision so convincingly that some segments of the population suffer damaging effects from exposure to wind turbine noise."

Can you cite for me the legal decisions that you're referring to there?

THE WITNESS: I don't think they're necessarily the legal decisions that were made in cases I've been involved with. They're cases that I've discussed with Rick James, and he's discussed some cases of others who he knows -- other acousticians who have been involved in these cases.

I cannot cite at this point -- I was basing that on information I had then, but I don't recall what I was basing it on at this point.

I think probably I was thinking for sure about the Wisconsin case. We mentioned the Shirley Wind case in this article, in fact. This was written in 2015 or '16. And that case was on going since, I don't know, 2012 at least, if not earlier. So the fact that it had been ruled a human health hazard was a legal decision in a court case essentially, in a hearing at least.

There are other cases in Europe. There are cases now that anyone about then in Canada, particularly Ontario, Australia, I think, Ireland where there are real community pushback -- there's real community pushback to

install turbine operations.

And even in Canada I think -- my understanding is that in the province of Ontario the new premier, Doug Jones -- excuse me. Doug Ford was elected in large part because of the community's complaints and upset with respect to all the turbines that are going up in that area of the country.

COMMISSIONER NELSON: Yeah. But that has nothing to do with a convincing legal decision.

So I want to go back to your reference to the Shirley Wind Farm issue where that area was declared to be a public health area.

THE WITNESS: Human health hazard, yes.

COMMISSIONER NELSON: Okay. And that decision was made by a court of law; is that correct?

THE WITNESS: Well, it was made by the Public Service Commission, I think, based on evidence from the Department of Health. I was not involved in that case. Let me make that clear.

COMMISSIONER NELSON: But that's the one that you're referring to in this paper; correct?

THE WITNESS: Okay. Correct. I believe so. I believe so.

COMMISSIONER NELSON: No further questions.

THE WITNESS: Again -- okay.

MR. DE HUECK: With that, Mr. Almond, do you have any redirect?

MR. ALMOND: No.

MR. DE HUECK: Prevailing Winds, do you have any recross based solely on Commissioner Nelson's question?

MS. SMITH: No.

MR. DE HUECK: Staff.

MS. EDWARDS: No.

MR. DE HUECK: Okay. Mr. Punch, thank you for your testimony today. You may be dismissed.

(The witness is excused.)

MR. DE HUECK: And moving on, Mr. Almond, you may call your next witness.

MS. AGRIMONTI: Mr. de Hueck, I'm sorry. I just realized the time. We're hitting 5:30, and I know we'll go until 7:00. I didn't know if this was the right time to break, or if you had a different time in mind.

(Discussion off the record.)

MR. DE HUECK: Reece, why don't you go ahead. Call your next witness we'll at least get your portion done and then think about a break before cross-examination.

MR. ALMOND: Intervenors call Paul Schoenfelder.

Paul Schoenfelder,

called as a witness, being first duly sworn in the above cause, testified under oath as follows:

DIRECT EXAMINATION

BY MR. ALMOND:

Q. Why don't you introduce yourself to the Commission?

A. **My name is Paul Schoenfelder. I live at 40228 296th Street, Wagner, South Dakota.**

Q. And do you own land in or around the project footprint?

A. **I do.**

Q. How long -- sorry.

A. **Sorry. Own a farm together with my wife. I in 2000 received a deed to a portion of what's my wife's family farm.**

Q. How many acres do you own?

A. **160.**

Q. And how long did you say you've lived there?

A. **My wife grew up on the family farm. We moved to Boise, Idaho and then in -- let's see 2017 my wife returned to the area, to the farm, and then I moved to the area in January of 2018.**

Q. And what do you do for a living?

A. **Right now I'm working on building two businesses in the area. We -- I lived out in Idaho for 24 years. I**

worked as a recreation manager for the city of boys I parks and recreation department. Wife and I worked on a business model, plan tried to figure out a way to basically get back to South Dakota get back to the farm. So right now since January I moved back. I'm in the process of building a business on the farm site.

Q. And what about your wife? What does she do?

A. **She's a training manager for a company called D T S. She works remotely the company she works for is based out of Orlando Florida she works out of our home remotely.**

Q. Do you have any children?

A. **We do. We have four adult children. Our adult child, Zachary, our third child, moved back to South Dakota in June.**

Q. Where does he live?

A. **He lives on the farm with us. He purchased a camper and moved on to the farm site. We're in the process of renovating the farmhouse, and so for the last few months we've been living in the camper since we don't have a flush toilet. So until I get my rough-in permit, my rough-in inspection and get my shower back in place, we're living in the camper on the farmsite.**

Q. The other three children live outside of South Dakota?

A. **Yes. All three live in Idaho.**

Q. And do you have any concerns with this project?

A. **I have numerous concerns with the project.**

Q. I should first clarify are you an Intervener in this proceeding?

A. **Yes. I am an Intervenor in this case. Several concerns. My primary concern is my health, the health of my family.**

We have several wind turbines proposed within a mile of our home. I know several people that live near the Beethoven wind project have had very credible health concerns associated with that. I've visited the Beethoven area. Again it's only a few miles from my home. Sound, shadow flicker, vibration. Those are things that are definitely concern for me. Long-term we're planning to live in this house I have to assume for the rest of our lives. It faces towards the east. To the southeast we've got multiple wind turbines. So health issues are huge.

You know, from an aesthetics standpoint, this is where where he want to live. This is where we've spent the last 10 years trying to figure out how to get back to.

I wake up every morning and look to the east and based on the maps vision where the wind turbines are proposed, I know that physically it would be a different

ATTACHMENT 13

STATE OF MICHIGAN

IN THE CIRCUIT COURT FOR THE COUNTY OF MISSAUKEE

CHARLES and DEBBY WILTZER
And SEAGER WILTZER,

Plaintiffs,

v FILE NO: 12-8205-CZ

HERITAGE SUSTAINABLE ENERGY,
a Michigan Limited Liability
Company, and HERITAGE STONEY
CORNERS WIND FARM LLC, a
Michigan limited Liability Company,

Defendants.

_ _____ ___/

CONTINUATION OF DAUBERT HEARING

BEFORE THE HONORABLE WILLIAM M. FAGERMAN, JUDGE

Lake City, Michigan - Thursday, December 5, 2013

APPEARANCES:

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Lake City, Michigan

Thursday, December 5, 2013 - at about 10:14 A.M.

THE COURT: The next matter before the Court is the case of Wiltzer vs. Heritage Sustainable Energy. We have file number 12-8205-CZ. This is the time and date set by the Court for the continuation of an evidentiary hearing with respect to a motion filed under the Daubert standard.

The Court was in receipt yesterday of an ex parte motion from the defendant to adjourn this proceeding. I reviewed that document, I reviewed a response to that document from Ms. Topp on behalf of plaintiffs, a supplemental document from the defense, and a supplemental response from Ms. Topp; and the Court entered an order denying the request to adjourn this proceeding.

I raise that because I don't intend to have any lengthy debate about that today; but is there anything else that you would like to say about that, Mr. Chaklos?

MR. CHAKLOS: Well just, your Honor, um, I appreciate the Court looking at this and deciding that. Um, I guess my only concern would

be since I'm not -- I mean I was shocked by the ruling, I'll tell you that, because I didn't think that, um, that my actions played any part in me not being prepared today to review the articles and to cross-examine the experts on them, and that's the purpose of the Daubert hearing; and you ordered it six weeks ago, and I got it two or three business days beforehand. So I was shocked by that.

I respect it, and that's your grounds of your ruling on that and obviously we will live by that. But I guess what I'd like to preserve I didn't know if you were going to make a ruling today on these matters; but since I probably have gone through half the literature, I would ask you to hold off on making any rulings so I can brief this issue after I have a chance to look at the articles.

I'm going to talk to Mr. James today about the articles we already went over just very shortly, because he interpreted those -- he interpreted those articles a lot different than I did. And I think I should be able to have, um, have a full understanding of those articles before I present any type of argument to you in terms of

whether or not these experts should be allowed to testify.

THE COURT: Well I think my note is correct that we started Mr. James' testimony on October 17; counsel agree with me, that that's the date?

MR. CHAKLOS: 24th I believe.

MS. TOPP: I believe the 24th of October, Judge.

THE COURT: The 24th, all right. My note is in error here. So we are talking about several weeks have passed since we started this process; and if I'm not mistaken, your motion was filed considerably before that.

The Court I think considered the documentation that plaintiffs had with respect to the Daubert standard that has to do with whether or not there is adequate scientific basis that is adequately peer reviewed in order for an expert opinion to be offered and determined that it appears as though it was there, but you wanted the opportunity to be able to cross-examine the two experts with respect to that and that was the process we were engaged in.

I will entertain your argument when we're

completed with the proofs here today if you think you need to submit a supplemental brief. I won't decide that right now. I'll consider that when the time comes up for that. Mr. Kasiborski, do you intend to be the counsel for plaintiff in this matter?

MR. KASIBORSKI: Well for the Daubert hearing, yes; but in so far as other issues come up --

THE COURT: Yeah, I didn't want to belabor the issue of adjournment. I considered the fact that we had started this hearing, Mr. James was in mid testimony when the Court was required to adjourn. I don't recall if it was the lateness of the hour or my schedule, but it was something that happened; and it was the Court's belief, even after reviewing submittals, that we should continue this hearing today to make this matter move forward. That's the Court's position; I don't mean to argue that any further.

I would note just as a procedural matter that I would encourage counsel to be sure to submit the originals that you filed with the Court; the Court Clerk has not yet received those originals. The Court has filed its order denying

it; it makes little sense in the file if we don't have the pleadings in the file just for the completeness of the file, understanding that under the circumstances you submitted them to the Court by facsimile and the Court ruled on those based on those submittals. So I'm prepared to go forward. Mr. Chaklos, are you prepared to continue with Mr. James' testimony?

MR. CHAKLOS: One thing I'd like to ask the Court is -- and we have talked to plaintiffs' counsel about this, and I guess they're against this, but we both have our clients here this morning.

THE COURT: Yes.

MR. CHAKLOS: And, um, and I would like to take just a short time, we'll know probably within a matter of minutes whether or not we will be able to settle this case.

THE COURT: Oh, you want to conduct a settlement conference before we proceed with this?

MR. CHAKLOS: Yes. And because I don't think your ruling is really going to affect what I value this case at. I think I know at least where you're leaning so I don't think it's going to be decide --

THE COURT: Mr. Kasiborski, do you think there's some utility in us doing that and you're thinking in terms of efficiency to allow your clients to leave; is that the idea?

MR. CHAKLOS: Yes.

THE COURT: Ms. Topp?

MS. TOPP: Judge, we did discuss this yesterday, and the reason for our objection to starting with the pretrial conference are threefold. First of all, we have our experts who are sitting here waiting to give their testimony which is costly to have them sit here.

Secondly, we're concerned that if we spend time doing the pretrial conference first, that the Daubert hearing might not conclude today if Mr. Chaklos is lengthy. We don't want to have to bring these experts back yet for a third day.

And then the third basis is that your ruling on the Daubert hearing I think is important to the issue of settlement depending on which direction you go as to how motivated the parties would be for settlement, so that is why we didn't agree with counsel when they requested that we stipulate to starting with a pretrial conference.

THE COURT: Well this Court is typically

-- has typically required parties to be present for a settlement conference, but I'm not opposed to having parties be available by telephone as long as they assured that they in fact are available; and if counsel believes that they can adequately discuss the issues of settlement in that fashion in the interest of people not sitting through this long hearing. Do you have a position with respect to that, Ms. Topp?

MS. TOPP: Well we would be willing to agree to holding the settlement conference this morning if the defendants would agree to compensate our experts and that they would stipulate that the Daubert hearing will be concluded today regardless of the amount of time that is left following the settlement conference.

THE COURT: Well I'm not going to agree to that. I have a schedule as well, so I can't buy into that. I don't know how long the testimony is going to be; I trust it will be shorter than it was when we were here on the 24th, but I don't believe I can agree to that. Do you have some objection to at least Mr. Chaklos' client being available by phone?

MS. TOPP: No, no objection to him being

available by phone.

THE COURT: Mr. Chaklos, does that solve that problem perhaps if your client can be available?

MR. CHAKLOS: It does. But your Honor, I mean we will know -- it's not going to take that long to hold just a settlement conference as to this case.

THE COURT: Well I'm certainly not going to preclude the parties from settling after the Court rules on the Daubert motion obviously. But my goal here at a settlement conference would be, number one, to make sure that you legitimately tried to negotiate a settlement.

MR. CHAKLOS: Your Honor --

THE COURT: And then number two to set a trial date and to discuss the length of that trial date, and I would typically like to leave after a settlement conference with a firm trial date so that all of the parties have that, and it will be on my schedule and all of yours.

MR. CHAKLOS: Okay. Your Honor, why don't we just do the settlement part. I can't believe that it's going to take over 15 minutes to talk settlement. We spent a lot of time yesterday

with conference calls with my insurance carriers and with Mr. Lagina.

THE COURT: Are there additional offers or proposals that you're prepared to present today --

MR. CHAKLOS: Yes.

THE COURT: -- that haven't been presented?

MR. CHAKLOS: Yes.

THE COURT: All right, I'm willing to do that. I'm going to set a time limit though, Ms. Topp, so it doesn't go too long. I'm going to indicate that the Court would intend to reconvene at the very latest by quarter to 11:00; however, I would encourage you if you're done to let me know, and we can then proceed to this hearing and start sooner than that. However, I would like your clients still to be available in case after we complete the hearing if we have to have it by telephone, if we have to have a discussion about a trial date and so forth.

MR. CHAKLOS: Okay.

THE COURT: How long that might take. All right. Anything else at this time then before we take a recess for no more than 20 minutes?

MS. TOPP: No, your Honor.

THE COURT: All right, thank you.

MR. CHAKLOS: Thank you.

(Recess at 10:24 A.M.)

(Proceedings reconvened at 11:07 A.M.)

MR. BOWDEN: If I may, Kurt Bowden for the record --

THE COURT: Yes, Mr. Bowden.

MR. BOWDEN: -- on behalf of Heritage Sustainable. To clarify, we did attempt some settlement discussions; and it's my understanding at this point that the parties are free to leave. Is it possible that there will be further discussion this afternoon regarding scheduling or are we going to reschedule a time to discuss the setting of a trial date and so forth?

THE COURT: I likely would like to address that today, but I'm not certain that I have to have your clients be available for that. Do you think there would be something that would be scheduled with them that you would want to be in contact with them about setting a trial date?

MR. BOWDEN: I guess mainly in terms of if there are conflicts that are already on the calendar would be the main concern.

THE COURT: Well what I can do then is I could get a concurrence among counsel as to the number of days of trial and then I can ask my staff to be in touch with your offices to set a specific trial date. Since I don't have my scheduling staff here in Lake City, my office and operation is in Cadillac, we can do that. We can do that other than today, but I will want to have a discussion with counsel about length of trial and if there's other pretrial issues that we have to have resolved and schedule in resolving these matters. Is that adequate, Mr. Bowden?

MR. BOWDEN: Yes.

THE COURT: Mr. Kasiborski, is that adequate from your standpoint?

MR. KASIBORSKI: Yes.

THE COURT: Certainly the clients are welcome to stay, but they're not required to.

MR. KASIBORSKI: Okay.

THE COURT: Fair enough.

MR. KASIBORSKI: And Judge, maybe Ms. Topp can help me sort out some of this stuff. You asked for a binder for the Court of articles.

THE COURT: One of the things that was difficult for me at the first hearing was this

reference to articles and looking at certain quotations, and I frankly didn't have that documentation so that I could follow along with the witness and that diminishes my ability to get the factual basis that's being displayed. Do you have that?

MR. KASIBORSKI: We have several things that we think might help, and we have given a copy of a lot of this to Mr. Chaklos. The witnesses, to try to help themselves stay organized, have prepared summaries of articles so that they can refer to them as notes without always flipping through a stack of documents. And we also have a listing of the articles that each witness might testify about which might also be a reference.

And we propose that they have those summaries and lists of articles with them at the witness stand to try to move this along and then we offer them as exhibits.

THE COURT: I believe perhaps they were part of those summaries were even -- were even faxed to the Court.

MR. KASIBORSKI: Yes, I believe part of the summaries were an exhibit to the --

THE COURT: To the motion and response to

the motion.

MR. KASIBORSKI: -- motion and the responses were filed yesterday; that was only part, part of it was redacted because it was still in preparation.

THE COURT: Mr. Chaklos, any objection to that?

MR. CHAKLOS: Whatever moves this matter along, your Honor, I'd be happy with it.

THE COURT: All right, very well. Let's do so.

MR. KASIBORSKI: All right, and we have a --

THE COURT: Yeah, this --

MR. KASIBORSKI: Should we mark these as exhibits now?

THE COURT: Why don't you do that. I don't think we marked any exhibits at the prior hearing; according to my notes, we did not so this would be Exhibit 1.

MR. KASIBORSKI: Exhibit 1 would be a summary prepared by Mr. James.

(Plaintiff's Proposed Exhibit No. 1 and 2 marked by the reporter).

MR. KASIBORSKI: Judge, Exhibit 2 would

be a summary of articles prepared by Dr. Punch.

THE COURT: All right.

MR. KASIBORSKI: And I'll hand these to the reporter, and I believe the witnesses have their own copies.

THE COURT: That's fine.

MR. KASIBORSKI: We also have a binder for you if you'd like, Judge.

THE COURT: I would if it's comparable to what --

MR. KASIBORSKI: One is for James and one is for Punch.

THE COURT: Comparable to what the witnesses will be using and the attorneys will be using.

MR. KASIBORSKI: Yes. Those are actual articles, and I believe it's got a listing in the front.

THE COURT: And then tabs for those.

MR. KASIBORSKI: Tabs, yes, which corresponds to that index.

THE COURT: Just so that we're on the same track, the Court's notes reflected that we had questions up to item 16 at the prior hearing, is that --

MR. KASIBORSKI: Apparently these numbers --

THE COURT: Are different.

MR. KASIBORSKI: They're alphabetical. They don't correspond to where we were when we recessed the last time, your Honor. Maybe we should have organized that way but we didn't.

THE COURT: All right, fair enough. Mr. Chaklos, is all of this helpful to you or not helpful?

MR. CHAKLOS: Well your Honor, like I said, whatever moves this quickly. I know you want to get this resolved.

THE COURT: Are we ready to continue with Mr. James then?

MR. CHAKLOS: Yeah. What I'd like to -- and I know that you said you were going to reserve your ruling on it, but it will affect how I cross-examine the witnesses. I read through most of Mr. James', I had time to do that. I didn't even go into Dr. Punch's, because -- and I can question Dr. Punch about this -- but I honestly think that some of the articles that I read or that I received from Dr. Punch were not part of his deposition.

So he told me at that time that he did not -- and maybe I'm wrong -- but that he, um, did not plan on doing anymore work on the case. Um, he did a word search on his computer for all the articles on his computer, and he came up with I think one article is a Korean article about infrasound; all of the other articles are noise articles which I don't consider relevant to this case, so I didn't really think that I had to go over those in detail in preparation for today.

And to be honest with your Honor, the reason that I filed the motion was I just happened to look at the articles that Ms. Topp sent over for Dr. Punch, and there are a lot of infrasound articles in there. And like I said, it was my understanding when I deposed Dr. Punch that he only had one.

And so I really haven't reviewed his articles and this is a long way to get to my question. But my question is, um, since I haven't had a chance to review at least half of these articles, I don't want to take the Court's time when they're on the stand and telling us about the articles and then try to read the articles and then try to cross-examine them from reading them

for the first time. That was the very reason for --

THE COURT: But you want to be able to summarize that in a supplemental brief --

MR. CHAKLOS: Right.

THE COURT: -- or at least make arguments in that respect?

MR. CHAKLOS: Right, because they can tell me what they think about the articles, and then I can go through and read the articles and then see if what they tell me is accurate. I'm not saying they're going to lie about it, but people interpret different articles different ways.

THE COURT: But of course that's not the Daubert standard. I mean the Daubert standard is is this junk science or is this real science. It's not to say that there aren't other scientists that will disagree with the conclusion.

MR. CHAKLOS: Oh, sure.

THE COURT: Those are different issues of course.

MR. CHAKLOS: I totally understand that.

THE COURT: I think the best I can say is let's proceed along with the testimony, get Mr.

James done, and allow Dr. Punch to get on the stand and we will see where we go; and if you persuade me that you do need time to be able to advocate in writing that some of the articles that he's relying upon are contrary to what he claims, I'll consider whether or not I grant that.

MR. CHAKLOS: Okay.

THE COURT: All right. I don't know how else to answer it. I'll have to see what proofs are first.

MR. KASIBORSKI: May I just clarify?

THE COURT: You may.

MR. KASIBORSKI: I think Mr. Chaklos, with all due respect, is mistaken about Dr. Punch's deposition. I believe Mr. Chaklos asked Dr. Punch a question about an article he had written with Mr. James which included a number of references; I don't remember how many references at the back of the article. And the question about that article was were any of the articles in your references about infrasound, and I believe Dr. Punch did do something on his computer and identified an article from someone I believe -- I think Mr. Chaklos is correct, I think it was from someone in Korea that was about infrasound.

But he did also have at his deposition his thumb drive with all of his literature and he offered to download it for Mr. Chaklos. He said it's too big for me to send it to you as an e-mail, but Mr. Chaklos didn't have a computer with him but he did have infrasound articles on his thumb drive at his deposition. And then insofar as him saying I don't have a plan to do anymore work on this case unless I'm asked to or something like that; well since his deposition, we have now had the motion in limine and the Daubert challenge, so of course he has now looked for additional articles some of which were written after his deposition to support his opinion.

THE COURT: Very well. Mr. James, do you want to come forward, and we will have you be sworn in again.

MR. KASIBORSKI: And I suppose Dr. Punch was asked to be sequestered the last time, so I assume the same rules.

THE COURT: Yeah, that's my recollection. Mr. Chaklos.

MR. CHAKLOS: Yes.

MR. KASIBORSKI: One other. I think Mr. Chaklos -- I don't want to put words in his mouth

-- you can take the stand -- does not protest that there's a lot of literature out there, peer reviewed, reliable, that stands for the proposition that audible noise can cause sleeplessness and other adverse effects and that includes noise from wind turbines; and if that is his position, then we can ask the witnesses to focus on infrasound articles.

MR. CHAKLOS: Well yeah, I'm not --

MR. KASIBORSKI: You just said something you didn't think the articles on audible noise are relevant.

MR. CHAKLOS: I mean I guess it depends on what the article says. But it's my understanding that the noise -- we separated them between noise articles and infrasound. I'm not going to stipulate to anything, but my plan was not to really go in depth about the noise articles, because their testimony from the plaintiffs didn't talk about noise. They talked about their symptoms that kept them up at night.

So the concept of infrasound is really what I want to get into. So but that was -- that was the reason that I didn't really -- with the short time that I had, I really didn't want to

concentrate on Dr. Punch's because I had to get everything from Mr. James, and I still didn't get everything from Mr. James.

THE COURT: And I'm going to say one more thing before we start Dr. James' testimony; and that is what I mentioned a moment ago that the standard here is not for me to decide which scientist I believe.

MR. CHAKLOS: Right.

THE COURT: The standard is is whether or not one of them is or isn't science. And that's really your argument is that there isn't science to support the conclusion that the plaintiffs want both of these witnesses to reach. So if we can focus our cross-examination as to why it's not science and why the articles they rely upon don't meet those standards that are prescribed by Daubert and by --

MR. CHAKLOS: The statute.

THE COURT: -- and by MCL 600.2955, then we can speed this along.

MR. CHAKLOS: Right.

THE COURT: All right. Mr. James, would you raise your right hand, please? Do you solemnly swear or affirm that the testimony you

are about to give in this cause shall be the truth so help you God?

MR. JAMES: Yes, I do.

THE COURT: Mr. Chaklos.

MR. CHAKLOS: Your Honor, is it okay if I sit down to cross-examine?

THE COURT: You can remain at counsel table seated, that's fine.

MR. CHAKLOS: Okay, thank you.

RICHARD JAMES

called at about 11:20 A.M. by the Defendant, testified:

CROSS EXAMINATION

BY MR. CHAKLOS:

Q Hello, Mr. James. How are you?

A Fine, thank you.

Q Before we get into the articles, I just want to ask you some questions about your background. Have you ever conducted any case studies, any testing, things of that nature concerning the effect, the adverse effect of wind turbines in terms of ultrasound and people with adverse health effects?

MR. KASIBORSKI: Your Honor, I object. There was a hearing I think a week ago setting the

scope of this hearing, and there was an order entered limiting today's examination as to whatever Mr. James' opinion is; and, two, is there literature upon which that supports his opinion. It's a very narrow scope. This question is a deposition question.

THE COURT: Mr. Chaklos.

MR. CHAKLOS: Well your Honor, it's my understanding that what the plaintiffs wanted me to do was limit my cross-examination to qualifications. And I wanted to cross-examine them about their opinions and that's what the issue was; and so I believe that the order reads or should read that I think what happened was Ms. Topp just added the words opinion into her order. But I think the order does read I can cross-examine him about his qualifications and his opinions.

THE COURT: I'll allow you just a little latitude in that respect and see what Mr. James says about that. Mr. James, can you recall the question and are you able to answer it?

A I recall it vaguely, but I'm not exactly sure where he was going with that question.

THE COURT: Can you clarify, Mr. Chaklos?

BY MR. CHAKLOS:

Q Sure. Did you conduct -- I know you've read a lot of literature. Have you conducted any case studies or testing in terms of the adverse health effects that result from infrasound and wind turbines?

A Yes, I have.

Q Okay. And can you explain those for me please?

A I've conducted testing inside and outside of homes in Ontario, Maine, New York, Wisconsin, Iowa, West Virginia, um, Illinois looking both at the aspect of infrasound, low frequency noise, and audible sounds.

Q Okay. Um, I guess my question --

A If you remember, I also have a paper that was published that was specifically on that topic.

Q I've got your paper here.

A Well it makes me wonder why you asked the question then.

Q Well with comments like that, we're not going to get done today.

A No, we aren't.

Q Okay. So let's try not to do that, fair?

A Fair.

Q Okay. I guess my question wasn't very clear. I

know that you're involved in cases in terms of people that allegedly have problems with either noise or infrasound, um, coming from wind turbines. Um, I guess my question was more specific in terms of case studies where you actually, um, took a group of people that were not either plaintiffs in a lawsuit or you were not retained -- retained to represent them or you were not involved in the case at all, that's where you just conducted your own test with just a number of people across the board and exposed them to either the noise or the infrasound to see what adverse health effects can result?

A I conducted studies both for people who are anticipating lawsuits and people who are just trying to establish that they have a problem in their house possibly to determine if they want a lawsuit or not. I've conducted studies for communities who have asked me to follow up on complaints. Um, the purpose of those studies isn't to do an epidemiological study tying together the sound levels and the complaints; but in many cases, the people who are living in the homes did take logs of -- keep logs of their health effects that I can match up to my data.

And it's the results of those studies and the comments that they have made that have basically led me to my conclusions.

Q Okay. So the people that you dealt with were either plaintiffs or people who were contemplating filing a cause of action against wind farms or people that had already or were in opposition to wind farms being constructed, is that correct?

A They were people who were experiencing unusual or unpleasant experiences, symptoms, whatever you want to call them, and wanted to know if it was related to any noise in their home.

Q Okay. So then you would not have conducted studies of just random -- random people who were exposed or who lived around wind turbines and to see whether or not the wind turbines when they were operational whether or not there were any adverse health effects, is that correct?

A I don't know what you mean by random.

Q Well --

A The homes that I -- or the properties or homes that I evaluated were selected based upon someone in the community saying we have a problem here and that's not random.

Q Well did you -- did you test people who did not

have complaints about or did not have complaints about the wind turbines and the wind farm causing any adverse health effects?

A I had a number of families where some members of the families have symptoms or experiences and others don't, and I guess that would qualify. And I also have done testing where one neighbor is experiencing problems and the next neighbor isn't, so.

Q Okay.

A In a way; but these are not formal tests, these are tests done at the request of people.

Q Okay. All right. So I mean there have been a number of case studies, and I believe you have them in your literature where at least scientists actually went out and conducted a random test, who would just get a group of people who were exposed to the wind turbines and to see whether or not they had any adverse health effects; that's not something that you've done?

A No, because that would require funding on a level that I don't have available.

Q I totally understand. Now the paper that you did -- maybe we talked about it last week or last time we were here, but I just want to ask you some

more questions on it if we could. What was the basis for the paper that you authored?

A Which one of the papers?

THE COURT: Mr. Chaklos, the only one that I see on my list is number 9 in the binder that we have, counsel, Mr. Kasiborski. Is that the one you're talking about, Mr. James?

MR. KASIBORSKI: Yes.

THE WITNESS: Well there should be two papers in here; one is that paper which was a review of literature and interviews with people who had been involved in the field.

THE COURT: I don't see any others that have your name on it.

THE WITNESS: That's what I'm looking for. It might have come under Bray.

THE COURT: Which one are you looking at?

THE WITNESS: Well in my table --

THE COURT: I'm sure hoping they're the same.

THE WITNESS: Number 4, Dynamic Measurements of Wind Turbine Acoustic Signals Employing Sound Quality, Engineering Methods, Considering Time of Frequency, Sensitivity of Human Perception. That was a study -- that paper

was in my original deposition binder.

BY MR. CHAKLOS:

Q Was the title of the paper Wind Turbine Infra and Low Frequency Sound: Warning Signs That Were Not Heard?

A That's a more recent paper.

Q Okay. And what did you do in terms of any research that you did and then lead you to author this paper?

MR. KASIBORSKI: Just to be clear, we're talking about warning signs that were not heard?

MR. CHAKLOS: Yes. Yes, I think it was actually number 9 on the list of production of James' documents.

A Number 9, yes.

BY MR. CHAKLOS:

Q Okay.

A In my table, your Honor, it's number five.

THE COURT: I'm sorry, what?

THE WITNESS: In my summary table.

THE COURT: Oh, your summary table and the binder are different as well? All right.

THE WITNESS: We didn't have time to coordinate things. I apologize.

THE COURT: That's less than helpful.

BY MR. CHAKLOS:

Q So again, just very briefly, Mr. James, what's the nature of the paper?

A The nature of the paper was a review of both literature and interviews with people who have had significant experience in dealing with the infrasound and low frequency noise related to public health problems like sick building syndrome, early change and development; the NASA papers, Howard Shepherd, etcetera.

And the purpose of that paper was to demonstrate that there was a well understood relationship between infra and low frequency sound and the type of complaints that people were reporting who live near wind turbines.

Q Okay. I believe you testified last time that this was not a case study and was not peer reviewed, is that correct?

A No, it was a combination of literature review and, um, interviews with key scientists and engineers.

Q So it was not a case study.

A No. No.

Q I misunderstood your negative response, sir. And you didn't do any, um, original research, and it was essentially either talking to others who had

done research and then also a literature review, is that correct?

A That's correct.

Q And would it be fair to say that when you drafted the paper or before you drafted the paper, you didn't talk to anyone who or did not include in your article people who did not think that the infrasound or the noise from a wind turbine did not cause any problems?

A Part of my paper discussed Dr. Leventhal's statements which claim there are no problems and demonstrated the reasons why other scientists and why the literature doesn't agree with him.

Q Okay. But the answer to my question would be no, you didn't talk to anyone who was or it's not part of your paper that you talked to anyone who was not of the opinion that whatever adverse health effects that they had was not the result of wind turbines. Is that correct?

A The only -- the only scientist that maintains that, who publicly I guess is the original source of that assumption is Dr. Leventhal. And although I do not refer to talking to him, I talked to him both e-mail and voice and also through other forums such as on panels. So I did not -- it was

not a study of this versus that; it was a study to put together information from people who, um, could help me understand what I was seeing when I went into homes or when I went into communities where people were experiencing problems. And in many ways, it was done to reaffirm to myself that there was a solid basis of science behind the position I was forming which was that wind turbines were causing these problems.

Q Okay. So if I understand your rather lengthy answer, um, the paper is basically an article review and or talking to other acoustic engineers who have done research. It was not any type of study, and you did not talk to anyone who did not claim that they did not suffer any adverse health effects from wind turbines. Is that correct?

A I said that almost the last third of the paper was on the American Wind Energy Association's position that there are no problems. And in that, I used Dr. Leventhal's early statements as contrast to what I in the first two-thirds of the paper reported from other people who disagree with him.

Q Okay. I don't know if we're on the same wave length here. I'm just asking you a question that your paper was not based on talking to anyone that

did not agree with the concept that wind turbines would produce infrasound which would then lead to adverse health effects, is that correct?

MR. KASIBORSKI: I think that's been answered. I think he said in effect that he didn't have to talk to Dr. Leventhal because he talked to him -- specifically about that article -- because he talked to him by e-mail, by telephone, at conferences. I think the point that is trying to be made is that he didn't consider the opposite viewpoint which I think has been debunked by the witness, and I think it's time to move on.

THE COURT: Mr. Chaklos.

MR. CHAKLOS: Well your Honor, obviously he didn't answer my question. I mean I want to know whether or not his paper is based on the review of literature except for Dr. Leventhal, the review of literature or talking to researchers that believe that, that, um, that wind turbines emit ultrasound or infrasound and then results in adverse health effects. A very simple question.

THE COURT: I'm sorry, you lost me, so I guess you'd better slow down. Mr. James, did you have any discussions with people whose views

differed with you other than Dr. Leventhal?

A Leventhal.

THE COURT: Leventhal.

THE WITNESS: I've had ongoing discussions with all of the people that follow his theory, but I did not include that in this document.

THE COURT: You did not make reference to those, but you did consider those opinions?

THE WITNESS: Yes, I did. That was the reason why I wrote the first two-thirds was to provide the contrasting information to their viewpoint.

THE COURT: All right.

BY MR. CHAKLOS:

Q But the paper doesn't -- but the paper does not reference the contrasting viewpoints except for your reference to Dr. Leventhal.

A It references in that the last third of it states the American Wind Energy Association's position, based upon the advice of Dr. Leventhal beginning in 2004, that wind turbines do not produce significant infrasound and that they could not produce any adverse health effects.

Q So the answer to my question is no.

A The question is no, I did not for the purpose of that paper include any of the interviews or anything that I had learned from talking to people on the other side of the argument other than the summary of it as stated in the OWEA (sp.) website.

Q And do the articles that you produced contain any other article that you said that you have written?

A That was in my deposition and it was included in the articles that I sent -- remember when I sent that package to you?

Q I'm talking about the literature that's been produced for this Daubert hearing.

A It was literature I produced; whether it's in the book or not, I can't say because I didn't produce the book.

Q Well can you look through the index?

A I can say it was in the deposition book, and it's been in all of the books because it's one of the papers I wrote; and since I thought this was about my expertise, I thought it was important to have papers I wrote as part of the record.

Q Well I didn't get the book, that's the problem. Um, can you see -- can you check very quickly, your counsel has put together an index in terms of the articles that you are to testify to today.

Does your other paper -- is your other paper contained in that list?

A It's not in that listing.

MR. KASIBORSKI: Mr. James, what is the name of the article? Maybe it was discussed at the last hearing.

THE WITNESS: Dynamic Measurements of Wind Turbine Acoustic Signals.

MR. KASIBORSKI: It's number 4 on your summary on Exhibit 1.

THE WITNESS: Yes. And it was included in the information provided to Mr. Chaklos in a folder called publications of Richard James or something like that at the time of the deposition.

BY MR. CHAKLOS:

Q I was never provided that folder.

A It was on the thumb drive, sir, in those thousand pages of documents.

Q There are about 10,000 pages of documents on the thumb drive. Do you have the article with you today?

A Do I?

MR. KASIBORSKI: We need a second to look.

THE WITNESS: James' publications. Yes,

we have a copy of it here.

BY MR. CHAKLOS:

Q And what's the nature of that article?

A This paper presents the results of a test we did at a home in Michigan where the family had been complaining of symptoms very similar to what the Wiltzers complained about. And it's a GE 1.5 megawatt turbine about 1,350 feet from the home so it's a similar situation, similar location, a smaller turbine.

And what we demonstrate in that paper is that with that wind turbine did produce infrasound; predominately at the blade passage we could see that the wind turbine was 1 hertz, and that the infrasound had certain characteristics, one of which was tonal and the second of which it was pulsating; and that those characteristics preclude the measurement of that sound using standard instruments. In other words, the studies that have been done using standard acoustical instruments, not the type we used for this study, do not see the pulsations. They average them out; and in the process of averaging them out, they understate the value or the level of energy that's being received at that site.

And the point of the paper was that the studies both by Leventhal and by others who have stated that wind turbines do not produce significant levels of infrasound is not because wind turbines don't produce it, but because they were using the wrong instruments and the wrong measurement procedures. And our paper was written to provide them with the information to know what they needed to do to do a better assessment of wind turbine infrasound, and what the limitations of their instruments were so that they would seek better instruments.

THE COURT: Did you use the better instruments when you evaluated the Wiltzers' property?

THE WITNESS: Um, I used the methods -- yes, I used the methods that we were talking about which is a recording and analyzing using software that does not have the same limitations as the built-in hardware for the instruments.

BY MR. CHAKLOS:

Q So that paper you didn't -- when you authored the paper and you conducted the interviews and whatever work you did with regard to that home, you didn't have the equipment to measure whether

or not there was any infrasound; is that correct?
A That's not what I told the Judge. I told the Judge that I used the instrument -- I used the methods that we had developed for the paper, the 2011 paper. And we had been using those methods prior to the paper, but we decided that we needed to publish a paper to alert other acousticians to the deficiencies and then give them the procedures.
Q It's my understanding that you have to use a different meter to get -- to measure infrasound, is that correct?
A It's not that you use a different meter; you have to use a recording and analyze it, analyze the sound using digital filters of the type that you would do with software instead of the ANSI S1.3 style filter that's built into the commonly used one-third octave band analyzer, because the ANSI style filter does not perceive the pulsations properly.
Q Okay. So were you able to -- with the equipment that you had, were you able to document the existence of infrasound?
A Yes.
Q Okay. And how were you able to do that?

A Well we have done it -- we have done it two ways. I take a recording. The recording -- the recording is calibrated using a sound level meter and the calibrators that are properly analyzed with a meter so that I can benchmark my recorded analysis into the sound level meter data. And then the acoustic data or the audio data is processed using a software program called Spectra Plus. And these are samples that are more difficult to analyze than Spectra Plus, then I provide them to my colleague, Wade Brade, who analyzes them using his software Artimus which is a proprietary package.

Since that time, we have learned that we can do this much simpler using micro barometers, and I now back up my audio and my sound level meter data with samples from micro barometers, and we have done that at the Wiltzer home.

Q So the equipment that you used at the Wiltzer home, you didn't have that for that study then?

A I think I said yes, I did.

Q I'm sorry, I misunderstood. I thought you said --

A I said we have done the study using all three methods; one-third octave band analyzers, audio data analyze using fast forwarding transformer

methods, FFT methods, and with a micro barometer. All three of the methods confirm the presence of the infrasound with the exception that the sound pressures, the peak levels are not seen in the one-third octave band analyzer data; only the averages are seen in that meter. And it's not the average that affects people, it's the peaks of the pulsations.

Q Does your -- what were the readings from the -- from the meter that led you to believe that there was infrasound in the home?

MR. KASIBORSKI: Judge, are we getting beyond qualification?

THE COURT: Yeah, we are getting far afield here.

MR. CHAKLOS: It's --

THE COURT: Let's stick with the Daubert question here whether or not he's qualified to render an opinion. He's already been qualified as an acoustic expert.

MR. CHAKLOS: Right.

THE COURT: He can make measurements and readings, and it's a question of credibility and it's a question of weight whether or not his technique and measurements that he made in the

Wiltzer house are accurate or if they were done properly. That doesn't affect this Court's required decision here under 702 whether or not I'm going to permit him to testify as to the circumstances there relating to the physical symptoms. So we got to keep the focus of this on whether there's science to support the conclusion that physical symptoms are caused by these conditions, not what conditions did he find at the Wiltzers'. So if you could limit your questions to that, I think that will help the Court in making a ruling.

And I think perhaps I've created a monster here because the rule requires that this burden is upon the person offering the testimony; and then typically it would be within the control of the plaintiff to go through the literature and say and what do you rely upon, Mr. James. I rely upon articles 1 through 31. Then you would have an opportunity, Mr. Chaklos, to try to challenge whether or not those things that he relied upon meet the standards that have been opined by the courts in Daubert and progeny that have come from that.

Otherwise, this is going to be just

general cross-examination as to the credibility and the weight to be given to his theory and that's not the purpose of this hearing.

MR. CHAKLOS: Right.

THE COURT: That's for the finder of fact to decide if I allow him to testify. So what readings he got, how does that help me answer that question?

MR. CHAKLOS: Okay. Your Honor, the only reason I went in depth because it was his paper. I mean that's the only reason.

THE COURT: Well I appreciate that, but that doesn't change the issue that I have to decide here, so if we can focus on that.

MR. CHAKLOS: We can do that. Would you consider -- I believe you testified in your deposition that there were a lot more articles about noise, um, being emitted from wind turbines than infrasound, is that correct?

A Much of the work in Europe, much of the research in Europe is focused on the A-weighted sound levels which excludes infrasound, yes.

BY MR. CHAKLOS:

Q And I believe that you even testified that you were one of the few people to have equipment even

to measure infrasound, is that correct?
A Well there's nothing -- I mean the equipment has been there. It's just that they weren't using it.
Q Okay.
A Sound level meters since about ten years ago have been built with the ability to record the measurements so you can do post analysis; in fact, a lot of acousticians don't take that extra effort. I see a deficiency in their work, but, you know, I mean it isn't that there's anything new or novel about this approach, anything difficult. It's there for them, it can be done very simply.
Q Well would it be fair to say that in comparing the amount of literature that's out there addressing noise being emitted from a wind turbine, um, is much more voluminous than the literature that discusses infrasound?
A I wouldn't use the term much more. I would say maybe two-thirds and one-third.
Q Okay.
A And at this point, it's turning the other way; most of it now is on infrasound.
Q Okay. Now would you consider the concept of -- now are there any states or countries,

municipalities, the World Health Organization, EPA, anything like that, that regulates infrasound like they do decibel levels?

MR. KASIBORSKI: I guess maybe this goes to qualifications in a roundabout way.

THE COURT: Mr. Chaklos.

MR. CHAKLOS: I'm just trying to establish a couple of the elements under the statute.

THE COURT: All right. I'll allow you some leeway; you're working your way through the Revised Judicature Act that applies here to personal injuries, 600.2955.

MR. CHAKLOS: Yes.

THE COURT: All right. You can ask a few questions on that if you can make them specific.

A There are standards in European countries for infrasound and low frequency sound.

BY MR. CHAKLOS:

Q And --

A One of them in particular is Denmark. I believe Sweden also has a low frequency noise standard; um, and usually these are directed at industrial resources. But in Denmark in 2011, the EPA in Denmark included the low frequency standards for

industry in the wind turbine standard.
Q Okay. And by low frequency, can we agree that you're referring to infrasound?
A Yes, sound levels in the infrasonic range from zero to 20 hertz.
Q Okay. So there are two countries then that regulate the level of infrasound that has to be met by wind farms?
A That's my understanding, yes.
Q And there are many, many, many, many more countries and states and municipalities and organizations such as the World Health Organization and the EPA that regulates noise from a decibel or a dBA?
A World Health Organization does have in it -- it focuses mostly on dBA, because the European directive, the directive since the union was formed has adopted dBA as the criteria. Not necessarily based on the advice of the acousticians, but that's the criteria, so most of the work and most of the standards are on that level. And that's why Denmark and Sweden and a few of the other countries who are experiencing similar problems with wind turbines have elected to put new standards in to control infra and low

frequency sound in wind turbines. This is a problem that is related to the new, larger wind turbines, not the type that were common in Europe before, so there was no need for standards prior to that time. It's the 1.5 megawatt and higher turbines that tend to produce these sounds.

Q Okay. Would you say that the measurement and regulation of ultrasound and the concept that it's emitted from wind turbines is a rather novel theory?

A No.

Q And why is that?

A Because this has been known since the 1970's. It was studied thoroughly and reported in the 1980's. Studies, research such as Dr. Kelley's was specifically to address the annoyance and other potential adverse effects of wind turbine infrasound; because at that time, it was felt that there were inadequate standards for it. So I can't see that something that's been known for 40 years is a new and novel problem.

Q Doesn't Kelley say that at the time that he wrote his article, which was 1987, that there were no universally accepted methods or descriptions for low frequency community annoyance?

A I think that's what I said. I said that because of the problems that they were having with infrasound from wind turbines, the government -- DOE and NASA and the other government agencies asked him to do the research necessary to develop those kinds of standards.

Q And I believe you told us the last time with Kelley that he had written one paper and done one interview, is that correct, to your knowledge?

A That's the one -- that's the one that I have, but Dr. Kelley was manager of NREL's labs, so he could have done many more that I just don't have access to.

Q Don't you think the fact that it's -- that at the level of infrasound is not -- is not regulated except for a couple of countries; wouldn't that render it a novel methodology or form of science?

A No. Countries very seldom are current with the type of regulations they need to protect public health until something happens that triggers complaints and then they play catchup; and that's what's happening in Denmark, Sweden. I'm saying that's what needs to happen here.

Q Would you agree with me that the concept of infrasound -- infrasound being emitted from wind

turbines causing adverse health effects is not a wildly accepted theory? I mean there are both sides -- both sides of the argument, are there not?

A There are -- there are two camps on that; one of which is headed by Dr. Leventhal which says they don't produce it; and even if they did, it couldn't cause a problem. And then the camp of people who followed him prior to that, his 2003 work, in which he identified wind turbines as a source of infrasound that could cause adverse health effects. I happen to be part of the camp that has never -- I understood that low frequency and infrasound can cause problems for people in the industrial work since I started working for the large automotive plants which have facilities that do that. When I started looking at wind turbines and realized that many of the symptoms were similar to what I've heard from employees who are asked to work in environments that had high levels of infrasound, I looked at the literature and found work by Dr. Leventhal showing that sick building syndrome, which is an infra and low frequency sound problem, was something that he understood. That the work that he and others like

Dr. Swinbanks has done on jet engines; early jet engines caused so much infrasound they made the passengers nauseous, so they had to find a way to fix that. But there's nothing novel -- there's nothing novel about it, and the fact that the wind turbines now -- if you're looking at a little 800 kilowatt wind turbine which was common in Europe, you don't have this problem. What Dr. Kelley was looking at was the NASA research where they designed two and a half to three megawatt turbines, the type that's now being installed, and they said these are going to cause a problem in the future; if that's the way the industry goes, we need metrics for it. We're now at the point where we're installing those machines and we're finding that the early concerns and anticipations were correct. I don't see that as new or novel.

Q If we can moving forward, let's limit it to wind turbines and not other industrial machinery, okay?

A I'll see how you phrase the questions. Yes.

Q Well all my questions will be limited to that.

A Well we're going to my experience, and my experience is much broader than wind turbines.

Q Well I want your experience on wind turbines. I don't want your experience from your 30 or 40

years before that, okay? Is that okay?

THE COURT: Mr. James, answer the questions as best you can. If it's required in order to give an educated answer to it and you have to refer to your background in other areas that relate to this, you may do so.

A Thank you.

THE COURT: I'll be the arbitrator of whether the questions are proper or not. Mr. Chaklos.

MR. CHAKLOS: Thank you, your Honor.

BY MR. CHAKLOS:

Q If I restate the question in terms of just the concept of wind turbines emitting infrasound that may or may not cause adverse health effects, would you agree that that's a novel theory just because of the -- well you only have two countries that even regulate it?

MR. KASIBORSKI: Asked and answered.

THE COURT: Well he's trying to make it more specific --

MR. CHAKLOS: Right.

THE COURT: -- as to infrasound coming from wind turbines causing health effects. Can you answer that, Mr. James?

A Yes, I can answer that. In 2004, Dr. Geoff Leventhal wrote a report to the government in Britain, the Defra report, in which he identified common sources of the infra and low frequency sound that caused adverse health effects; and in his list of machinery, he included wind turbines.

In 2003, 2006, that era, Dr. VandenBerg, Frits VandenBerg, studying wind turbines in Germany, identified similar problems and similar frequencies, so I don't see that this is new or novel. It's just related to machines that are now just currently being installed in the U.S.; and, therefore, it's becoming a U.S. problem and not a research lab problem or a European problem.

BY MR. CHAKLOS:

Q Okay. But it's a concept that even though you don't consider it novel, it is not regulated in this state or in this country at all, and you do agree that there are two sides to this debate.

A I agree that there's two sides to this debate and I can point to scientists who argue both sides.

Q The articles that you've -- that you've produced, and I'll let you pick out whatever article describes this. I don't want to go through all of your articles or we will be here all day. Are

there any articles that are published by an acoustical engineer like yourself and engineer, but are there any articles that, that, um, that have had a medical basis for also theorizing or also coming to the conclusion that wind turbines emit ultrasound or infrasound, that, um, causes adverse health effects? And the reason I ask that is because we reviewed a lot of articles and most of them just talk about families that complain or people with houses that complained about wind turbines, and, um, possible annoyance and things of that nature. And I see very little in the studies there where they actually -- where the authors actually talked to the doctors to see if they agreed that this person has these adverse health effects because of the ultrasound.

MR. KASIBORSKI: Judge, I think that's more argument than a question. I don't know what the question was.

THE COURT: I think he started off with any of the articles that you rely upon, do they have any input from people who would be licensed medical personnel?

A Yes.

THE COURT: Which ones? Can you identify

those easily or not?

THE WITNESS: Yes, on the list.

THE COURT: On the list 1 through 31?

THE WITNESS: Yep.

THE COURT: All right.

THE WITNESS: We will go down this. Alves-Pereira, Dr. Branco, M.D.

THE COURT: Which number are you looking at?

THE WITNESS: Number, one, Alves-Pereira.

THE COURT: Oh, I see. Thank you.

THE WITNESS: She is a colleague of Dr. Carlos Branco in Portugal.

THE COURT: Is there a medical doctor involved?

THE WITNESS: Yes, Dr. Branco.

MR. CHAKLOS: I'm sorry, Mr. James, I lost you. It's my fault. Can you identify a number?

MR. KASIBORSKI: On the other sheet.

MR. CHAKLOS: Oh, the other sheet.

MR. KASIBORSKI: We apologize that there wasn't coordination.

BY MR. CHAKLOS

Q Okay, so number one?

A Number one. Jeffery is an M.D., number 10. Crow is a pharmacist and the editor of the Canadian Physicians Desk Reference.
Q He's a pharmacist?
A She's a pharmacist.
Q Maybe if you can just point out medical doctors?
A Dr. McMurtry is a medical doctor and formerly the equivalent of the Surgeon General for the United States under the previous administration in Ontario. Dr. Nissenbaum for 14 and 15, he is an M.D. Pedersen, I don't know if she's an M.D. but she works for the school of medicine in public health. Persinger is a neuroscientist. I don't know if he's an M.D.
Q I'm sorry?
A Persinger, number 19.
Q 19.
A Salt is a medical researcher, one of the people that publishes as an M.D. I'd say those are the primary ones where medical people are involved.
Q Okay. Would you agree with me that there is a significant difference of a significant impact when you have just talking to people who say that they have certain symptoms; but if you don't have doctors or other qualified people to say that they

confirm that their adverse health effects are caused by wind turbines?

MR. KASIBORSKI: I don't understand the question. Do you understand the question?

MR. JAMES: No.

MR. KASIBORSKI: Maybe it can be broken down.

THE COURT: I think perhaps I have a question related to that. Mr. James, out of those case studies that you spent some considerable time talking about and I've reviewed in these documentations, was there a process of elimination that the symptoms that they're experiencing are based on other health needs?

A Yes.

THE COURT: Not unlike Dr. Grace did with the plaintiffs here?

THE WITNESS: Yes.

THE COURT: Is that one of the things that's reported as part of those studies?

THE WITNESS: The McMurtry papers identifies the process that he went through which included clinical evaluation of people in Ontario who were making similar complaints in order to develop a case definition.

THE COURT: And has that been true throughout most of these studies that you try to eliminate other sources of the symptoms?

THE WITNESS: Absolutely.

THE COURT: Physiological sources of the symptoms.

THE WITNESS: Absolutely, that's the standard engineering approach.

THE COURT: And other environmental sources perhaps as well.

THE WITNESS: Yes.

THE COURT: So it's a process of elimination to say that you can explain it no other way and that the presence of infrasound or perhaps audible sound, the conclusions then reached that it causes the symptoms or may cause the symptoms.

THE WITNESS: Yes, if you can provide measurements showing that indeed in those homes are properties that such sounds exist.

THE COURT: But is that inherently the scientific approach that is taken in each of these case studies?

THE WITNESS: Some of them are -- are just reports from clinical reviews like McMurtry's

working with patients.

THE COURT: What do you mean by that?

THE WITNESS: Um, patients who have had problems where he has as an M.D. done a clinical evaluation.

THE COURT: All right. And what -- and reaches what conclusion?

THE WITNESS: And basically identified what their symptoms were, ruled out other causes, and then used that to develop a list of symptoms and priorities for other doctors who have to make similar determinations and case definitions so to speak.

THE COURT: All right. I'm stepping in your case here --

MR. CHAKLOS: That's fine, your Honor.

THE COURT: -- Mr. Chaklos, but that was the area you were headed towards, wasn't it?

MR. CHAKLOS: It was. I just wanted --

THE COURT: Wanted medical testimony?

MR. CHAKLOS: Right.

BY MR. CHAKLOS:

Q Now when you said a process of elimination -- I guess the Judge knew where I was going. It's a process of elimination done by an acoustical

engineer or someone who is not medical or done by a doctor in the paper that you identified; and if you could pull out the ones where they are in the process of elimination was done by someone with medical training as opposed to the report or the article itself just identifying what somebody says they think they have.

A I think the list of the documents I gave before include primarily, um, summaries and conclusions of medical researchers or medical doctors, um, that demonstrate that process that you just described. Acousticians don't follow that process; acousticians follow an empirical process. For example, we take data, we listen to people who say this is what I feel, this is what I'm experiencing; we take sound level measurement and other types of data, and we compare that to places where people do not have those problems. We try to identify what part of the environment maybe triggering it and then set up experiments where we will ask people how do you feel when the turbines are off, how do you feel when the turbines are on. If they're making a lot of noise, does that affect the way you feel; and basically develop an empirical data base that lets us conclude that the

cause is a particular machine, the wind turbine or a HVAC fan or a foundry cupola or whatever. And then by looking at ways to change the environment, controls and mitigation, see if we can eliminate the problem. If we can eliminate the problem that way, it never gets to the M.D.'s, because the problem then goes away. We know how to design it better, the problem just isn't there. It's when a problem is not easily categorized that you may need to do the epidemiological work, etcetera; but for wind turbines this is very simple.

The classic test is do the symptoms go away when the turbines are off or you're away from the turbines. And if the symptoms go away in that case but return when you're near the turbines, then we have concluded or we demonstrated that the turbines are an important component. If the people have those symptoms even when they don't know if the turbines are on and off, which have been some of the blind studies that are done, then that affirms even higher that it's not a usual cue telling them to get sick or whatever, that it's something that they're feeling inside their homes. And those are -- those are the ways acousticians have traditionally approached things, whether it

be a wind turbine or be a new novel industrial machine or process.

THE COURT: Does some of your articles that you rely upon, have they conducted such blind studies so that that can be verified?

THE WITNESS: Well the work that I reported; Nissenbaum, his is -- his isn't on and offs. Rand, Schomer, Thorn, Ambrose; so let's see, two relating to sick building syndrome, number three by Blazure. I'd have to look at the one from number 4 again to see what that is.

THE COURT: All right.

THE WITNESS: Hubbard -- Hubbard and Shepherd were pure research.

BY MR. CHAKLOS

Q Can you limit it to just wind turbines?

A Most of these are wind turbines.

Q I want them all to be wind turbines.

THE COURT: Mr. Chaklos, this is my question. What your point is is that there are blind studies that have been done and these report those.

THE WITNESS: Yes.

THE COURT: And is the conclusion reached that those people are not experiencing symptoms --

THE WITNESS: Yes.

THE COURT: -- because they know the turbine is on, they experience it because of the affect on their body?

THE WITNESS: Yes.

THE COURT: All right.

THE WITNESS: Yes.

THE COURT: And that has significance to you.

THE WITNESS: That does, and that is my I'll call it one of the things I try to do when I evaluate a new case is to weed out people who are responding to other cues by finding out if indeed they can tell me that the symptoms -- and I'm doing this with 40 years of experience of interpreting how people are responding; but my focus is can they say that the symptoms they're feeling are occurring only when the wind turbines are on. And in many cases, the people are so adverse that I have trouble getting them to go to their homes to do these kind of studies. The Shirley wind study, for example, that was done for the Wisconsin Public Service Commission evaluated three homes and the biggest hurdle was getting the people to go back to their homes so that they

could respond to -- they could basically say to the acousticians yes, I'm feeling it now, so we knew when to take the audio samples. They were very -- they were very adverse to subjecting themselves. But that study again confirmed that the sound levels present in the home at the time the people were saying they were feeling, um, body vibration or nausea or any of the other range of symptoms only occurred when the wind turbines were on.

THE COURT: But they didn't know if they were on or not?

THE WITNESS: And they did not know if they were on or not.

THE COURT: That's the point, some of the studies were conducted in that fashion.

THE WITNESS: Yes.

THE COURT: Mr. Chaklos, do you have further questions for the witness?

BY MR. CHAKLOS:

Q Just along the lines that's one of the reasons I wanted to limit it to having a doctor involved or someone who is not an acoustician but who is making that sort of -- that sort of call. Um, so if we look at again the ones that you circled or

that you got one, two, three, four, five, six, seven; you indicate that those all involved doctors that made a determination that these people were, um, or they made a diagnosis that these people were suffering from adverse health effects as a result of the infrasound emitted from a wind turbine. Do I understand that correctly?

A I don't know what you said was one, two.

Q Well the ones you gave me were 1, 10, 13, 14, 15, 19, 24?

A Those are the ones that were done by medical professionals.

Q Okay. And when they're done by medical professionals, are you also telling me that in those studies, the finding that the infrasound from the wind turbine caused the adverse health effect, that was also the finding they confirmed that was indeed true?

A Those aren't the studies that I said used the empirical approach the acousticians did. Those I'm referring to as Schomer, 25, 26.

Q Yeah, I -- I don't --

A Statewood, Thorne, Ambrose, etcetera. We were talking about the difference in approaches by acousticians and medical professionals. And

acousticians don't do medical diagnosis; therefore, we use other tools basically comparing what sounds are present when people are experiencing adverse effects, what sounds are not, and seeing if we can infer from that what machine or what component of a machine is causing the problem. We change the machine, see if the problem goes away; if it does, then we go onto some other problem. We're not interested in the biological link that caused that problem, only that we fixed it.

Q Well my question was whether or not any of the studies, any of the papers that you're relying on that whether or not they include findings by the medical personnel that agree with, um, the concept that the people that were suffering from adverse health effects, that was the result of infrasound from wind turbines.

A Yes.

Q All right. So if we examine those, that is what we will see is what you're saying?

A I'm saying the McMurtry case definition was derived that way with his work with people in Ontario. Others are sometimes quality of life survey, sleep index surveys, etcetera, which may

not differentiate it the instant of time when the wind turbine is on or off, but are looking at the overall effects on health and other aspects of a person's life caused by long-term exposure.

Q Well we don't have that here, long-term exposure, do we?

A Long-term exposure is when you do it day after day.

Q All right. So just so I'm clear, if we read one, two, three, four, five, six, seven articles, we will see that a doctor has made a diagnosis that was caused by the infrasound, the adverse health effects is what you're saying.

THE COURT: Well that was a different question.

MR. KASIBORSKI: That was a totally different question.

THE COURT: I asked the question of the witness whether or not there were medical personnel involved in any of these studies; the witness identified those seven different articles. I don't think that he went so far as to say that a medical doctor made a diagnosis that these symptoms were the cause of the turbines. Did I misstate that, Mr. James?

A No, you stated it correctly.

THE COURT: Mr. Chaklos, I think that was the Court's question to him and in fact I directed him in that respect.

MR. CHAKLOS: Right. I thought his identifying those seven articles was in response to my question and then your question followed I thought.

THE COURT: Perhaps it did. I think mine was perhaps less particular than yours. I'm not sure you said the first time that there was a medical diagnosis; you wanted to know if medical personnel were involved is the way you questioned it, and then I inquired of him about that to try to get him focused on that point. Do you know, Mr. James, if any of these articles have contained documentation that a medical doctor made a diagnosis that the symptoms were caused by a turbine?

THE WITNESS: I don't know if the article -- I would have to review the article again, but the McMurtry article was based upon his work with people in Ontario who had expressed these problems, his personal examination of them or his review of other medical doctors who had

examined them.

THE COURT: All right.

THE WITNESS: And questions as to just the problem, um, I think they set up a respite house --

THE COURT: I understand.

THE WITNESS: -- to let people get away.

THE COURT: I understand the theory about eliminating the cause. Okay, I think I've learned all I can from that, Mr. Chaklos. I don't want to preclude you; well actually I do want to preclude you from further inquiry. Do you have any other specific questions about the articles that are relied upon in challenging whether or not they reach the conclusion that they support his ability to render an opinion?

BY MR. CHAKLOS:

Q Well you mentioned McMurtry article. Doesn't he say that there's insufficient research on infrasound and there needs to be more research done to make a definitive finding?

A Yes, he does, and I agree with that, too. That's one of the reasons he was very important, very influential in getting the Canadian government to establish this $2 million study, Health Canada

Study, which is exploring that with proper funding.

Q Okay.

A We have all been advocating better research.

Q Didn't he also I thought -- unless my notes were wrong, I thought that, um, what he did, he actually reviewed literature. It was more a literature review where he listed all of the symptoms that were complained about in the literature and then came up with a working diagnosis --

A That --

Q -- isn't that correct?

A That was part of his process. But Dr. McMurtry hired me to take sound measurements in the homes of about six or seven different people in Ontario that he then personally worked with as a physician, a clinical physician, and then did a literature search. It was based upon his personal experience with specific individuals in Ontario and his medical experience and what he could find in the literature. And his conclusion was that there was sufficient information to provide a case definition that matched both the literature and his own review of these families.

I didn't get involved in his review of the families, but I did write letters to several doctors for him explaining what kind of situation the doctor was to evaluate them for. So you may have to forgive me, your Honor, because I have been kind of a central person with many of the studies. I sometimes know more about what went into the studies than is in a paper.

THE COURT: Okay.

THE WITNESS: And that confuses me at times.

THE COURT: Well while you were speaking, I was also reading Dr. McMurtry's conclusions on page 319 of his article.

THE WITNESS: Okay.

THE COURT: That's number 13 and page 319. It's tab 13.

THE WITNESS: Okay.

THE COURT: And the article number is 13 and his conclusions. Is that what you're referring to, Mr. Chaklos?

MR. CHAKLOS: Yes, your Honor.

THE COURT: In particular the last item, number 4.

MR. CHAKLOS: Number 4, yes.

THE WITNESS: I think that's -- if you're an M.D. or if you're a researcher or even if you're an engineer and you see a problem that is affecting people, and you realize that there's inadequate research on it, then one of the recommendations you would make is you need more research. And as I said, Health Canada has taken up that challenge and has a $2 million study underway at this point.

I included in my literature this time another study that was promoted by Dr. McMurtry's influence with the Ontario government at the University of Waterloo which has found similar problems.

THE COURT: That's perhaps enough on that.

THE WITNESS: Okay.

THE COURT: What is the Bulletin of Science Technology and Society?

THE WITNESS: It's a professional journal that focuses on issues at the interface of the new technology and its impact -- new technology or science and its impact on society.

THE COURT: What is your understanding of an article that's peer reviewed?

THE WITNESS: My understanding of an article that's peer reviewed is several fold; one, that there's the formal peer review process where you send the paper in for review.

THE COURT: Send it to who, to the --

THE WITNESS: Send it to a publisher.

THE COURT: A publisher.

THE WITNESS: Like Noise Control Engineering Journal, etcetera.

THE COURT: How about the Bulletin of Science.

THE WITNESS: Bulletin of Science and Technology, yes.

THE COURT: All right. And what happens when that's sent in for review.

THE WITNESS: They send that paper out to selected individuals who they feel can conduct a proper review of it, that review goes on.

THE COURT: They consider any critiques of that and make a decision whether or not this is the type of thing they want to have published or whether or not they think it's bad science?

THE WITNESS: Yes.

THE COURT: That's the ultimate punch line?

THE WITNESS: Yes, that --

THE COURT: What's your understanding of this article? We're referring to number three.

THE WITNESS: This article was vetted through that process.

THE COURT: How do you know that?

THE WITNESS: Because I wrote an article for the Bulletin of Science and I went through numerous revisions, numerous validations particularly because I had used interviews.

THE COURT: Is that something that's noted or documented in an article when it's published?

THE WITNESS: No.

THE COURT: All right. So --

THE WITNESS: It's the assumption that you're reading --

THE COURT: Reader beware.

THE WITNESS: -- that you're reading the article, yes. A peer review has some good elements and some bad elements.

THE COURT: Well but peer review is one the things that the Supreme Court and the Legislature has told me to consider.

THE WITNESS: Uh-huh.

THE COURT: And so that's why I'm asking you that question.

THE WITNESS: Uh-huh. And that's why I focused here on as many of the peer reviewed articles as I could. There's much more literature of the type that you get at professional conferences where the peer review process is that you submit a paper, it's then passed around session of chairs, etcetera, to decide if it's important or if it's valid. But the critique you get on the paper is typically when you present it to the people in the audience who are your peers, provide feedback so that you know whether you're doing well or not.

THE COURT: Uh-huh. All right.

THE WITNESS: And then at the end there's what I consider to be government reports, um, which are not peer reviewed in the official sense, but the people who were picked to do those jobs were picked by panels.

THE COURT: Okay, that's perhaps enough on that. I just wanted to ask you that question, because that article or that publication is the same in which your article was published, is that correct?

THE WITNESS: Yes. Yes.

THE COURT: Was that subject --

THE WITNESS: They selected a series --

THE COURT: Let me ask you another question, one at a time.

THE WITNESS: Okay.

THE COURT: Was your article subjected to a similar review as was this article number 13 by Doctor is it McMurtry?

THE WITNESS: Yes, it was.

THE COURT: It was subjected through the same process?

THE WITNESS: Yes, it was.

THE COURT: Thank you.

THE WITNESS: Mine was subjected; because I used interviews, it took almost a year to get through the review process.

THE COURT: All right, very well, that's what I wanted. Thank you. Mr. Chaklos, any other questions with respect to the articles?

BY MR. CHAKLOS:

Q Yes. Do you know whether or not I mean whether every article that is submitted to that journal is peer reviewed?

A That's my understanding.

Q And what's that based on, because yours was?
A My only experience with them peer reviewing mine, and I know some of the other people that were submitting articles, and they had similar experiences.
Q Okay.
A It's a professional publication, and they have their own standards.
Q But you can't -- but you can't testify with certainty as to which articles were not except for yours, isn't that correct?
A I know that some of the other articles underwent similar processes because I know those people, and I know they have commented to me on the process they were going through. And the reason why I was curious about that is because it was taking so long to get mine published.
Q Okay. Do you know whether or not it depends on what type of article and what the contents is if you're taking -- if you're making certain general statements of whether or not you talked to people or whether or not you quoted other sources? Do you know whether or not the peer review process for that journal differentiates between the contents of whether or not they're going to have a

peer review?
A I don't know how I could know that.
Q I was just asking you.
A You would have to ask the Bulletin of Science and Technology.
Q So you don't know whether or not --
A No, I don't know how I could know. I'm not on their staff.
Q I'm not faulting you at all, I'm just asking you your knowledge, sir.
A I said I don't know how I could know it.
Q Okay, that's fine. So then what you say is your article was; and some of the people who you know that did publish in the journal, they had theirs reviewed?
A Yes.
Q Beyond that, you can't say, is that correct?
A That's correct.
Q Did you find -- last time we were here, I quoted from Dr. Salt's article that you were relying on and he was very -- he didn't make any conclusive findings and then you didn't know if that was his final draft. Do you remember that?
A Which paper are you talking about?
Q Well I think it's --

A 22, 23, and 24 in my book.
Q You've got three of them there. It's the Infrasound From Wind Turbines Could Affect Humans; that was a question, number 23.
A Now could you ask that question again?
Q Sure. When you were here last time, I quoted from the conclusion where he is very noncommittal in terms of -- in terms of whether infrasound does emanate from wind turbines and whether or not it causes adverse health effects and then you indicated that the form of the article that I showed you did not look like it came from or did not look like a final copy. And I wondered if you had the final copy.
A I do have a final copy. But I'm looking here, and I think the one that we used in the last one got brought forward; because what's in here is number 24 is the, I'll call it, um, initial manuscript. He has done several other papers since then and his conclusions in each one of the papers are moving towards making a statement, a hard conclusion and not a soft conclusion.
Q Okay. I got the final copy of the one that you said was not a final draft and it contains --
A Could I see that?

MR. CHAKLOS: Sure. Your Honor, could I approach the witness?

THE COURT: You may. Are we looking at number 23 in my book; is that the one we're looking at, Mr. Chaklos?

THE WITNESS: Or maybe 24. Let's see, infrasound from wind turbines.

THE COURT: Just a moment, Mr. James.

THE WITNESS: Okay. We have both of them here. 23 is the published version.

THE COURT: Right. Right. I had caught onto that. And I suspect, Mr. Chaklos, you're referring to the last paragraph of that article just above the declaration of conflicting interest found on page 301 of that article?

MR. CHAKLOS: Yes, your Honor.

THE COURT: Do you see that paragraph that says we can conclude, Mr. James?

THE WITNESS: Yes, I do.

THE COURT: All right. You don't take exception to that conclusion?

THE WITNESS: No. It is scientifically possible that infrasound from wind turbines could affect people. I agree with that.

THE COURT: Mr. Chaklos, did you have

questions about that?

MR. CHAKLOS: No.

THE COURT: I think that clarifies where we were.

MR. CHAKLOS: I asked him about this exact same language, and he thought that the first one was a draft so maybe the final would be changed.

THE COURT: Do you see now it's in the published version of it?

THE WITNESS: Yes.

MR. CHAKLOS: Right.

THE COURT: Very well.

BY MR. CHAKLOS:

Q Does Mr. Salt go into -- I mean would you agree with me that his conclusion was not definitive in any way; he said could and possible?

A I think when you're dealing with a medical -- with a researcher, that could and possible is the way they conclude everything usually followed by more research is necessary.

Q Okay. Now I think there are three Salt articles that are listed there. Are there -- is there another Salt article that's more definitive?

A There's been several more and there's one that's

out for review at this point that I'm coauthor on. All of them, as I said, are becoming more conclusive in their statements.

Q I don't have a copy of that or at least I didn't read it.

A Yeah, I didn't include them here.

Q Well it's -- I think it's number 24 on the one list. I'm not sure where it is.

A 24 on the list in the binder that the Judge has. 24.

Q Yes.

A And 23 are the same.

Q Okay.

A One is the draft and the other is the published article.

Q Okay. So we don't have a different article from Salt that is more definitive --

A No.

Q -- than that?

A No. The one that's going out for peer review will be; the others weren't peer reviewed so I didn't include them. They were conference presentations.

Q Do you know the articles well enough to point to ones that are case reviews where they actually do studies as opposed to a lot of them seem to be,

um, research reviews and then summarized by the author. Do you know which ones of the --

A The big three -- the big three that I would consider to be research papers --

Q Okay.

A -- would be Nissenbaum Noise and Health, Volume 14, that's item number 15 on the production of James' documents list.

Q Okay.

A That was in a peer reviewed journal in Noise and Health. The other is Shepherd Noise and Health, number 28, and the third one is the Waterloo study which isn't in this binder but was the last one on my table. It may not -- it may not have gotten in for the deadline.

Q Okay. Can you pull those articles out and just kind of identify them for me what they do?

A One at tab 15 Noise and Health, which is a peer review journal, documents two rural sites in Maine were studied; one was an island community Vinalhaven with three, 1.5 megawatt turbines that were installed with the total support of all islanders. There was no community affect.

Q What was that?

A Community affect prior to operation. Sometimes

people have alluded that, um, that the complaints afterwards were from people who didn't want them in the first place. In this case, the islands wanted the turbines because they pay outrageous electric prices and they were promised lower prices.

The second component of the study was a rural community along the base of a ridge, Mars Hill ridge where a string of 1.5 megawatt turbines are located along the top. The studies found the people living within 1.4 kilometers of the wind turbines had worse sleep, were sleepier during the day, and had worse function scores than those living in a distance of more than 1.4 kilometers. Coping mechanisms such as mood, sleep, drugs were more prevalent the closer the home -- the closer the home was to the wind turbines. And the authors concluded that the studies demonstrated that 1.4 miles of separation -- kilometers of separation is not sufficient to protect the public's health and well-being, and that was number 15.

Q Okay. How would that -- now that was the author Nissenbaum?

A There was three authors on it, two M.D.'s and an

epidemiologist.

Q Do you know whether or not -- what was the circumstances under which Nissenbaum and the other physicians got involved in that study? I mean was it a situation where there was litigation with the surrounding landowners, was it a situation where the municipality was trying to shut it down or trying to regulate it?

A Those were not -- those were not factors that entered into the study. The study was done because Dr. Nissenbaum, Aramini, and Hanning concluded that this was a good case study; that we had communities with two different factors that were convenient to do the study, um, and they designed the study using standard traditional survey tools for which we know how people respond to them; sleep index studies, quality of life studies, etcetera. And they applied it to those communities so that there would be information available to other researchers as to what they found from the study. There was lawsuits in Mars Hill subsequent to this, there were lawsuits in Vinalhaven but those were not instigating factors.

Q Do you know whether or not they tested people or they interviewed people who are not or did not

claim that they were -- that they had adverse health effects because of the operation of the wind turbines?

A Yes, they did.

Q Okay. And what does the article say about that?

A The article -- the article shows that there are people who have I'll call it a higher resistance to these factors; but the relationship between distance from wind turbines and the severity of the symptoms or the degree of coping mechanism used vary with the same relationship as distance. People that were closer to the wind turbines had more sleep disturbance, mood disorders, etcetera. People that were farther away -- and I believe this went out to six kilometers in one of the studies -- had less. Um, so I think that is an answer without going on too much.

Q Okay. Can I just see the article real quick? Can you pull it out of there? All right. I've got it here. Thank you.

A You have it?

Q Okay. Now those -- the people that were part of the study, they were exposed to the wind turbines for over a year, were they not?

A Yes. There had been at least a years worth of

exposure.

Q And we don't have that here, do we?

MR. KASIBORSKI: Judge, that goes beyond the scope.

THE COURT: It does goes beyond the scope of the qualification question. It would be a question of the weight to be given to an opinion.

MR. KASIBORSKI: And your Honor, I think Mr. James has been questioned about his qualifications and literature for maybe five hours --

THE COURT: I agree.

MR. KASIBORSKI: -- now. And I would suggest with all due respect that he's demonstrated both that he's qualified to opine that wind turbines can cause adverse health effects; and two, there's substantial, reliable literature, much of which is peer reviewed, to support his conclusion; and buttressed with the fact that his conclusion is not based solely on literature but only part on literature, but respectfully suggest that the Court could now decide this issue as to Mr. James.

THE COURT: Yeah. Mr. Chaklos, any argument that that's not true here?

MR. CHAKLOS: Well your Honor, well yeah, I could go on and on.

THE COURT: Unless I don't let you which I'm inclined not to do.

MR. CHAKLOS: And I totally understand that.

THE COURT: All right.

MR. CHAKLOS: So but like I said in the beginning, I am handicapped because I did not get a chance to review all of the articles. I can't cross-examine them. And I think that the points that I pointed out in terms of I mean he's going to rely on the articles. The problem that I have I think the Court has to wear two hats I think in this case; one hat is whether or not Mr. James is qualified to render causation testimony. Number 2, he's going to use articles at the time of trial and say well the plaintiffs have, you know, symptoms that are consistent with these articles. And so I think that that's one of the reasons I brought up -- well in the Nissenbaum article why I brought up the fact that they were exposed for a year; and so, you know, I mean that's the reason that I did that. It doesn't affect his qualifications, but it does show that he has an

article that is not relevant to the facts in this case and that should not be presented to the jury.

THE COURT: Well that's not the question that I'm being asked to decide here today. What I'm being asked is whether or not he can be qualified as a witness and reach a conclusion as to the Wiltzers having health effects from the presence of the turbines by the defendants. And you certainly can challenge that and that's one of the things that you can do and he can -- you can cross-examine him by learned treatises all you want to try to challenge that.

But once I've reached -- once the plaintiffs have satisfied this Court that it's not junk science, that the Daubert requirements and the requirements of the statute 600.2955 are adequately met, then I qualify him. That's not to say that I'm deciding that his opinion is right or your expert's opinion is right, I'm not deciding that; that's going to be the finder of facts' decision and they're going to make a determination.

This Court is satisfied from the testimony that I've heard so far that Mr. James qualifies as an expert. The Court is required, of

course, by reviewing the statutory language at 600.2955 to consider all of the factors if they're relevant. And I would note that that statute essentially added back in an old Frye-Davis test at subparagraph E that was by some arguments removed from the requirements for qualification when the U.S. Supreme Court came down with the Daubert decision.

But here we have factor A, whether or not the opinion is based has been subjected to scientific testing and reputation, Mr. James has satisfied the Court of that; whether the opinion is based has been subjected to peer review publication, Mr. James has satisfied that requirement.

The existence and maintenance of generally accepted standards governing the application and interpretation of the methodology or technique in which the opinion is based are consistent with the standards. Mr. Chaklos has properly pointed out there is limited amounts of standards with respect to standards in terms of placing wind turbines and their health effects. But I'm satisfied from Mr. James' testimony and his C.V. and his background that he has conducted

appropriate scientific tests to allow him to make an examination here.

Whether or not governments have established standards for application of wind turbines within the proximity of people's residences is another matter; that's not -- that's not a Daubert requirement.

The known potential error rate; I don't believe I really have any evidence as to that, but that's only one of the factors to be considered.

The degree in which the opinion and its basis is generally accepted within the relevant expert community. The publications and Mr. James' testimony adequately satisfies the Court with respect to that.

Whether the basis of the opinion is reliable and whether experts in the field would rely on the same basis to reach the type of opinion being offered. It appears clear that that opinion was offered in a number of the articles that were presented, and Mr. James has satisfied me that they are adequately peer reviewed within that somewhat dubious definition of what that means.

And whether or not this is relied upon in

the field of experts outside the context of litigation; again, Mr. James has convinced me of that. He's described his experience in the industrial applications, his attempts to try to resolve health problems from certain circumstances. He described heating and cooling environments where they tried to make changes in the environment to alleviate the effects. There's no indication that those methods and technologies were used for purposes of litigation, but rather to alleviate potential health problems for employees or others in the community.

Mr. Chaklos perhaps properly raises whether or not this is a novel technology, and subsection two of that same statute requires the Court as follows: A novel methodology or form of scientific evidence may be admitted into evidence only if its proponent establishes that it has achieved general scientific acceptance among impartial, disinterested experts in the field.

Here, I don't find, first of all, that it's novel based on the age of some of the articles in Mr. James' testimony; and further, even if it were considered to be somewhat novel, it appears as though that it's been generally

accepted.

The Daubert standard doesn't put the Court in a position in making a decision between two competing scientific theories and how those theories might apply to a particular fact circumstance; but rather whether or not the Court should permit one opinion to be presented or not, whether, as I've said repeatedly here today, whether it's based on real science or junk science.

This Court is satisfied that it's adequate science to have a correlation between the audible sound and the infrasound levels that have been reached and recorded by this expert and that he can reasonably opine from the research and his background that the symptoms that were created based on the Wiltzers being in the vicinity of the turbines and the lack of those symptoms when they left to opine that those are caused by that. That is, of course, subject to the defendants presenting contrary evidence in cross-examining Mr. James in front of the jury.

So the Court is going to deny the request to exclude Mr. James' testimony based on a Daubert challenge; and I trust that, Mr. Kasiborski, that

you or Ms. Topp could prepare an order that was consistent with that.

MR. KASIBORSKI: Yes, Judge.

THE COURT: The Court is in a position now to be required to take a lunch break for the benefit of all of us I guess.

MR. CHAKLOS: Your Honor.

THE COURT: I'm going to ask -- Mr. Chaklos, do you have a comment?

MR. CHAKLOS: Yeah, just a comment. And I wanted to get in my last round of questions was just going to be very brief on this. Mr. James testified, and we went over this ad nauseam the first time around, because when he gave his deposition, he said he wasn't qualified to give a --

THE COURT: Yeah, I understand that, and I think that's pretty well documented here that those statements, you put it in your brief, you've recited it. Did you want to ask more questions about that?

MR. CHAKLOS: Well just that from I think what he has said --

THE COURT: I think the answer was a medical diagnosis was what the question was.

MR. CHAKLOS: Well the question was not that; that's what he said he interpreted it even though he had mentioned that during his dep. He did here at the Daubert hearing.

THE COURT: You can impeach him with that. You want to impeach him with it there and make me change my mind, is that the idea?

MR. CHAKLOS: Well the argument that I want to make is that -- is that he said he will defer to a doctor, okay, because he cannot rule out other causes. So he can defer to a doctor.

THE COURT: Uh-huh.

MR. CHAKLOS: And so the doctor has an explanation that it's caused by, um, another illness.

THE COURT: Sure, a neurological illness will cause these symptoms, for example.

MR. CHAKLOS: Then he's not qualified. Okay. But if a doctor cannot find another cause, then he is qualified. Now I don't understand how either -- I mean either the witness is qualified or he's not qualified. It's not like being a little pregnant. I mean he either can testify that the wind turbines caused it or he can't testify that the wind turbines caused it. He

can't, you know, let's say you have two plants.

THE COURT: Well every expert has to have a factual predicate, and it has to be adequately proven pursuant to the rules of evidence before they can render an opinion; that's a requirement of any expert offering an expert opinion that the adequate facts and basis for that opinion as they apply to this case are established, and all of us are acquainted with that.

MR. CHAKLOS: Right.

THE COURT: And it's my understanding that the offer of proof that's made by the plaintiffs is is that they will have the Wiltzers describe that the symptoms were there when they were in their home, they were not there when they moved to their other residence; and further, I appreciate there may be a legal question about admissibility of Dr. Grace, am I correct?

MR. KASIBORSKI: Correct.

THE COURT: Dr. Grace's testimony as to his testing of the Wiltzers and his elimination of other physical reasons for the symptoms; that's all a predicate offering is testimony.

MR. CHAKLOS: But I've never questioned Doctor or Mr. James' qualifications as an acoustic

engineer and he's very well qualified. He's read all of the literature. But he's told us that if a doctor can find another cause --

THE COURT: Sure.

MR. CHAKLOS: -- then he's not qualified. He can't rebut that doctor.

THE COURT: Isn't that true, Mr. James; if a doctor came in here and said they tested Mrs. Wiltzer and they found she has a brain condition that's causing a particular symptom, would you --

THE WITNESS: I would sure take that into consideration.

THE COURT: -- say I can't definitively say then that it's the wind turbine that's causing it by any means, is that correct?

THE WITNESS: Yes, that's correct.

MR. KASIBORSKI: Judge, I think that what he testified to when we were here before was if a doctor believes there's a medical cause and tries to treat it and the problem doesn't go away, then we're back to the wind turbines. And on this whole issue of the Mulholland case, the Supreme Court case which we cited in our motion in limine response brief, states very clearly to be qualified as an expert to opine on causation, you

don't have to be able to rule out other causes; otherwise, nobody would be an expert. And that's the law of the State of Michigan, the Supreme Court.

MR. CHAKLOS: Well but your Honor, he admitted, he made the admission that he would defer to a doctor. So if he didn't make that admission, then I would agree with counsel.

THE COURT: You suggest that there's going to be -- you make an offer of proof that there's going to be a doctor come in here and describe some or any of these symptoms that are described by the plaintiffs as being caused by a medical condition?

MR. CHAKLOS: Yes.

THE COURT: You do?

MR. CHAKLOS: Yes, I do.

THE COURT: Where does that come from; did they examine them, did they do an IME? Is that what they did?

MR. CHAKLOS: No, because it wouldn't do them any good to do an IME; because by the time the case was filed, they had moved out of their house.

THE COURT: So they have done a review of

their medical records.

MR. CHAKLOS: That's correct.

MR. KASIBORSKI: Judge, this goes to the weight of his testimony.

THE COURT: That goes to the weight. That's going to go to the weight of it.

MR. CHAKLOS: But Mr. James himself testified at his deposition; now he's changed his testimony here in this hearing. Because at his deposition he said and you in fact pointed out in my motion in limine in my brief was that he would defer to a doctor if a doctor found another cause.

THE COURT: Okay.

MR. CHAKLOS: Okay. Now but he's -- but he is -- but he feels that he is qualified to render an opinion if a doctor cannot. Now I guess my -- he's qualified or he's not qualified.

THE COURT: Okay.

MR. CHAKLOS: It shouldn't depend on whether or not a doctor comes in with a different opinion.

THE COURT: The Court's determination is is that those factors will go to the weight of the testimony to be given by the finder of fact. The Court has ruled on the motion, the motion is

denied. I will say that we're going to take a lunch break. May Mr. James be excused, by the way, so he doesn't have to wait around here?

MR. KASIBORSKI: Yes, but they traveled together.

THE COURT: Oh, okay, so they traveled together.

MR. KASIBORSKI: May he sit in the courtroom?

THE COURT: Yeah, I don't think there's any preclusion from him doing so. We're going to reconvene at two o'clock, and we will be ready to take Dr. Punch's testimony to the extent that it's necessary.

MR. KASIBORSKI: Okay.

THE COURT: That will be all. Thank you.

(Recess at 12:56 P.M.)

(Proceedings reconvened at 2:04 P.M.)

THE COURT: Mr. Chaklos, are you ready for Dr. Punch to be a witness?

MR. CHAKLOS: Yes, I am, your Honor.

THE COURT: Mr. Kasiborski, are you ready?

MR. KASIBORSKI: Yes, we are ready.

THE COURT: Doctor, would you come

forward, please. Would you raise your right hand, Doctor? Do you solemnly swear or affirm that the testimony you are about to give in this cause shall be truth so help you God?

DR. PUNCH: I do.

THE COURT: Have a chair and speak up please. Thank you. Mr. Chaklos.

MR. CHAKLOS: Your Honor, again I'd like to sort of state on the record given the lateness of when I received these articles, I did not review them at all. I don't know if it's going to make any difference to your Honor, but and I wanted to restate my request from Mr. James, I know you've made your ruling, but just that I thought about the articles that I didn't have a chance to read and it may not affect your opinion. But I would like the opportunity to file a brief that I'm not going to create work for myself, believe me, if I don't feel it's there. I'm not going do it, but I request the opportunity to on both of these witnesses to file a brief, a brief brief once I review the articles to see if it would sway your Honor.

THE COURT: All right. I'll consider that once he's completed his testimony. Do you

have questions for the witness?

MR. CHAKLOS: Yes, I do. Thank you.

THE COURT: All right, thank you.

JERRY PUNCH

called at about 2:06 P.M. by the Defendant, testified:

CROSS EXAMINATION

BY MR. CHAKLOS:

Q Hello, Dr. Punch. How are you?

A Good afternoon. I'm fine, thank you.

Q Mr. Punch, I'm basically going to take -- I deposed you for a long time and I'm going to cut through that, and I'm not going to go into a lot of detail and I'm not really going to talk about the articles much, because I didn't get a chance to read them since I received them so late, so I'm going to basically just kind of go over what we talked about at your deposition, okay?

A Okay.

Q Now you got what -- what in front of you today in that binder?

A Well the binder -- more than half of the binder is the articles that you and the Judge have. Um, the other things are things like my C.V. if I should need to refer to it; um, the questionnaire that I

conducted with the Wiltzers.

Q Okay.

A Do you want me to go through the list of tabs?

Q No, that's fine.

A My work on the technical work group in the State of Michigan should the issue come up; the literature you have used in the past to make your case; article summaries are the main thing I have here that I'm going to use here today if I may, and then the articles themselves.

Q Okay. Now the articles that you have there, were those your articles that you had when I deposed you way back when?

A I think, yes, I brought a set of articles. These are more than the number that was included in that set.

Q Okay.

A These are -- include articles that I have become aware of in addition to those articles since the deposition; because to me, the game changed when the Daubert hearing issue came up. The issue was now more about infrasound and low frequency noise. The issue related to the Audiology Today article was more of an overview of the literature that I thought, we thought audiologists would be

interested in.

Q Okay. Now isn't it true that the vast majority of the articles that you had when I took your deposition were basically noise articles and not infrasound articles?

MR. KASIBORSKI: Well, again, I think we might be mixing apples and oranges. You asked -- when the witness was deposed, you asked him about questions included in the references to his Audiology Today article, and he found the one infrasound article; but, again, he had his thumb drive with his file including numerous articles and --

THE COURT: Do you have an objection to the question?

MR. KASIBORSKI: Well I think I was objecting to it.

THE COURT: Are you objecting that it's an improper question because it's based on facts that are not accurately portrayed?

MR. KASIBORSKI: I think -- correct. I was not articulate, but, yes, that's the basis of the objection.

THE COURT: Mr. Chaklos, your response?

MR. CHAKLOS: Well I guess my response is

that even the witness has testified that he has added literature to his -- to his review and he's going to testify about that.

THE COURT: And aside from your argument with regard to timeliness, what's wrong with that?

MR. CHAKLOS: Well because I asked him whether or not he was going to conduct anymore work and whether or not his opinions were final at his dep, and he said his opinions were final and he did not plan on doing anymore work.

THE COURT: Except now you've challenged his qualification to render an opinion, and he has a right to bolster that by what scientific data or what peer reviewed articles he believes support his ability to render an opinion. Those are not necessarily admissible in court if they weren't disclosed or properly identified, and I suspect that almost all of the articles are not going to be exhibits. They're not eligible to be exhibits, they're hearsay. So what's your point?

MR. CHAKLOS: Well I guess my point is is that, um, is he gave me his opinions.

THE COURT: Yes.

MR. CHAKLOS: And unless his opinions changed, he gave me his opinions; they were final

opinions at the time.

THE COURT: Yep.

MR. CHAKLOS: They were based on certain literature, okay. My Daubert or my motion in limine was based on the testimony that he gave me at his deposition.

THE COURT: Okay.

MR. CHAKLOS: Okay. And now he's trying to I guess qualify himself for giving me that opinion that he based it on certain literature, and now he's added literature to defeat my motion; that's what I elicited from the witness.

THE COURT: Mr. Kasiborski.

MR. KASIBORSKI: Well just briefly; the witness was asked if he's going to do anything more; and in part, he said I haven't been asked to do anything more and I think now that we're done, I'll go play golf, words to that effect; and Mr. Chaklos said fair enough. I think the testimony will show that some of the articles that Mr. Punch produced today that support his opinion were authored after his deposition. And I don't -- I think the fundamental question is has his opinion changed; I believe his answer will be no. I believe the witness will testify I believe there

was ample support for my opinion based on my experience, my research experience, etcetera, etcetera, my years of teaching, my teaching anatomy of the ear, my interviews, so on and so forth, and in part the literature. And there is more literature that he is aware of today than he was the day of his deposition; but the issue is was he qualified to go before the jury whenever it is we have that trial and give his opinion.

THE COURT: All right. Mr. Chaklos, your question was at your deposition most of the articles were with respect to audible sound, is that your question?

MR. CHAKLOS: Yes. Yes. In fact I think I asked him to do a search on his computer, and he came up with one article and it was a Korean study.

THE COURT: Okay.

MR. CHAKLOS: And he basically agreed that that was the only article that was, um, that had to do with ultrasound or infrasound; all the other ones had to do with noise.

THE COURT: All right. You can ask him that, and I expect he's going to say that's true. I don't know what he's --

MR. KASIBORSKI: Well I think I found the part in the deposition that he was asked questions about his article was published in 2010. I think he was asked questions about what he found in 2009 when he was researching the article which is four years ago, not at the time of his deposition.

MR. CHAKLOS: Well no, I wanted to know what articles he was basing his opinion on; and then so he said he would like to do a search and so he did a word search on his computer and he came up with one non-noise article. And now since I've challenged his expertise to give the opinion that he gave me, you know, a few months ago, why should he be able to then become more educated then to give further opinions when -- I mean when is it going to change? Do I have to take his dep right before the trial to find out what his opinions are and then what else he's going to base his opinions on?

THE COURT: No. No, the plaintiff has an obligation to answer your challenge that the expertise and the science doesn't qualify under the statute. They have a right to have their expert rely upon any documentation, whether it's been produced before or whether or not he

specifically referred to it. I don't think that's a limitation for such a hearing. So can you ask questions about the articles that he has presented to you, Mr. Chaklos, or are you unable to do that?

MR. CHAKLOS: Pardon me?

THE COURT: Are you unable to ask questions about the articles that were produced?

MR. CHAKLOS: Well again, your Honor, I'm kind of -- I'm in a difficult position because I have not reviewed the articles. I didn't have a chance to do so before the hearing today because of when they were produced to me.

THE COURT: So what makes you think that these articles do not support the conclusion that he reaches, that they somehow support your position?

MR. CHAKLOS: Oh, oh, I'm not saying they support my position. I'm just talking about when I looked at his articles, when they were produced I think on the Friday before this hearing, I wasn't really concerned about it because there was only one article that dealt with infrasound and this is not a noise case, but an infrasound case. So I really wasn't concerned about it. So then I look at it on Tuesday, and I'm looking through

these articles and there's all these infrasound articles in there. I thought he was producing what articles he had at his deposition to provide his opinion.

THE COURT: Mr. Kasiborski.

MR. KASIBORSKI: Again, we're mixing apples and oranges. The one article he identified about infrasound was the one article about infrasound that was listed as a reference in his paper. He did not say at any time as far as I can tell during his deposition, that his thumb drive file which he had with him and offered to load onto Mr. Chaklos' computer but Mr. Chaklos didn't have one, I don't believe he ever said there were no articles except one that I have here today on my thumb drive.

THE COURT: Okay. All right. Mr. Kasiborski --

MR. KASIBORSKI: Maybe the witness can clarify.

THE COURT: Mr. Kasiborski, since -- since you really bear the burden of proof to show that the witness's testimony should be admitted, do you want to do some brief questioning to establish that factual basis?

MR. KASIBORSKI: Sure.

THE COURT: All right. Please do so.

CROSS EXAMINATION

BY MR. KASIBORSKI:

Q Dr. Punch, your qualifications, your work experience and education are set forth in your C.V. which was submitted as an exhibit -- I'll represent was submitted as an exhibit to the opposition to the motion in limine, is that correct?

A That's correct.

Q Okay. And if I asked you to go through that, you would merely refer to that C.V., correct?

A Correct.

Q Now it's my understanding that in this case, you have formed the opinion that the operation of wind turbines on the wind farm adjacent to the Wiltzers' home has caused the physical symptoms of which they have complained, is that correct?

A I have, yes.

Q Okay. And is it your opinion that the Wiltzers' symptoms are caused by the audible noise from the wind turbines, the infrasound from the wind turbines, or both?

A I think both.

Q Okay. And is your opinion a medical diagnosis made for the purpose of treatment?
A Absolutely not.
Q And is your opinion dependent upon a medical doctor ruling out medical causes for the symptoms?
A It's not dependent on a doctor ruling -- a medical doctor ruling out other causes, although that would probably bolster my opinion that the wind turbines and specifically noise from the wind turbines are causing their symptoms.
Q All right. Is your opinion to which you just testified based solely on your review of the literature?
A No.
Q All right. Please tell the Court the factors upon which you rely to reach the opinion that you have; in your background, things you have done in this case.
A Yes. Well my -- first of all, my Doctorate degree in terms of what I know about audiology and the ear, I think these symptoms are closely tied to how the ear is processing the noise from the wind turbines. So my education, my training, my clinical experience, my research experience, more recently my interviewing the Wiltzers, before that

interviewing several families, not to the extent that I interviewed the Wiltzers, but talking to several families in Ubly, Michigan, in Huron County.

Q Okay. Let's maybe stop and provide the Court a little more detail about some of these components. You described your education and you have a Ph.D. in audiology, is that correct?

A I do.

Q And will you just tell the Judge briefly what the profession of audiology encompasses?

A Basically the study of the ear and hearing as well as hearing disorders. Most audiologists are clinical audiologists who deal with day-to-day patients who have hearing loss, testing their hearing, determining how much hearing loss they have, perhaps where in the system the problem occurs, not necessarily the cause; but also fitting hearing aids, fitting other devices like cochlea implants; some audiologists do that. At that point, some people become highly specialized, not everybody does that, of course, and there's a variety of work studies where people do these things. Research is another component, of course; primarily if you have a Ph.D., you end up

typically like myself in academia and doing research.

Q Okay. And as a researcher, have you taught courses in research design?

A I have; graduate level research design courses as well as -- well they are graduate courses, yes.

Q All right. And is there a type of research known as single subject design or that may be a short hand?

A There is. In my field, the clinicians, speech pathologists whom I work with closely or I've worked with closely is an affiliated field to audiology; as well as audiologists work with single subject designs to show that when there is no treatment, the performance of say a child or an adult is at a certain baseline. And then a treatment is done such as putting them in therapy; could even be wearing hearing aids for the first time, and we look at the difference. A better test so you can have other factors is to withdraw that therapy for that same child and see what happens so you chart performance over time. No exposure to wind turbines would be analogous to this for the end condition. I'm talking about what I call an ABA -- what's called an ABA

reversal design. So yes, to answer your question, it is a well accepted research design. It's much like the crossover design that epidemiologists use to determine causation. It's one of the strongest methods by the way. It's I think if you look -- if you read a book or read on this, you'll find that it's considered one of the stronger designs to show causation.

Q Okay. And you have a sound knowledge of the ear and sound, is that correct?

A I consider it sound, yes.

Q All right. And it's true, is it not, that you've taught courses in the anatomy of the ear?

A Of course, multiple years. Yes.

Q Has that been at the graduate or the medical school level?

A The courses I've taught at MSU, at Michigan State University, it's been at the undergraduate level, usually juniors and seniors. I've taught courses in the past components of the anatomy of the ear, primarily; and I think in a position that I had at Riley Hospital in Indianapolis Medical school and residents -- primarily we're talking about physiology, but residents attended some of those classes. I have not taught a formal course in

medical school though.

Q All right. And I think before I cut you off, you were making mention that you interviewed the plaintiffs?

A I have.

Q All right. And I think you told Mr. Chaklos one of the things that you have with you are the results of those interviews?

A I do.

Q All right. Can you tell the Court briefly what you learned from those interviews and if those interviews impacted in any way your opinion on this case?

A Um, may I refer to my notes on that?

Q Sure.

A I do have a table.

THE COURT: Mr. Kasiborski, is this really necessary for the purpose that we're here? I really anticipated you asking questions to try to clarify the scope of literature that could be used to bolster his opinion.

MR. KASIBORSKI: All right, I misunderstood. I thought you wanted me to --

THE COURT: No, I really don't want you to do that. I'm concerned about getting to the

punch line about whether or not he has generally in rendering opinions looked at a variety of articles that may be broader in scope than what Mr. Chaklos claims he identified as being the basis for his support.

MR. KASIBORSKI: All right, let me focus on that.

BY MR. KASIBORSKI:

Q Did you bring in either hard copy or electronic form copies of articles upon which you relied in forming your opinion? And I believe your deposition was taken this passed July, late in July?

A Are you asking did I do that during the deposition?

Q Or did you bring articles with you to the deposition?

A I brought a stack of some articles, yes.

Q Okay.

A As well as some things on the thumb drive.

Q You had the articles on the thumb drive?

A Yes.

Q Okay. And since you learned of this Daubert hearing, you've looked for additional articles; is that correct?

A I have. I have, because I thought I did what was asked for the deposition. When I was asked to look more into articles that bolstered or supported my opinions relative to low frequency noise and infrasound, I absolutely found a lot more articles. And I still don't think I've seen them all, I still think there are other articles.

Q All right. And you have in front of you your copies of the articles upon which you rely today --

A Today.

Q -- to support your opinion?

A Today, yes.

Q Is that correct? And some of them deal with primarily audible noise?

A Primarily, no. I would say most of them deal with low frequency and infrasound.

Q All right. And you prepared summaries of those articles which we have had admitted into the record as Exhibit 2.

A I have.

Q And those were prepared by you, correct?

A Yes. I spent something like 30 hours preparing this, organizing the summaries. I mean, excuse me, organizing the articles, reviewing and

re-reviewing articles and then creating the summaries.

Q Okay. And you got a notebook in front of you that has for a number of articles, I think approximately 50 or 52 articles, a copy of the article itself plus your summary of the article?

A That's correct.

Q Okay. And you're prepared to go through those one by one today --

A If need be.

Q -- if need be to explain briefly who the author was, where the article was published, the level of peer review, give a brief synopsis of the article, and also relate how you believe that supports the opinion to which you just testified?

A I am.

Q Okay. And another way we could get there would be to read your summaries, that's essentially what your testimony.

A That's true. That's true. My summaries in some cases were taken from the abstract to make things simpler, and particularly in the cases where the details were important enough to bring to this Court or this situation. But in many cases, they were my own interpretation of the articles

including some of the information in the summary; for example, some of the summary and some of the abstract and some of the conclusions at the end of the article.

Q All right. Let me be perhaps more precise with my question. The first article that we have listed as an article from Ambrose from the Bulletin of Science and Technology, etcetera, having to do with wind turbine acoustic investigation infrasound and low frequency noise a case study.

A I --

Q Please let me finish the question.

A Sorry.

Q Okay. So we have a summary of that article in your booklet, and we included the summary of that article as part of Exhibit 2. Would your testimony today be any different than what you set forth in the summary which we have incorporated into Exhibit 2?

A No, I haven't made any changes since I gave you those for your purposes.

Q Okay. And if we were to go through the articles one by one, you would reference the summaries and more or less parrot the summaries.

A Paraphrase is a fair --

Q It's probably a better word than parrot. All right. Um, and, again, you've organized that by author, year, title, source, level of peer review, factors contributing to the validity, summary, key words in relation to this case.

A I have.

MR. KASIBORSKI: All right. Judge, I'm looking to the Court for direction. We can go through these one by one.

THE COURT: All right. Mr. Chaklos, now you have objection to the Court considering at this hearing articles that are beyond the scope of what he identified as you put at the deposition that you identified?

MR. CHAKLOS: Well I do, your Honor. Because the purpose for the Daubert hearing is to see whether or not he was qualified to render the opinions that he gave me at his deposition.

THE COURT: No, the purpose is to determine if I'm going to qualify him as a witness at trial; that's the purpose.

MR. CHAKLOS: Okay. But I would assume that would be based on what the opinion --

THE COURT: Perhaps it is, perhaps it's not, depending on what you asked him at the

deposition. Mr. Kasiborski, you indicated that he was asked what infrasound articles he relied upon in writing number 38, his article in Audiology Today, and you said he relied upon or he responded that he relied upon this one Korean or Chinese.

MR. KASIBORSKI: Correct, which was included in his references to his article.

THE COURT: And you represented to the Court that he was prepared to produce electronically a number of other articles that would have supported his opinion.

MR. KASIBORSKI: I believe that's what he just told us a few minutes ago --

THE COURT: Why don't we ask him.

MR. KASIBORSKI: -- that he had articles on his thumb drive.

THE COURT: Why don't we ask him about those compared to the ones that he wants to rely upon today. They're more expansive here today, Dr. Punch?

THE WITNESS: They are more expansive.

THE COURT: Okay. And what is it that makes that improper, Mr. Chaklos? I'm not sure.

MR. CHAKLOS: Well I guess --

THE COURT: Can you show me a question

where you say identify for me all of the articles that support your opinion as to your conclusions with respect to the Wiltzers. Did you ask that question and he identified just one article on infrasound?

MR. CHAKLOS: He said -- I asked him if there were any articles that he's read on infrasound, and he said that he doesn't know, he would have to check his computer. So I thought when he checked his computer, that then provided him with information and he did a word search for the word ultrasound and that's when he came up with the Korean.

THE COURT: I'm going to cut through it. This Court is not going to limit a witness who has now been challenged under Daubert with respect to the qualifications to limit the scope of what he indicates bolsters his opinion. I believe that it's appropriate for him to have some leeway in that respect; and, in fact, he can rely upon additional articles if he's cross-examined about that at the time of trial if further articles come out or further research is something that he should consider in rendering an expert opinion. So I'm not going to limit that. Mr. Kasiborski,

do you think you need to ask anymore questions at this time to allow --

MR. KASIBORSKI: Well I --

THE COURT: You've had him identify that his summaries are what his testimony would be at --

MR. KASIBORSKI: His summaries would be his -- I think the witness has confirmed that his direct testimony, if we went through these articles one by one, would be essentially what he put forth in his summaries.

THE COURT: All right, fair enough. Thank you. Mr. Chaklos, do you choose to cross-examine the witness?

MR. CHAKLOS: I'm going to try.

THE COURT: All right.

RECROSS EXAMINATION

BY MR. CHAKLOS:

Q Would it be fair to say that before you went out to the Ubly wind farm or the Ubly -- is that a house or wind farm?

A Both.

Q Okay. That you never heard the word ultrasound?

A No, that's not true.

Q And how would you have -- how would you have been

familiar with that concept?

A Um, it dates back to at least 1960, late'60's.

THE COURT: Mr. Chaklos, I'm not sure what you're talking about. What does that mean?

MR. KASIBORSKI: You said ultrasound instead of infrasound.

MR. CHAKLOS: Oh, I'm sorry.

THE COURT: Well you went to someone's wind farm, what wind farm did you go to?

MR. CHAKLOS: Oh, I'm trying to get an understanding of when his experience with Mr. James has been as an acoustical engineer when he first became involved with the concept of wind turbines and infrasound and things like that. I wanted to know when this witness started.

THE COURT: Okay. But I thought you referred to his visit to some house.

COURT REPORTER: Maybe you could spell it, Ubly.

MR. CHAKLOS: I think it's U-B-L-Y.

THE COURT: Is that someone's name?

MR. KASIBORSKI: That's a town.

THE COURT: Oh, Ubly is a town.

MR. KASIBORSKI: In the thumb area of Michigan.

THE COURT: All right, now I'm starting to catch on. I wasn't sure what you were talking about.

MR. CHAKLOS: That's my fault, your Honor.

THE COURT: All right, thank you.

BY MR. CHAKLOS:

Q Go ahead.

A Should I explain the Ubly situation?

Q Explain that first and we will back up from there.

A I think in either the late fall of 2009 or early -- excuse me -- late summer of 2009 or early fall, somewhere in that vicinity, Rick James asked me to go with him on a visit. I was reluctant. We talked about the issue there which was -- I can't remember the name of the company now -- had put in a wind farm. One of the -- I think the very -- excuse me, the very first one in the State of Michigan. He thought it would be of interest because Rick and I had worked on a number of community noises; in general, he had been kind of a consultant for me as an adjunct instructor at MSU for a number of years, worked on several different projects.

So I went and I interviewed -- we

interviewed together a family who later brought a lawsuit because they had to abandon their home because of the wind farm. They were living in a hotel during the times when they couldn't sleep at night. I interviewed that family, not in a formal way, I didn't have any paperwork with me. I didn't write down the responses or that sort of thing. I was just learning about the issue of wind turbine noise and adverse health effects, because they had experienced a number of these including all of the ramifications of losing sleep for a number of nights or weeks.

Q Okay. In fact I think you said you told me that before the Ubly matter, wind turbines possibly causing adverse health effects was not even on your radar personally.

A That's probably true. But you asked me earlier a question about whether I understood the concept of infrasound or ultrasound. I'm not sure what you used now.

Q Right.

A And when was that; it was back when I was educated in my Masters program at Vanderbilt University and my Ph.D. at Northwestern University. We talked about infrasound. There wasn't much known about

it; there's still a lot to be known about it. And we talked about ultrasound which most people assume is -- well it is a high frequency.

Q I made a mistake, it should have been infrasound.

A Okay.

Q So if you would just proceed with that understanding.

A Okay. We talked about infrasound in terms of defining it. There was no way to measure at that point, we're still having problems measuring it.

Q Uh-huh.

A But I knew the concept of infrasound. We didn't know about adverse health effects from it in the late 60's, early 70's.

Q Okay. Now with regard to either your clinical work or your research or your teaching at MSU, um, the majority of that was with regard to hearing aids, isn't that correct?

A No. No. It was research design. It was anatomy physiology of hearing and speech by the way.

Q But design of hearing aids.

A No, research design; just in general research experimentation, how to conduct research. Okay. Various procedures in statistical methods and so forth in analyzing data and so on, but it wasn't

just on hearing aids. I did some clinical hearing aid work at MSU and supervised some students in that regard and saw patients. The clinic stopped doing that a few years ago, but I have been retired since 2000 -- early 2011. And I haven't fitted hearing aids in quite awhile actually, about five years.

Q Okay. And I believe you also told me that you believe that you were first introduced to the concept of wind turbines possibly causing adverse health effects after the Ubly matter or together with the Ubly matter and then after that, is that correct?

A In conjunction with it and after, yes.

Q Okay. And then I believe you told me that peaked your interest in that area at that time, is that right?

A Well it's fairer to say that I had been interested in community noise issues for some time.

Q Okay.

A And this was another different kind of community noise issue to me.

Q Right. And in fact you said that that community noise is a common -- a common interest of audiologists, is that correct?

A Well I'm not sure. We can go back to the deposition, I'd like to see that again. I don't remember that I said that. But it is not a -- I think it's a specialization actually within audiology; and, frankly, most people who have that special interest are people with Ph.D.'s.

Q And could you tell me in terms of your qualifications to render your opinions today -- let's exclude the articles. What can you tell me about your other experience let's say in terms of -- in terms of wind turbines causing or emitting, um, infrasound which then would result and possibly cause adverse health effects?

A I was asked to be Chair shortly after the time the article came out in Audiology Today by the technical work group by the Department of Energy Labor and Economic Growth which is now has a different name in the State of Michigan, it's the Department of Energy basically, a division of energy. I was asked to Chair a technical work group to come up with a set of or revision for the at that time current guideline on how to site on shore wind turbines in Michigan.

Q Okay. And but that never came to fruition, is that correct?

A Well that went on for over a year and a half; and so it came to fruition in the sense of a number of meetings, a number of reports, draft reports. Um, it didn't come to fruition when we were told that -- what we were told is that the state really didn't have the authority in the first place to form such a committee which was not very -- I didn't believe that was the case, and I have no way of saying it wasn't the case.

Q Yeah, you told me it may have been a political thing.

A I think it was very political, because we were about to recommend 40 dBA as the maximum level. We had other things we were covering besides noise but that was one of the major issues.

Q Okay. And then you had -- you were involved in two matters, one in Wisconsin and one in Ohio.

A Yes. I was going to get to that, too, yes. I was asked to be an expert witness in a case in Ohio, the power siting board there was undergoing -- had a decision to make about whether this one company could site turbines in the town of Forest which is in west -- I'm sorry, that's in Wisconsin. And this was more generally about Ohio siting wind turbines in Ohio. And there was this Wisconsin

case, some families in Forest, Wisconsin contested the development of the wind farm in their town; that case has never been settled yet, but I was a witness in that case, also. I did not make a public -- I mean a personal appearance there as I did in Ohio, but I testified via phone held by a conference call.

Q Okay. So would that be -- so which one came first, your article review which you submitted to I think it's Audiology Today?

A That's correct.

Q Is that what it is? And so where did that fit into those three things Ubly, Wisconsin, and then Ohio?

A The sequence was the article -- oh, I'm sorry, the sequence was Ubly first.

Q Ubly, okay.

A Then the article, then the technical work group appointment, and then Ohio, and then Wisconsin. There was a little overlap between the Ohio and Wisconsin cases.

Q Okay. And James was involved in I think one of those and he got you involved?

A He was involved in Ohio.

Q He was also involved in Ubly?

A Well he was involved in a court case in Ubly. I was not involved in that case.
Q Okay. So in Ubly, what you did was you just went and talked to the family?
A Yeah, we sat in their house and we talked; and I heard and I experienced some of the sounds that they were talking about. At that point, we were only talking about audible sounds.
Q Okay. And so when did your first experience come into play in terms of, um, wind turbines emitting ultrasound or infrasound -- there I go again -- which then may possibly cause adverse health effects?
A As we were writing the article, we knew there was this one article, the Jung article -- J-U-N-G -- the Korean article.
Q Yeah, the Korean article.
A Yeah. You know, I knew there were other articles but this was a tip of the iceberg article. It was not a comprehensive, exhaustive literature; but we wanted to mention that some folks -- some scientists were beginning to just talk about infrasound as a possible basis for these kinds of complaints people were having.
Q Okay. Now I believe that you said, um, you didn't

mention the word infrasound in your article that you wrote, is that correct?

A I hope I didn't say it, because it's not true. We mentioned it at least once. I think it was only mentioned once.

Q Okay. All right. And then you believe that your writing of -- now the audience for the article would have been audiologists, is that correct?

A Primary audience, yes.

Q Yeah. And that's because some of them were interested in curing noise like you are?

A That's correct. And some of them were seeing patients, some of whom might have been coming into clinics and mentioning those symptoms.

Q All right. And did you -- have you ever conducted any case studies, done any testing, done anything like that with regard to wind turbines and emitting noises or emitting, um, infrasound which may cause, um, adverse health effects?

A Well I need you to separate the clinical implications of that versus the research implications, because infrasound is kind of a research issue. I certainly have had cases -- I think the Wiltzers are a perfect example of a case study.

Q Okay, yeah, and I will hold you to that. But before we get to the Wiltzers, had you ever conducted any type of testing or case studies or anything like that at all?
A No, just a review of the literature.
Q Okay. And I believe when Mr. James took you out to the Wiltzers, you really had no idea why you were going; isn't that correct?
A Well I knew why we were going. Rick briefed me on their situation. I think he had a couple of visits before I went with him, and he thought because his testimony as an engineer or -- yeah, as an engineer -- might not be sufficient in a case involving health issues, that someone like myself should be involved.
Q Okay.
A I did not go knowing or thinking that I would be involved in any litigation.
Q Well and except for the questionnaire, you didn't think you'd be involved in doing anything.
A You know, I was at nearing retirement, and I thought this is really a community noise issue that I might have an interest in, and I was prepared to have opinions very different from Rick James believe it or not. Some of our opinions

might differ somewhat today, but I think Rick James is absolutely right on as far as most of the opinions involving what's going on here I know are similar to mine. We have talked about it, we have been colleagues for a long time. We have not talked about this proceeding, this particular proceeding. But I'm finding more as I read more and know more and learn more, I agree more and more with Pierpont about wind turbine syndrome, and I'm agreeing certainly with McMurtry.

Q Now when you went up to Ubly, that was a noise case, wasn't it?

A In my view at the time, I didn't know that it was a noise case, a legal case, but just a family who had strong complaints about the noise.

Q So what I was going to ask you about --

A It was a noise case in that sense, but not necessarily --

Q Pardon me?

A It was a noise case in that sense but not necessarily wind turbines.

Q Okay. But it certainly wasn't an infrasound case at that point, wouldn't that be true?

A I don't think there was a clear distinction made between infrasound and audible sound.

Q Okay.
A There might have been some hunches that on that side, on the family's part, that low frequency noise was the issue, the rumble I think was mentioned for example. Vibrations were mentioned in the house, and oh, you know, that can only be caused by lower frequency sound.
Q In your deposition, you told me that you said, you know, we didn't even have a reason to look into that, so we hadn't. And you were talking about infrasound.
A The issue didn't come up. I mean the term infrasound wasn't necessarily a label that we put on it.
Q And in fact you admitted that in 1909 -- I'm sorry, 2009 -- that you didn't find a lot of literature that dealt with infrasound and wind turbines, is that correct?
A That's probably true. I hadn't looked very deeply as I have recently.
Q Okay. Would you say that you have more ultrasound articles that you've read since your deposition than before?
A That's true because of the challenge of the Daubert hearing.

Q So you don't think that you were qualified before you read the ultrasound articles to be qualified in the Daubert hearing?

A Quite frankly, I didn't understand the purpose of the deposition as clearly delineating between issues involving infrasound versus other kinds of sounds. So I did what I thought I was asked to do and to bring, and what I brought did not include all of the articles that I brought today.

Q Okay. Who gave you the additional literature that you had since the deposition?

A Who gave it to me?

Q Yeah.

A No one. I accessed it myself.

MR. CHAKLOS: Okay. I'm not sure if this gets into work product or not, your Honor, but I'll ask you, if I asked him if he was told to do that by plaintiffs' counsel.

MR. KASIBORSKI: I don't know the relevancy of this, Judge. I think the Judge has already -- the Court has already ruled that he can support his opinion with whatever articles he has.

THE COURT: I'm assuming that plaintiffs' counsel probably encouraged him to do that if it helps any. I don't find anything prohibitive

about that. I don't know that it's work product. I don't think that's work product. I think if he got some direction from counsel to look at supporting articles; is that true, doctor? Did one of the attorneys say and perhaps you ought to look and here's --

THE WITNESS: I had been advised about what their -- counsel's interpretation was about the requirement of the Daubert hearing.

THE COURT: All right. And you're going to have to --

THE WITNESS: And we concluded together in a conference that that would be the way to meet the challenge.

THE COURT: All right. And that prompted you to make a further inquiry?

THE WITNESS: It did. It did.

MR. KASIBORSKI: In fact I can represent that many of the articles about infrasound that Mr. James used the first day of his hearing were taken out of Dr. Punch's binder because Mr. James showed up the first day only with an electronic file. So we had a lot of articles on infrasound and adverse health effects here six weeks ago or whenever it was.

MR. CHAKLOS: I don't doubt that. But when did -- how many ultrasound articles did you have when I cross-examined you at your deposition?

THE COURT: Yeah. Mr. Chaklos, I've already made a determination.

MR. CHAKLOS: Okay, you're right. You're right.

THE COURT: The standard here is his qualification as a witness at trial.

MR. CHAKLOS: Okay.

THE COURT: Not at deposition.

MR. CHAKLOS: Okay.

BY MR. CHAKLOS:

Q Now you have to admit, Doctor, that infrasound is not audible, is that correct?

A It depends on the level.

Q Okay.

A Infrasound by definition, standard dictionary definition is sound below about 20 hertz; and up to now, it hasn't been believed that the ear can hear that sound as sound.

Q Okay. So would it be fair to say -- I mean as an audiologist, you deal with sound that you can hear, isn't that correct?

A As an audiologist that's fair to say that we

concentrate mostly on the audible range of hearing, because one of our concerns is the development of normal speech in a child and the ability to hear conversation and other environmental sounds. We didn't know a lot about wind turbines at all. There wasn't much in the U.S. going on until relatively recently compared to other countries like Europe and Sweden and so on.

Q Sure. And would it be fair to say that any research that you did and certainly your clinical work would deal with noise as opposed to infrasound which is -- which you can hear?

A Which we can hear.

Q Can't hear.

COURT REPORTER: Can or can't?

A Can or can't.

Q Can't.

MR. KASIBORSKI: Can you maybe repeat that?

A No.

MR. KASIBORSKI: Did you understand the question?

THE WITNESS: I think the answer is no if I understood the question. Could you repeat it

first?

BY MR. CHAKLOS:

Q Sure. It's true that your clinical work didn't address infrasound, is that correct, because that's dealing with noise?

A That's correct, sound and noise in the audible spectrum.

Q Sure. And then I believe that you told me that a lot of your research at Michigan State concerned trying to improve hearing aids.

A Much of it; not all of it, but I'd say a majority of it, certainly.

Q So most of your -- would you agree with me before -- before the Ubly case or before your article, very little of your eduction at all or your knowledge at all knew -- you didn't know anything about infrasound in terms of your --

A I don't understand the implication or the relevance, but it's true that my career has not focused on infrasound.

Q Okay. Well I guess I'm trying to split up exactly how you're getting your knowledge about infrasound.

A I'm learning as I go, Mr. Chaklos. I learned more after school than I ever learned in school.

Q I believe we all do that.
A And I'm still learning.
Q I believe we all do that. Would it be fair to say that the majority of your knowledge concerning wind turbines and emitting ultrasound, infrasound, okay, um, which can cause adverse health effects, it came from the articles?
A Yeah, I would say so in terms of bolstering my opinions here. Yes.
Q Now when I asked you about your opinions during your deposition, you basically told me it was a logical assumption that you were making, and you referred to it was a one subject --
A Single subject design.
Q Yes. The fact that they didn't have the symptoms before the turbines were put in, they have them when the turbines -- when they're around the turbines, they move away and the turbines are gone; and you characterized that to me as you were just making a logical assumption, is that correct?
A Well I'm not making a medical diagnosis. I'm looking at cause and effect in terms of an experimental design. An analogy to experimental design, that is design to determine cause and effect. So yes. I mean I don't think there's

anything wrong with or demeaning about saying I'm using logic. I certainly am using logic, research is about logic.

Q Well --

A It's more from my research, you know, my research knowledge base that I make that kind of link between cause and effect than anything else.

Q Okay. But you didn't have any -- you didn't do any research other than reading articles, um, in forming your opinions about -- about the causation between wind turbines and infrasound and adverse health effects; isn't that correct?

A That's correct.

Q I mean correct me if I'm wrong -- and I don't mean this in any derogatory way at all -- but I mean what you've done is you've read a lot of articles after it peaked your interest when you were involved with Ubly, you read a great deal of literature and articles and you're going to give an opinion at trial based on -- based on the literature that you read?

MR. KASIBORSKI: I object. I spent some time until the Court stopped me asking -- having the witness identify the --

MR. CHAKLOS: Your Honor, this is

cross-examination. I don't want him instructing the witness.

THE COURT: Yeah. Why don't we just let you finish the question, Mr. Chaklos. Overruled.

MR. CHAKLOS: Can I have the question read back, please?

(Requested information read by the reporter.)

MR. CHAKLOS: Isn't that correct?

A Well with reference with this case; may I answer it relative to this case?

BY MR. CHAKLOS:

Q Yes.

A I relied on my clinical experience and my knowledge of case history information.

Q Okay.

A And I conducted an interview based on the case history protocol, although it was much more -- I guess it was much deeper and more comprehensive than a normal case history with a patient, because we're getting that specific question relevant to this fairly technical issue.

Q Okay. So I was going to interrupt you because I wanted to take those one at a time. So other than -- other than the literature, what else do you

rely on in providing your opinion here today?
A And I was saying my knowledge as a clinician.
Q Okay.
A And audiologist.
Q And how did that help you with regard to understanding infrasound causing -- potentially causing adverse health effects when it's emitted from wind turbines?
A Well how the ear processes sounds is always behind every case of audiologic evaluation assessment. Even hearing aid fitting, you have to be knowledgeable about how the ear works. Infrasound is not directly an issue there I admit. I mean that's true, but the ability to do a case history form was very much a part of our ability to develop a questionnaire that was comprehensive in this case and do the interview with the Wiltzers.
Q Okay. In fact, that's why Mr. James brought you along, because he thought that you would add maybe some medical knowledge so he could use that questionnaire on a consistent basis throughout some of his cases I believe or not? That's what he told us.
A Well other cases, of course, this was related just to this case. I don't know what his suppositions

were.

Q Okay. Well when you were driving out to the Wiltzers, did you have any idea why you were asked to go out there?

A Yes. I would be able to -- excuse me, I'll start over. We didn't develop the questionnaire until after the first visit; and then we went back and administered the questionnaire if that answers your question.

Q Okay. So when you were first driving out to the Wiltzers and before when Mr. James said, you know, come on Dr. Punch, we're going out to the Wiltzers. And you get into the car and you go out there, did you have any idea why he was taking you out there?

A He wanted me to see for myself the house, meet the family, talk to the family just generally about what they experienced, and see if I could provide any insight into how wind turbines may be affecting their health. Because we both agreed, James and I agreed it's related, linked to the way the ear processes sound, and I'm an audiologist who knows something about the ear. I may not be the only witness who could do this, obviously, but there's not too many audiologists involved in this

issue right now.

Q Well, you know, I guess that's my point. I don't mean to be disrespectful, but the fact that you're an audiologist and you deal with the ear, it's my understanding that, if you believe Mr. James, that infrasound actually comes in through other -- doesn't just come in through the ear. He says it comes in through your chest, it comes in through your neck, things of that nature. So other than the fact that that happens to be sound and you happen to have a degree that has to do with the ear, I mean that's about it, isn't it?

A Well if you review these articles in depth, you'll find a number of articles that talk mostly about two things; the vestibular or balance component of the inner ear and the cochlea or the auditory part of the inner ear. And from Pierpont to a lot of other authors, there are people who agree; Salt is one of them and his colleagues. You've heard that name I'm sure.

Q Right.

A Are saying that it's what happens at the level of the inner ear that causes us to have a -- that gives us a basis for believing that these kinds of symptoms like dizziness and nausea, tinnitus and

headaches, and all along, you know, are related to the fact that acoustic energy comes into the inner ear and is picked up, one, by the outer hair cells of the cochlea, and, two, by parts of the vestibular system. It is true, I'm aware of that literature that says it can be chest, it can be vibration, feelings of vibrations, it can be palpitations. These are all signals coming into the body sensory organisms, sensory neural pathways, goes to the brain, and it can't make sense of it all. And I don't believe we or anybody who even studies this understands exactly how it happens, but there are a lot of people who have offered a number of studies and various kinds of evidence to show that these symptoms are very much related to infrasound and low frequency noise.

Q But again, the low frequency noise or the infrasound is not something that an audiologist generally concerns himself with, because he concerns himself with sound and dealing with the ramifications of not being able to hear so you fit them with hearing aids, correct?

A Normally, typically that's true. May I add that your implication in the deposition in here is that

it should take a medical doctor to do what I'm trying to do here.

Q No, I'm not saying that at all.

A Okay. Okay, I'm sorry.

Q I'm not.

A That's not the case, well --

Q I never said that so. And I believe you told me that even the one Korean paper that you referenced in your article did not involve wind turbines, is that right? Do you remember that?

A No, but I have -- the paper is by Jung. If you tell me the date of that article, I don't remember the year. I can find it here.

Q Let me show you in your dep.

A It's around 2010 maybe. No, it had to be around 2008 or 9.

MR. KASIBORSKI: 2008 it looks like.

THE WITNESS: Yeah, okay. Yes, it did have to do with upwind wind turbines. The emphasis in the study was infrasound and low frequency noise. He talked about not only does it produce the very, very lowest infrasound but also about 6 or 7 harmonics of that sound above the lowest level. He just analyzed acoustically the wind turbine noise. It's just another article

that says wind turbines do emit infrasound. There's a lot of articles that say that.

BY MR. CHAKLOS:

Q Okay. Is that from your summary or from the article itself?

A We can look. I mean it's in my summary. I don't think I'd say anything that's --

Q No, no. I'm talking about are you taking information from the article?

A In my summary, I took it from the article.

Q And the only reason I ask is because in your deposition, you said it was not -- it did not deal with wind turbines.

A I probably did -- I was going to say that, yes. I've looked at it more carefully I guess for this purpose. Again, at the time of the deposition, I didn't know the emphasis was going to be on or should be on or would be on infrasound per se.

MR. CHAKLOS: Just one more question and just want to follow up with my -- may I approach the witness, your Honor?

THE COURT: You may, please.

MR. CHAKLOS: I just want to follow up with my question about your opinion being a logical one.

MR. KASIBORSKI: What page is that?

MR. CHAKLOS: I'm sorry, 14 --

THE COURT: You referring to deposition testimony?

MR. CHAKLOS: Pardon me?

THE COURT: Are you referring to deposition testimony? I'm not sure what you handed to him.

MR. CHAKLOS: Oh, yes, yes, deposition and it's page 144.

BY MR. CHAKLOS:

Q If you just want to read it to yourself.

A Should I read the question first?

Q Yeah, sure. You can read as much as you want.

A (Witness so doing.) Yes, this is about the idea that when they left the turbine site of the home, they didn't experience the symptoms any longer; and when they came back, they did, basically, is that the gist of it.

Q Yeah, and I think you can go further and you say admit you're not making your -- it's not your own independent diagnosis of finding, you're just making a logical conclusion. I think that's what you say there, right?

A Well I don't consider those independent. I mean

my logical conclusion is my opinion.
Q Okay. It is something that you told me during your deposition.
A Yeah, I said it's a logical thing really.
Q And then you went further I think. Then I asked you further and you said as opposed to being an independent diagnosis or finding.
A Well maybe I was thrown a bit by your word diagnosis there in your question, because we had already talked about I don't make medical diagnoses. As a researcher, I don't make a diagnosis; I make a conclusion based on logic from using all of the data that I have available which includes other people's work.
Q Okay. And there's nothing about you being an audiologist that would make -- that would make you specialized in reaching a logical conclusion.
A I disagree because --
Q Wait, wait, no, let me finish the question.
A Sure. I'm sorry.
Q And there's really nothing about you being an audiologist; you can be a brain surgeon, you could be anybody, but in just making a logical conclusion that when the Wiltzers were around the wind turbines, they had their symptoms; when they

moved away, they didn't; when they went back, they did; when they moved away, they didn't. So you made the logical assumption that is caused by the wind turbines, and I guess my point is is that anybody could make that same logical conclusion. You don't have to be an audiologist, you don't have to be a doctor, you don't have to be a rocket scientist; correct?

A Well I can -- sorry.

Q Or know anything about infrasound or anything, because we know that they had it when they were there, and they didn't have it when they were gone.

A You're saying it doesn't require expertise that I may have just to make that conclusion. I can walk over to the light switch and turn it on and off about ten times; and you can see that it's a light switch causing it so anybody can make that kind of a conclusion. But I made this conclusion based on that kind of logic, plus my knowledge of single subject design research which I know to be one of the main stays of causation and research in my field and a lot of other behavioral fields.

Q So any researcher or any doctor or anybody that has done that type of research would then be able

-- would be just as qualified as you to make that logical assumption?

MR. KASIBORSKI: I think this is argument now.

MR. CHAKLOS: No, it's not.

THE COURT: Well I'll allow the question. This is cross-examination. Can you answer the question, Doctor?

A I think if any doctor, any lawyer, anybody made the observation that when a family leaves its home and no longer suffers symptoms that they have when they're at home and they do it multiple times repeatedly, anybody can make that conclusion. I agree with that logically.

MR. CHAKLOS: Your Honor, I'm not going to go into the articles. I didn't read them, and I don't think it makes much difference if I do.

THE COURT: All right, fair enough. Mr. Kasiborski, do you have cross-examination?

MR. KASIBORSKI: Well I think I covered most of the points that I want to make. I think we've, you know, to go through the literature I would just have him paraphrase the summaries which have been admitted into the record. The Court may read those at its leisure.

I guess I would point out that many of the articles included in Dr. Punch's summaries and in his packet of articles are identical. They overlap to what Mr. James testified to and those were covered in some detail --

THE COURT: All right.

MR. KASIBORSKI: -- during Mr. James' examination. And I guess I don't know, if I could briefly confer with Ms. Topp. I don't believe I have anymore questions, and I don't know if you want us to argue.

THE COURT: I want to see if we're done questioning the witness and then we will discuss that.

MR. KASIBORSKI: All right.

MR. CHAKLOS: I just have one more. Oh, I'm sorry.

(Off the record discussion at 3:13 P.M.)

MR. KASIBORSKI: I'm just looking at my notes for a second, your Honor.

THE COURT: Yeah, take your time.

MR. KASIBORSKI: I think through the affidavits of Dr. Punch that were submitted with the motion in limine response, the questioning today, exhibits to the summaries of the articles,

I think we're satisfied with our presentation.

THE COURT: Did you have further questions, Mr. Chaklos?

MR. CHAKLOS: Just one, your Honor.

THE COURT: All right, go ahead.

MR. CHAKLOS: Can I approach the witness again?

THE COURT: You may.

BY MR. CHAKLOS:

Q Page 169, I think you admit there that you're not an expert in infrasound.

MS. TOPP: What page are you on?

MR. CHAKLOS: 16 -- let me check.

MR. KASIBORSKI: Let us find the page, please.

MR. CHAKLOS: It's 169, I'm sorry. Wasn't that the question and answer we were kind of going back and forth on?

A Yes.

BY MR. CHAKLOS:

Q And you admitted that you were not an expert.

A May I ask how you define an expert because definition can vary.

THE COURT: I'm not sure, counsel. Can we have a question here so I know the context of

your conversation? I haven't read what he's reading.

THE WITNESS: I don't mean to be difficult here. I'm trying to answer.

BY MR. CHAKLOS:

Q No, that's fine. Let me do this the right way I guess. Okay.

I asked you: "Since you are an audiologist, I would assume that you are not an expert, you would not consider yourself an expert in infrasound; would that be a fair statement?"

You said: "I would probably not be considered by most people, right, as an audiologist to be an expert in infrasound."

That's what you said.

A Yes, that's what I said, and I think that's correct, I would not be considered by most people because I'm an audiologist to be an expert in infrasound; if you mean that there are many other people in the U.S. or the world that know more about it than I do, I would admit that certainly.

MR. CHAKLOS: Okay. That's all I have.

RECROSS EXAMINATION

BY MR. KASIBORSKI:

Q You went on to explain, correct?

A I did.

Q And you may tell the Judge how you went on to explain and elaborate on the answer; that most people would not consider you as an expert.

A May I read that, your Honor, my answer?

THE COURT: Any objection, Mr. Chaklos, any objection to that?

MR. CHAKLOS: Well that's not really -- I mean he can --

THE COURT: Well it's only fair when there's cross to expand upon it when you just take an excerpt. So go ahead, Mr. Kasiborski, you want him to read further?

MR. KASIBORSKI: Yeah, I think that was --

THE COURT: Read further.

MR. KASIBORSKI: I think he -- the witness went on to explain his answer and that's all I'm asking him to do now; and whether you want to read a loud to the Court the rest of your answer or simply paraphrase it, that's fine with me, Dr. Punch.

MR. CHAKLOS: You might as well just read it from the transcript.

THE COURT: Or if you'd like me to read it from a certain page number to a line, I'd be happy to do so.

MR. KASIBORSKI: Do you have a transcript?

THE COURT: I don't.

MR. KASIBORSKI: I'll hand you mine.

THE COURT: Yes.

MR. CHAKLOS: It's line 18.

MR. KASIBORSKI: The question starts on page 169 line 10, and then the answer continues onto page 170, Judge.

THE COURT: Okay, thank you.

MR. KASIBORSKI: And we will save the reporter two pages of transcript.

(The Court so doing.)

THE COURT: All right, fine. I've had a chance to read that. Thank you.

MR. CHAKLOS: That's all I've got, your Honor.

THE COURT: All right, thank you. Any other questions for the witness or can he step down?

MR. KASIBORSKI: I think he can step down, Judge.

THE COURT: You can step down, Doctor. Thank you for your testimony. Mr. Chaklos, did you want to revisit your request to be able to supplement your arguments as to these articles?

MR. CHAKLOS: Um, no I don't think I need to do that to be honest with you.

THE COURT: All right. Mr. Kasiborski, did you have any evidence you wanted to introduce here in addition to what we have now?

MR. KASIBORSKI: No, Judge.

THE COURT: Mr. Chaklos, did you want to make any argument with respect --

MR. KASIBORSKI: I would just again like to -- excuse me. Just remind the Court that as we discussed I think when we were here several weeks ago, we do rely on the C.V. and the affidavits that were submitted with the response and opposition to the motion in limine as part of our direct exam of the witness.

THE COURT: And I did review those prior to coming to the hearing today. Mr. Chaklos, do you have argument?

MR. CHAKLOS: Just briefly, your Honor.

I think Dr. Punch is a smart man, he's an accomplished doctor and this is not to, you know, say that he's not; but he is just someone who read articles. His specialty has nothing to do with infrasound, and they're going to play it up in front of the jury and confuse the jury, his specialty has nothing to do with infrasound; he's an audiologist, it has nothing to do with the ear.

The issue in this case is the lack of hearing or they're not getting noise, and he deals with noise. And all he did was read a bunch of articles and now he thinks he's -- he's qualified, and he just keeps on reading more and more because even when he gave his dep he apparently didn't feel he was qualified.

I just don't see where his testimony is going to aid the jury, because all he's doing, it's almost hearsay testimony because he's saying he's going to get up in front of the jury and say well the article says this, the article says this, this is why I believe it. He has also told us that his opinion is a logical opinion. He didn't say it was based on the articles; he just said it was a logical opinion and anybody could make that logical opinion. A juror can make that logical

opinion.

I don't think you need Mister or Dr. Punch to make that logical opinion, and he admitted it was a logical opinion; you know, a lawyer could make it. So I don't think that his -- I don't think he will aid the jury is what I'm saying, your Honor.

THE COURT: You're suggesting that a lawyer making a logical opinion is a pretty low standard?

MR. CHAKLOS: Well I try to do most of the time, most of the time I don't fulfill that.

THE COURT: I apologize for saying that. Mr. Kasiborski, any argument?

MR. KASIBORSKI: Just briefly, Judge. I think, first of all, you have to recall that Dr. Punch did not at the outset when I began questioning him, his opinion is first of all not limited to infrasound. His opinion is that both -- the symptoms are caused both by the audible sound and the infrasound.

Second, and he brings certainly a different skill set to the courtroom than Mr. James, but it's impressive; a Ph.D. in audiology, acoustics as shown in his affidavit was an

important aspect of his education, his work as a clinician over 40 years experience in audiology, has conducted research in the field of audiology, college level courses on the anatomy of the ear, has taught graduate courses on research and design, has published extensively in scientific journals, has admittedly studied extensively literature regarding wind turbine noise and its affects on people. He's developed a questionnaire for use of people who live near wind turbines. He's interviewed these plaintiffs extensively. He's published an article on the affects of wind turbine noise based on an extensive review of the literature. He's presented expert testimony regarding the health effects of wind turbine noise in two other jurisdictions, Ohio and Wisconsin.

Then when you go through all of the various criteria in the statute, MCL -- MCLA 600.2955, I think, just as Mr. James satisfied each and every one of those components, he likewise satisfies them.

In Michigan, the case law instructs us that we have a broad standard of qualification under MRE 702; that's the Grow case cited in our brief in opposition to the motion in limine. The

defendants in their brief admitted that there's a broad application of the MRE 702 standards. And as we also are taught in the Grow case, if the Court believes there are any limitations at all in Dr. Punch's qualifications -- and I don't think there are -- that should go to the weight of his testimony ultimately before the trier of fact and not to the admissibility of his testimony. And the McPeak case, which is cited by defendants in their motion in limine brief on page 5, stands for the same principle.

I think he's met the threshold. They can argue that their witness, their experts will be more qualified. I think he's clearly met the threshold. Any arguments that Mr. Chaklos has with regard to his qualifications properly go to the weight, but not to the threshold question of admissibility.

THE COURT: Thank you. Mr. Chaklos, did you wish to rebut?

MR. CHAKLOS: Just one quick thing. And again, even Dr. Punch admitted that his opinion is a logical opinion. He didn't even say it related to the articles that he read. He didn't even say that. And he admitted that really anybody who

conducts any type of a research can also give the same logical opinion. And his opinion being logical, he doesn't even relate it to the articles; and that's really the only thing he has in his article. If you can qualify an expert to testify about something like this by having them read a bunch of articles that are basically just one-sided articles, you know, I mean everybody would be qualified. I don't think he adds much to the jury because his opinion is logical.

MR. KASIBORSKI: Well Judge --

THE COURT: Yes.

MR. KASIBORSKI: Again, when you invited me to begin the questioning of Dr. Punch, I asked him what his opinion was and I had him explain the bases for his opinion; certainly logic is an important prong of his opinion, but he talked about his experience, his interviews, his interviews of others who live near wind turbines, people other than the Wiltzers, and his review of the literature. There are multiple factors supporting his opinion.

THE COURT: All right, thank you.

MR. KASIBORSKI: And he so testified here about an hour ago.

THE COURT: Well the Court here, of course, is required to require, as counsel is well aware, Michigan Rule of Evidence 702. Here, there's an argument made that the Court doesn't even need to get to 702 because there's a preliminary question; that is, if the Court determines that scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education may testify thereto in the form of an opinion or otherwise; and then it says if, and then we get into what we all referred to here today as the Daubert standard.

As a preliminary matter, the defense argues that we don't need an expert because the opinion that's reached by Dr. Punch is one that is logical and one that can be left to a lay person as opposed to one with specialized training, experience, skill, or knowledge or education; that is an attempting proposition. However, the Court relies upon the testimony from the Doctor here today, and in particular his affidavit that was submitted as an attachment to the response to the

motion to disqualify him, and in particular paragraph 21 of that affidavit that he recites how his expertise can aid in determining the effects of the low frequency sounds referred to as infrasound here in this hearing. So the Court believes that he does have expertise in terms of his clinical experience, his education, and training, skill, and knowledge as to the affects of infrasound as it relate to the human body and the affects that it might have.

The next standard then is that after the if where I stopped before; number one, the testimony is based on sufficient facts or data. The Court is satisfied here that it is based upon sufficient facts or data, and it certainly will be facts and data that will be presented to the finders of fact at the time of trial.

Next subsection is the testimony is the product of reliable principles and methods. Here the doctor is skilled in making his scientific approach in analyzing data and making logical conclusions; he has applied that to this circumstance and has done so to the satisfaction of the Court that he's qualified as to that aspect.

The third aspect is that the witness has applied the principles and methods reliably to the facts of the case; that appears to be in fact the case as well.

As I discussed with Mr. James' testimony, the standards as required by the statutory provisions of MCL 600.2955 require review of the factors to be applied there. Here, I believe that all of those factors have been made out to a greater or lesser extent.

Again, I would note that there's little testimony here regarding the known or potential error rate of the opinion or its basis. Again, Dr. Punch has indicated that medical expertise would be necessary I believe in his deposition to rule out other causes or symptoms that are applied, but that he has applied reasonable methodology.

I don't find that this is a novel or unique methodology; and, therefore, I don't believe that I have to analyze subsection two of that statute in order to make a determination.

I do believe that the defense has a number of points to be made in terms of the amount of weight to be given to his testimony and I in

fact find some merit to the argument that it doesn't meet the first prong; however, I do believe that there is some special expertise here that would permit them to -- permit the plaintiffs to present this testimony. Therefore, the Court is going to deny the motion to exclude Dr. Punch's testimony based on the Daubert standard similar to the ruling on Doctor or Mr. James.

Ms. Topp, would you be able to submit an order that's consistent with the Court's ruling as to these issues as well?

MS. TOPP: Yes, your Honor.

THE COURT: Counsel, I believe right here while we're on the record because I think it's efficient to get it done, that we ought to talk about trial in light of our settlement conference that occurred here today. Mr. Kasiborski, have you considered with some care how many days it might take for you to present the plaintiffs' case.

MR. KASIBORSKI: Not with some care, but could I ask the Court, um, I don't know how you run trials. Do you go from 8:30 to 4:30 or 9:00 to 2:00?

THE COURT: I can tell you that I

typically run jury trials starting on a Tuesday and running them through Friday and then reconvening if they're longer than four days on the following Tuesday. The reason for that is is that when it comes to Circuit Courts for the two counties, I'm the lone ranger.

MR. KASIBORSKI: Right.

THE COURT: And if I don't keep motions going, things tend to fall apart. And my day is typically 9:00 to 5:00 with appropriate breaks but limited breaks; a lunch break which frequently involves necessarily for me to engage with cases that are unrelated to this case --

MR. KASIBORSKI: Sure.

THE COURT: -- not unlike the probation violation we had here this morning. So I would say that it's safe to say that you'll get six hours of -- a good chunk of six or more hours of trial time each day.

MR. KASIBORSKI: Well everything in this case has taken longer than I thought. I quite frankly think we need to block aside two weeks.

THE COURT: Two weeks meaning eight days.

MR. KASIBORSKI: Eight days. Susan?

MR. CHAKLOS: That's reasonable I think,

Judge.

THE COURT: I would suggest that what I do then is that I go back and consult with my scheduling staff in terms of that timeframe. I'm just thinking that I'm looking perhaps at March or April. Is there any commentary about that timeframe appreciating that the plaintiffs are anxious to have the matter resolved. I understand that, but I'm suggesting that to you.

MR. KASIBORSKI: March does not work very well for me.

THE COURT: I'm intending to have you be called, of course, before I set the dates.

MR. KASIBORSKI: Sure. March is a bad month for me.

THE COURT: Mr. Chaklos?

MR. CHAKLOS: Yeah, March -- I've got to be in Pittsburgh for about a month trying the case.

THE COURT: Do you really? So March is bad.

MR. CHAKLOS: Yeah.

THE COURT: If I give it to you in early April you're not going to be ready for trial. You might want to go later than that.

MR. CHAKLOS: Just a little bit.

THE COURT: Mr. Kasiborski, any comment about that?

MR. KASIBORSKI: Either February or April will work for me but not March.

THE COURT: February. What about February for you, Mr. Chaklos?

MR. CHAKLOS: Well February I unfortunately --

THE COURT: Getting ready for March.

MR. CHAKLOS: Yeah, it's a bad case.

THE COURT: Well I also -- I also think that perhaps my schedule is pretty full for February. I just -- I didn't bring it with me. I don't carry it around, it changes as all of ours do. It's likely that I'm going to be looking at April then. So what I would ask you to do, counsel, is to talk to your staff. Ms. Topp, would you be in a position where if I had my office call your office, you would be able to check with Mr. Kasiborski? Does that work?

MS. TOPP: Yes, it would, your Honor.

THE COURT: Would that work that way? And I'll ask you to have your staff understand that they're going to get a call and my staff is

going to be saying we want to pick a Tuesday Friday and a Tuesday Friday following thereafter and look and try to give them some guidance on what would work for you so she could have some choices between the two of you that could fit in my schedule. I didn't say that very well. I apologize.

MR. CHAKLOS: I know what you mean.

THE COURT: I think you could do some work ahead of time. Maybe I'll even have her wait and call your offices until Monday or thereafter.

MR. CHAKLOS: That's better.

MS. TOPP: That's fine, Judge.

THE COURT: Is that agreeable? Anything else that either of you think we should address on the record?

MR. CHAKLOS: Your Honor, I know we still have my motion regarding Doctor --

THE COURT: Dr. Grace.

MR. CHAKLOS: Dr. Grace. But given the time schedule.

THE COURT: Okay.

MR. CHAKLOS: I don't think it's of immediate concern.

THE COURT: All right, fair enough. I'll

deal with it if it's noticed. I would suggest, counsel, that I'm going to return both of these notebooks. I appreciate you putting them together, but I don't think it's necessary for me to maintain those. I will file the exhibits that were filed here with the County Clerk. Anything else that we need to address?

MR. KASIBORSKI: I can't think of anything, Judge.

MR. CHAKLOS: No.

THE COURT: We will be in recess. Thank you for your time.

MR. KASIBORSKI: Thank you.

MR. CHAKLOS: Thank you.

(Proceedings concluded at 3:33 P.M.)

STATE OF MICHIGAN)
)
COUNTY OF WEXFORD)

I certify that this transcript, consisting of 175 pages, is a complete, true, and correct transcript of the proceedings and testimony taken in this case on December 5, 2013.

January 8, 2013

_____
JANET KELLY
437 East Division Street
Cadillac, Michigan 49601

ATTACHMENT 14

Reece M. Almond

From: Roland Jurgens <rjurgens@thorstadcompanies.com>
Sent: Wednesday, October 28, 2015 2:38 PM
To: Eric Elsberry
Subject: RE: A few questions

Hi Eric, In general the setbacks proposed in Lincoln County really do nothing to increase safety or further protect the public, they just make the wind farm more expensive and unnecessarily spread out across a larger area, potentially effecting more people.

For example the State requires 500 feet or 1.1 time total height from a non-participants property lines, so even if a tower could tip straight over the tower would land within the project. A 2 times the commercial height from any exterior property line does not increase tip over safety or access to aerial crop spraying or change the visual effect of the turbine. 2 times the commercial height from any exterior property line does increase the length of the access roads and negatively affects a farmers operation when working his field for no reason. It also makes a project more expensive to build, decreasing the chances that a project will be built.

The 1.25 times the total height from the right-of-way line of any public road or highway again does nothing to increase safety over the State's 1.1 time total height from the right-of-way line. It just increases the length of the access road and negatively affects a farmers operations again.

The 1,500 feet from any habitable structure is fine but if you are really worried about safety, I would use the ice throw formula plus 10% instead; Max Throw = 1.5(2R + H). Because it is possible that 1500 feet is not enough in the future if turbine blades get larger as they have been. It also needs to be inhabited structure not any habitable structure.

The 45dB participant, 35dB non-participant noise restraint is absolutely the best way to protect non-participants. It will move turbines away from the people that don't like them. The reality is when the other setbacks are increased it forces us to put the turbines closer to people's houses and farm places because you paint us into the proverbial corner and unnecessarily limit where we can put the turbines.

The limits on Shadow flicker does the same thing, it will move turbines away from the people that don't like them. Which is good.

Setbacks like Lincoln County are proposing do more harm than good, sadly I have seen it happen more than once.

Hope this helps, I think you guys have it right if you just add the 35dB non-participant noise restraint.
Roland

P.S. I also understand that wind project supporter are asking Lincoln County why there ordinance is not like Bon Homme County and every other County in state that has wind farms and wind farm zoning. I am sure their ordinance is going to change too.

From: Eric Elsberry [mailto:bhcem@hcinet.net]
Sent: Wednesday, October 28, 2015 1:10 PM
To: Roland Jurgens
Subject: [illegible] few questions

Good Mo[illegible]ng,

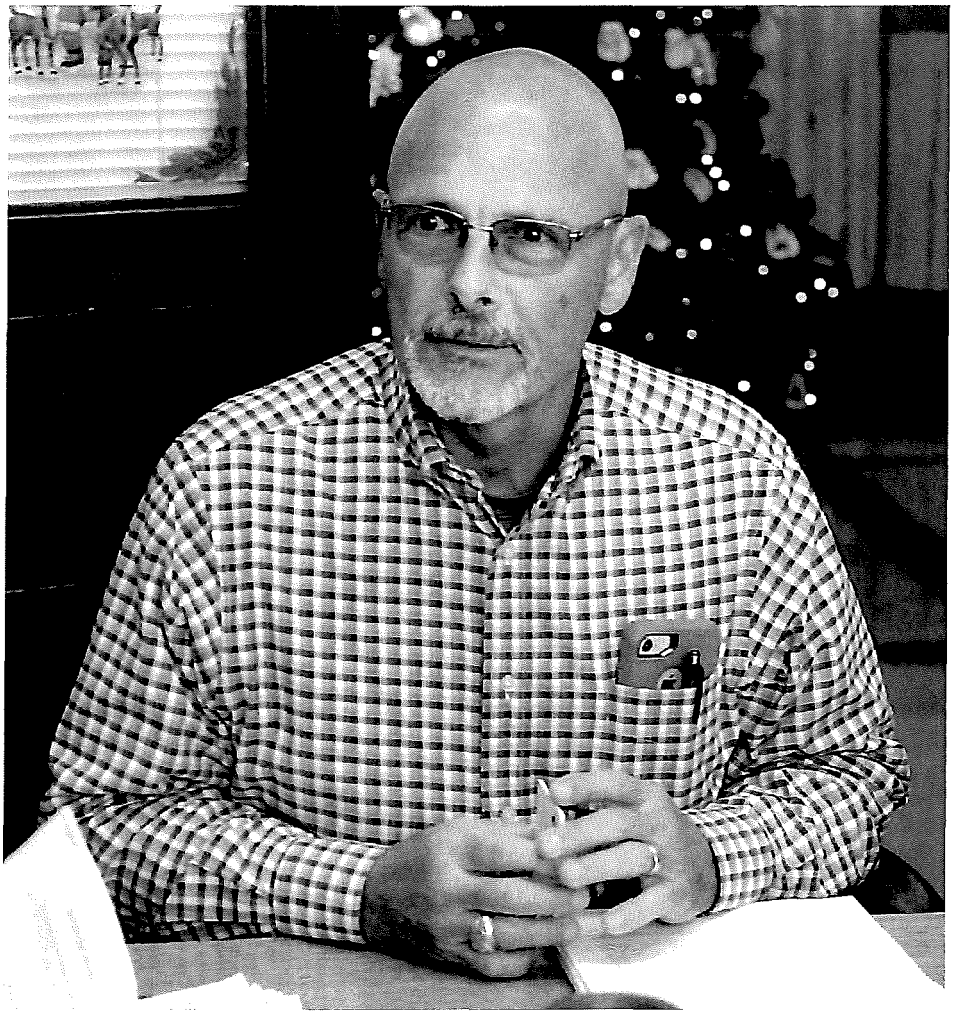
EXHIBIT Ltr. 1-24

ATTACHMENT 15

https://www.yankton.net/community/article_de578c94-1a0d-11e9-8e6e-ef7719e7a046.html

New Wind Farm Ready For Next Step In Three Area Counties

BY RANDY DOCKENDORF randy.dockendorf@yankton.net Jan 16, 2019



Construction manager Scott Creech meets with the Bon Homme County Commission about a road-use agreement for the proposed Prevailing Wind Park near Avon.

RANDY DOCKENDORF/P&D

Buy Now

A proposed $297 million wind farm in southeast South Dakota could surpass the energy output of a nearby Missouri River dam, its project manager says.

The Prevailing Wind Park, scheduled for completion later this year, is permitted for 61 turbines producing a maximum of 219.6 megawatts.

The project will cover about 50,000 acres in Charles Mix, Bon Homme and Hutchinson counties. The turbines will be generally located north of Avon and southwest of Tripp.

For perspective, project manager Roland Jurgens compared the wind farm to Gavins Point Dam at Yankton, based on information from the U.S. Army Corps of Engineers website.

"We have 57 turbines that can create 200 megawatts of energy," he said, referring to the planned production. "Gavins Point's total generating capacity is 132 megawatts. The output of the wind farm at its peak is more than the dam's hydroelectric power."

Jurgens said he wasn't allowed to release the exact numbers for the wind farm's output, but he used a statistic.

"A 200 megawatt wind farm in South Dakota will put out more than 800 million kilowatt-hours of average annual energy. Gavin's average annual energy is 726 million kilowatt-hours.

"This is just a good perspective of how much energy a wind farm can make in South Dakota."

According to the Corps website, Gavins Point generators provide enough electricity to meet the annual needs of 68,000 homes, Jurgens said.

In turn, Jurgens noted the tremendous renewable energy potential when combining the output from the dam and wind farm.

"Gavin's turbines are turned by water and Prevailing Wind Park's turbines are turned by wind," he said. "Both do not cost us anything other than the facilities needed to capture the energy, and they both make a tremendous amount of energy every year."

BREAKING NEW GROUND

sPower (Sustainable Power), a national renewable-energy company, will own and operate Prevailing Wind Park for the next 30 years, Jurgens said. sPower will sell the wind farm's energy to the North Dakota-based Basin Electric Power Cooperative, he added.

Prevailing Wind construction manager Scott Creech expects the process will move quickly if no problems arise along the way. "We're looking at starting construction in March or April and being done by December, if not sooner," he said.

Jeff Nemeth, the sPower director of wind power development, said his company has launched a number of solar energy projects. Now, sPower sees Prevailing Wind as part of its effort to increase its wind portfolio, he added.

"We are a national company, with projects running from California to Virginia and everything in between," he told the *Press & Dakotan.* "We're very excited to get started (with Prevailing Wind). I'm looking forward to getting this (project) in the ground."

Nemeth said the Prevailing Wind project is breaking new ground for his company.

"This is our first multi-county project, and I'm excited to have that new challenge," he said. "This is also sPower's first project in South Dakota."

As of last month, sPower had signed up 35,000 acres and had reached the amount the land needed for the wind project, Nemeth said.

Jurgens brings familiarity with the site and local officials. He also worked with the neighboring Beethoven wind project in the same three counties. The 80-megawatt Beethoven wind farm, which he has listed as a $120 million project, consists of 43 wind turbines and came online in 2015.

The Beethoven wind project is now owned and operated by NorthWestern Energy.

Besides their owners/operators, Beethoven and Prevailing Wind differ in two other

ways, Jurgens said.

A major difference comes in the rotor, which contains the propeller-like blades. The rotor is connected to the tower and spins a generator to create electricity.

The bigger rotors for Prevailing Wind towers mean it can produce much more power than its Beethoven counterparts, Jurgens said. It also means Prevailing Wind towers will be spread out more than its neighbor, he said.

"You're seeing 2½ times the generation capacity but only 14 more towers. That's because the generators in them are significantly bigger," he said. "You need fewer wind turbines to generate more wind energy."

The larger wind turbines are more efficient and can produce more power at lower wind speeds, Nemeth said.

Prevailing Wind exceeded the 100-megawatt threshold and needed approval from the South Dakota Public Utilities Commission (PUC).

"It was a great opportunity for members of the PUC and their staff to learn more about wind energy," Jurgens said. "We all learned more about what we want done here in South Dakota."

FOLLOWING THE PROCESS

Prevailing Wind initially filed a state permit application in 2016. The PUC held an August 2016 public input meeting at Avon, which drew an estimated 300 persons and lasted four hours. The meeting showed sharp division, including opposition from neighbors.

Prevailing Wind withdrew its state permit application a week later, citing misinformation surrounding the project.

Prevailing Wind Park filed another PUC application last May. State law requires the commission to make a decision within six months of receiving a wind energy facility application.

Last July, a public input meeting was held in Avon. About 200 people attended, with audience members speaking on both sides of the issue.

On Aug. 9, the PUC issued an order granting intervention to six individuals and one county government. One individual filed a late application for party status, which was granted by the Commission.

An evidentiary hearing was held in Pierre in October. The commission received post-hearing briefs from the parties on Nov. 13.

The PUC granted the construction permit at a Nov. 20 ad hoc commission meeting, according to a press release.

PUC staff and Prevailing Winds proposed more than 40 conditions that address issues such as road conditions during construction, cultural resources, assignment of a public liaison officer, and land restoration after construction, among other conditions.

The commission also made changes dealing with shadow flicker, sound level, avian (bird) mortality and decommissioning.

Prevailing Wind Park received the construction permit, with conditions, from the PUC.

MOVING FORWARD

As the next step, Prevailing Wind and sPower officials met with the three county commissions on road-use agreements. Nemeth also intended to meet with the Yankton County Commission because of the use of the WAPA substation near Utica Junction.

In December, the Bon Homme County Commission met with Jurgens and sPower officials, reaching a road-use agreement.

"The bottom line of this is that your roads will be as good, or better, than they are today," Creech said.

Prevailing Wind will use the same agreement as the Beethoven project, Jurgens told the *Press & Dakotan.*

"The purpose is to make sure those roads are well maintained and protected and to reassure (local officials) that our activities aren't a burden to any of those units of government."

At the same time, sPower can maintain the roads as needed, ranging from extra gravel to snow removal, he said.

sPower plans to use the same routes, including a main road, as were used for Beethoven, Jurgens said. '

Bon Homme County Commissioner John Hauck of Tabor expressed his continued opposition to seeing the wind farms. "I don't believe in wind towers, but this project is going to go," he said.

Jurgens answered questions from the county officials about the project, protections and the anticipated revenue.

The PUC placed about 40 conditions on the wind farm, Jurgens said. Those terms included a shadow flicker limit to 15 hours a year (reduced from 30 hours) with a maximum of 30 minutes a day.

In addition, sPower has committed to creating minimal issues with red lights activated by aircraft, Jurgens said.

"Unless an airplane is coming within a certain distance, the lights will stay off," he said.

"The lights on these turbines will be off probably 95 to 99 percent of the time."

In addition, the turbines will operate with 140 feet from the ground to the tip of the blade at its lowest, Jurgens said. "The blades on some of these won't come anywhere close to the ground."

Jurgens noted the steel towers come from Brandon, the blades from Aberdeen if possible (on at least one occasion, they were made in Grand Forks, North Dakota) and the generators from Florida or another domestic source.

In terms of schools receiving tax dollars from the project, Jurgens noted the Avon, Wagner and Tripp-Delmont districts will receive the dollars.

Avon looks to gain the largest share because of the number of turbines in its school district, he said. The county and other entities will also share in the tax revenue, he added.

"Bon Homme County has got the most megawatts this time, which is what controls the most tax dollars. The largest portion of the tax dollars for this project will come to Bon Homme County. You'll get a pretty significant amount," he said.

"The last project, you had the smallest part. You're getting about $25,000 a year from the Beethoven project. This time (with Prevailing Wind), it's going to be a lot more than that."

The state treats old and new wind projects differently when it comes to taxation, Jurgens said. In addition, he noted interest in keeping more wind revenue in the local school districts. A major reason, he said, is because of more school districts with more wind farms.

The current formula could change during the 2019 Legislature now under way, Jurgens said.. The session contains newly-elected Gov. Kristi Noem and a number of new lawmakers, he added.

"I don't know what is happening this year, but if you want to see change, go out and work at Pierre to have them change things back (to the previous formula)," he said.

The Prevailing Wind Park docket can be viewed on the PUC's website at www.puc.sd.gov.

Follow @RDockendorf on Twitter.

ATTACHMENT 16

Wind Energy

WIND ENERGY
Wind Energ. 2016; **19**:151–166
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RESEARCH ARTICLE

Analysis of throw distances of detached objects from horizontal-axis wind turbines

Hamid Sarlak and Jens N. Sørensen

Section of Fluid Mechanics, Department of Wind Energy, Technical University of Denmark, DK-2800 Lyngby, Denmark

ABSTRACT

This paper aims at predicting trajectories of the detached fragments from wind turbines, in order to better quantify consequences of wind turbine failures. The trajectories of thrown objects are attained using the solution to equations of motion and rotation, with the external loads and moments obtained using blade element approach. We have extended an earlier work by taking into account dynamic stall and wind variations due to shear, and investigated different scenarios of throw including throw of the entire or a part of blade, as well as throw of accumulated ice on the blade. Trajectories are simulated for modern wind turbines ranging in size from 2 to 20 MW using upscaling laws. Extensive parametric analyses are performed against initial release angle, tip speed ratio, detachment geometry, and blade pitch setting. It is found that, while at tip speeds of about 70 m/s (normal operating conditions), pieces of blade (with weights in the range of approximately 7-16 ton) would be thrown out less than 700 m for the entire range of wind turbines, and turbines operating at the extreme tip speed of 150 m/s may be subject to blade throw of up to 2 km from the turbine. For the ice throw cases, maximum distances of approximately 100 and 600 m are obtained for standstill and normal operating conditions of the wind turbine, respectively, with the ice pieces weighting from 0.4 to 6.5 kg. The simulations can be useful for revision of wind turbine setback standards, especially when combined with risk assessment studies. Copyright © 2015 John Wiley & Sons, Ltd.

KEYWORDS

wind turbine accidents; blade element theory; blade detachment; ice throw; aerodynamic model; HAWT

Correspondence

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1. INTRODUCTION

The ever-growing number of wind turbines installed near inhabited areas, buildings and community facilities, such as bridges, power installations or highways, has resulted in an increasing concern by authorities to determine risk levels associated with wind turbine blade failure. From a safety point of view, the most serious failure is associated with splintering of rotor blades and detachment of debris, which could be thrown over long distances and damage people or property. Ice-throw from wind turbines installed in cold climate is also of high concern, especially for wind turbines erected near highways where the ice pieces thrown from a wind turbine may strike a passing car, which in the worst case may cause a fatal accident.

Various types of hazards regarding operation of wind turbines have recently been reported by Durstwitz and the Caithness Windfarm Information Forum.[2,3] According to a recent survey by the Caithness Windfarm Information Forum, blade failures resulting in either whole blades or pieces of blades being thrown from the turbine are the most important causes of turbine accidents.[3] A comparative graph showing the growth of wind turbine accidents over the past four decades is shown in Figure 1, where the share of blade accidents and accidents due to fire, which may eventually cause throw of fire patches, are also presented. Due to such accident data, energy authorities all over the world have tried to enforce safety distances around wind turbines and wind farms. The safety distance is a distance within which it is not allowed to build human structures such as buildings and roads. Shown in Table I is an example of the safety distance standards defined by different authorities. It can be seen from the table the values of offset safety distances fall within an extensive range of

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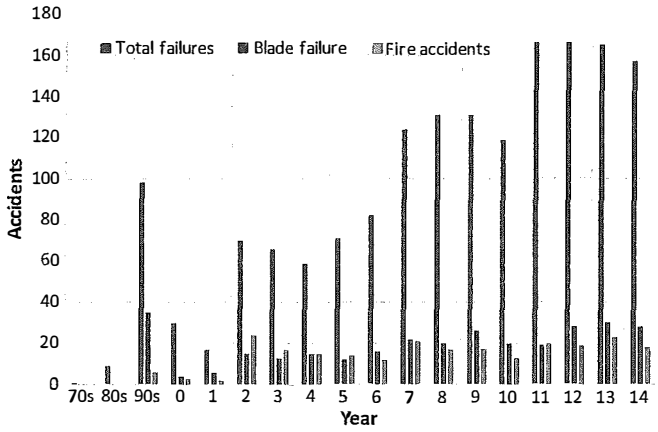


Figure 1. Comparison of wind turbine accidents and particularly blade failure data in a period from 1970s until 2014 (data taken from Caithness Windfarms[3]).

Table I. Safety distances of wind turbines from human structures as practiced in different regions of the world.[17]

Authority/source	Safety distance [m] (ft)
France	1609 (5280)
Germany	1609 (5280)
Rural Manitoba, Canada (1981)	(6500)
US National Research Council	762 (2500)
IL, USA	457 (1500)
Riverside County, CA, USA	**3218 (10560)**
MI, USA	**304 (1000)**

scales between 3.2 km and 300m, and that the setback standards are not even similar in different regions of the same country. To standardize such safety guidelines, it is useful to employ mathematical models of the throw in various conditions and risk assessment tools to associate the probability of failure in each particular setting.

Motions of solid particles in fluids were first addressed analytically by Kirchhoff.[4] He showed that the equations of motion for a solid body in an ideal fluid reduce to a set of ordinary differential equations (ODE) based on Euler's equations. Further experimental investigations on falling objects revealed, despite originating from Euler's equations, various states of chaotic motion. It was also mathematically shown that Kirchhoff's equations had been prone to yield chaotic solutions [5]. Tanabe *et al.*[6] developed a set of two-dimensional equations of motion (including rotation) based on simple mechanics in which plates of zero thickness were subject to lift, friction and gravity forces. Based on those assumptions, they found five different falling patterns, ranging from a periodic movement to chaotic random motions depending on the density ratio between the solid and the surrounding fluid and on the length of the object. Pesavento and Wang[7] and Andersen *et al.*[8] performed more detailed studies to determine the motion of a falling two-dimensional elliptic object using direct numerical simulation of the Navier–Stokes equations. They took added mass and added moment of inertia into account and analyzed the transient motion and local jumps of the falling object thoroughly.

Due to complications in a real-life blade accidents (erratic motions, high Reynolds numbers, complex geometries etc.), the fundamental studies mentioned above could only partially help understanding the physics of wind turbine blade throw patterns. To cope with the wind turbine problems, simplified approaches were used. Macqueen *et al.*,[9] for instance, studied the problem of blade-throw from wind turbines, using classical ballistics and also assumption of constant lift and drag. A lift coefficient of $Cl = 0.8$ and a drag coefficient of $Cd = 0.4$ were used for the gliding simulations, with $Cl = 0.0$ and $Cd = 1.0$ for the tumbling motion. However, the probability that gliding would occur was deemed very small. Their maximum throw studies using simple ballistic analysis, that is, by neglecting aerodynamic forces, showed that in the extreme throw velocity of approximately 310m/s, the maximum throw length reaches 10km.

One of the first detailed studies on the aerodynamics of a detached wind turbine blade was performed by Sørensen[1] using a blade element approach. In this approach, the detached blade is divided into a number of sections and the aerodynamic loads are determined for each section. The total external aerodynamic load on the whole blade would then be determined as the summation of the individual forces on each section.

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DOI: 10.1002/we

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Recently, Rogers *et al.*[10] used a dynamic model employing quaternions instead of Euler angles and rotation vectors to form the orientation matrix and performed Monte Carlo simulations of a large set of initial conditions in order to obtain a range of the throw distances.

Ice throw has also been investigated, especially for the turbines erected in the cold climate. Seifert *et al.* measured ice-throw accidents together with a simple aerodynamic model and performed risk analysis of the ice fragments thrown from the blades.[11] Recently, a model of ice throw for a wind turbine in operation was presented by Biswas *et al.*,[12] in which calculations were carried out for ice pieces by neglecting lift and using a fixed drag coefficient of $C_d = 1.0$. It was also estimated that including the highest possible, lift increases the throw distance by approximately a factor of two.

The problem of blade/ice throw has also been investigated through the window of probabilistic methods. Such methods deal with risk levels and probabilities that a certain throw distance will occur. Such studies are typically performed together with a dynamic model for calculating the throw distances. Macqueen *et al.*,[9] Morgan,[13] Morgan and Bossanyi[14] and Rogers *et al.*[10] carried out risk analyses of ice throw to determine safety guidelines for wind developments in ice-prone areas. Sørensen[15] proposed a statistical model that determines risk levels of debris hitting people. Similarly, Carbone and Afferrante[16] performed a combined probabilistic and dynamic analyses to quantify hazards due to the blade throw.

In the present work, detailed aerodynamic analysis are performed for simulating flying debris. The cases include blade throw in which the blade together with its components is thrown, a case in which only a shell laminate is thrown and a case involving detachment of ice fragments. The governing equations of motion form a set of 18 ODEs responsible for the six degree-of-freedom motion. The resulting system of discretized equations are solved using an ordinary time integration method. Throw distances for four different turbine sizes ranging from 2.3 to 20 MW are compared, by employing simple upscaling rules. The computations are carried out for different wind and tip speeds.

2. MATHEMATICAL MODELING

The equations of motion for a detached blade include equations of translation and equations of rotation. These are obtained using Newton's second law and Euler's equations of motion, with the aerodynamic forces obtained from tabulated airfoil data. To be able to quantify the rotational motion of the detached blade, the moments of inertia around the rotation axes are calculated. This, however, cannot be calculated in a fixed coordinate system (i.e., an inertial system) since both the moments of inertia and the rotational speeds are varying and a solution would become very complicated. Instead, the equations are computed around the body-fixed principal axis, and the obtained values are subsequently transformed to the global (inertial) coordinate system to represent the absolute location and orientations. Two coordinate systems are defined here: a global coordinate system $\mathbf{x} = (x, y, z)$ with the origin on the tower basement and orthonormal right-handed unit vectors $(\vec{i}, \vec{j}, \vec{k})$, with the y-axis in the wind direction and the z-axis in the upward direction. A body-fixed coordinate system $\mathbf{b} = (x_b, y_b, z_b)$ is defined by an orthonormal right-handed unit vector $(\vec{r}_1, \vec{r}_2, \vec{r}_3)$, with the origin located at the center of gravity of the detached blade fragment and the third axis parallel to the length axis of the blade (Figure 2).

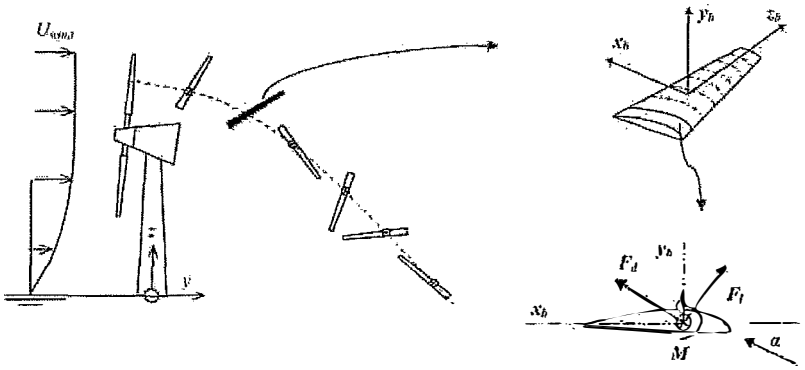


Figure 2. Sketch of the problem and definition of coordinate systems.

The orientation of the detached part is determined through a matrix $\mathbf{R}$, which gives the transformation from global coordinates to the body-fixed coordinates

$$\begin{bmatrix}\vec{r}_1\\ \vec{r}_2\\ \vec{r}_3\end{bmatrix} = [\mathbf{R}]\begin{bmatrix}\vec{i}\\ \vec{j}\\ \vec{k}\end{bmatrix} = \begin{bmatrix}r_{11} & r_{12} & r_{13}\\ r_{21} & r_{22} & r_{23}\\ r_{31} & r_{32} & r_{33}\end{bmatrix}\begin{bmatrix}\vec{i}\\ \vec{j}\\ \vec{k}\end{bmatrix} \quad \text{and similarly,} \quad \begin{bmatrix}\vec{i}\\ \vec{j}\\ \vec{k}\end{bmatrix} = [\mathbf{R}^{-1}]\begin{bmatrix}\vec{r}_1\\ \vec{r}_2\\ \vec{r}_3\end{bmatrix} \tag{1}$$

Equation (1) holds for transformation of any variable between the two coordinate systems. This way of defining a vectorized rotation matrix (as opposed to Euler's scalar angles) ensures uniqueness of orientation angles and avoids the problem known as gimbal lock.

The full six degree-of-freedom motion is governed by Newton's second law of motion and Euler's equations of motion:

$$m\ddot{\underline{x}}_g = \underline{F} + m\underline{g} \tag{2}$$

$$\underline{\underline{I}}.\dot{\underline{\omega}}_b = \underline{\omega}_b \times (\underline{\underline{I}}.\underline{\omega}_b) = \underline{M} \tag{3}$$

where m is the mass of the blade, $\underline{x}_g$ is the position vector of the center of gravity, $\underline{F}$ is the aerodynamic force acting on the center of gravity, g is the gravitational acceleration, $\underline{\underline{I}}$ is the moment of inertia tensor, $\underline{\omega}$ is the angular velocity in the rotating frame of reference, M is the aerodynamic force acting along the principal axis of the moment of inertia tensor and (.) denotes differentiation with respect to time. To close the system, the following relationship between the motion of the unit vectors of the body (the blade fragment) and the angular velocity is used:

$$\dot{\underline{r}} = \underline{\omega} \times \underline{r} \tag{4}$$

where $\underline{\omega}$ is the angular velocity of the blade fragment in the inertial coordinate system, which by equation (1) is transformed into the local body-fixed coordinate system. The total set of equations are solved using a fourth-order Runge–Kutta–Nystrom or a third-order Adams–Bashforth method. For more information about the mathematical and numerical treatment of the equations, readers are referred to the early work of Sørensen.[1]

2.1. Aerodynamic modeling

For the solution of the system of ODEs, a blade element approach is employed in which each blade is divided into n sections along the span. In each section, the external forces and moments are calculated from airfoil data based on the local wind speed and relative velocities.

The three-dimensional edge effects are to some extent considered through the finite aspect ratio assumption of the blade, and the aerodynamic coefficients of lift and drag are calculated for all angles of attack based on flat-plate theory. The induced velocities are, however, neglected, and the Reynolds-number dependence of the airfoil data is disregarded. Once the aerodynamic coefficients are found, the lift, drag and moments on the blade fragment are computed as

$$L_i = \frac{1}{2}\rho v_i^2 A_i C_{Li}, \quad D_i = \frac{1}{2}\rho v_i^2 A_i C_{Di} \tag{5}$$

where L_i and D_i are lift and drag forces on the i-th section, ρ is the air density, v_i is the local relative airspeed, $A_i = c_i \Delta r_i$ is the local planform area where c_i and Δr_i are the local chord and the section lengths, and C_{Li} and C_{Di} are the sectional lift and drag coefficients at the desired angle of attack.

The static forces aerodynamic coefficients of the airfoil only depend on the angle of attack. Unsteady effects at high angles of attack are included by using the dynamic stall model of Øye.[18] In this model, the dynamic lift coefficient is obtained by interpolating between the lift coefficient of an airfoil in a fully attached flow and a lift coefficient of the airfoil when the flow around the airfoil is fully separated, i.e.,

$$C_{l,dyn} = f_s C_{l,inv}(\alpha) + (1 - f_s) C_{l,fs}(\alpha) \tag{6}$$

where $C_{l,inv}$ is the lift coefficient for a fully attached flow (i.e., inviscid flow assumption) and $C_{l,fs}$ is the lift coefficient for fully separated flow. The stall-changing rate is defined as

$$\frac{df_s}{dt} = \frac{f_s^{st} - f_s}{\tau} \tag{7}$$

where f_s is the time-dependent separation function, which can be thought of as the unsteady weighting function between the fully attached and the fully separated flow. f_s^{st} is a function of airfoil section,

$$f_s^{st}(\alpha) = \frac{C_{l,st}(\alpha) - C_{l,fs}(\alpha)}{C_{l,inv}(\alpha) - C_{l,fs}(\alpha)} \tag{8}$$

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and τ is an empirically determined time constant giving the time lag between the dynamic value of f_s and its static value. It follows from equation (7) that

$$f_s(t+\Delta t) = f_s^{st} + \left(f_s(t) - f_s^{st}\right)\exp\left(\frac{-\Delta t}{\tau}\right) \tag{9}$$

2.2. The atmospheric boundary layer effects

The inlet wind is included as a velocity profile corresponding to the Atmospheric Boundary Layer (ABL). As a result, in addition to simulating uniform inflow,[1] it is possible to simulate throw distances for blades thrown in wind fields following a power or logarithmic law, depending on the specific site information. The ABL wind profile as a function of height and atmospheric conditions reads

$$u_z = \frac{u_*}{\kappa}\left[\ln\left(\frac{z}{z_0}\right) + \psi(z, z_0, L)\right] \tag{10}$$

where u_* is the friction velocity, κ is the von Karman constant (~ 0.41), z_0 is the roughness length, ψ is a function of atmospheric stability and L is the Monin–Obukhov stability parameter (see Wyngaard[19] for more details).

If no data are available in a specific site, and neutral ABL is assumed, a power law $u(z) = u_{hub}(z/z_{hub})^{\alpha}$, $\alpha \sim 0.14$ will be used for the wind velocity at different heights having the wind velocity at hub height as an input. The power-law method is used for the parametric studies in this paper.

Using the mentioned wind profile and denoting the local position vector of a point p on the wing as $\vec{r}_{pb}$, the local relative wind velocity $\vec{u}_{pb}$, as seen by the blade fragment, is given as

$$\vec{u}_{pb} = [\mathbf{R}].(\vec{u}_{wind} - \vec{u}_g) - \vec{\omega}_b \times \vec{r}_{pb} \tag{11}$$

where the wind vector is assumed to be $\vec{u}_{wind} = (0, u_y, 0)$, neglecting the vertical and lateral components.

3. SIMULATION RESULTS

Simulations of both blade-throw and ice-throw distances are performed by solving the equations derived in the previous sections using the in-house aerodynamic code *Savbal**. The overall procedure for the solution consists of three stages, comprising coordinate transformation, aerodynamics load assessment and time integration. The initial position, orientation and velocities of the detached part are first evaluated at their local coordinates. Based on these values, an iterative procedure starts where the local velocities are evaluated, according to exerted aerodynamic loads, and integrated to give the location and orientation of the fragment in global coordinates until the fragment reaches the ground level.

For the blade-throw analysis, cases with different detached lengths and tip speeds are compared in two sub-cases: (1) the whole blade together with its sandwich structure is thrown and (2) only the shell layer of the blade is thrown. For ice-throw analysis, it turns out that the drag to mass ratio plays an important role for the magnitude of the throw distance. As a result, a few cases with different C_dA/m ratios (as discussed by Biswas *et al.*[12]) with both standstill and running turbine conditions are simulated. The analyses are performed for different wind turbine sizes.

3.1. Turbine upscaling laws

The throw distance analysis was initially performed for a 2.3 MW turbine using publicly available data. A series of empirical relations was then used to upscale the data for the larger turbines, and the analyses were performed for four different wind turbine sizes, i.e., 2.3, 5, 10 and 20 MW. The scale-up factors are first obtained for the blade length, which scales as the square root of the power ratio. Therefore, denoting the blade length, mass (applicable to both total sandwich structure and the shell laminate masses) and mass moment of inertia for the reference turbine with index a, i.e., r_a, m_a and $\mathbf{I_a}$, respectively, the corresponding values for the upscaled turbine, index b, can be obtained as

$$r_b = r_a\left(\frac{P_b}{P_a}\right)^{S_l},\quad m_b = m_a\left(\frac{r_b}{r_a}\right)^{S_m},\quad \mathbf{I}_b = \mathbf{I}_a\left(\frac{m_b}{m_a}\right)\left(\frac{r_b}{r_a}\right)^2 = \mathbf{I}_a\left(\frac{r_b}{r_a}\right)^{S_m+2} \tag{12}$$

*The computing code *Savbal* will be available upon request for further studies on this field.

Table II. Characteristics of different turbine sizes considered in the throw analyses.

Size	$L^* = \frac{L}{R}$	L (m)	m (kg)	I_x (kg·m^2)	I_y (kg·m^2)	I_z (kg·m^2)
2.3 MW $R = 45$ m, $H = 100$ m	1.0	45	7.3E+3	0.1E+7	0.1E+7	0.3E+04
	0.5	22.5	2.4E+3	0.1E+6	0.1E+6	0.40E+03
	0.2	10	4.1E+2	0.4E+04	0.4E+04	0.2E+02
5 MW $R = 66$ m, $H = 147$ m	1.0	66	2.6E+04	0.9E+07	0.9E+07	0.2E+05
	0.5	33	8.2E+03	0.1E+07	0.1E+07	0.3E+04
	0.2	14	1.7E+3	0.3E+05	0.3E+05	0.2E+03
10 MW $R = 93$ m, $H = 208$ m	1.0	93	8.2E+04	0.5E+08	0.5E+08	0.1E+06
	0.5	46.5	2.7E+04	0.6E+07	0.6E+07	0.2E+05
	0.2	20	5.3E+3	0.2E+06	0.2E+06	0.1E+04
20 MW $R = 132$ m, $H = 294$ m	1.0	132	2.6E+05	0.3E+09	0.3E+09	0.9E+06
	0.5	66	8.7E+04	0.4E+08	0.4E+08	0.1E+06
	0.2	29	1.6E+04	0.1E+07	0.1E+07	0.8E+04

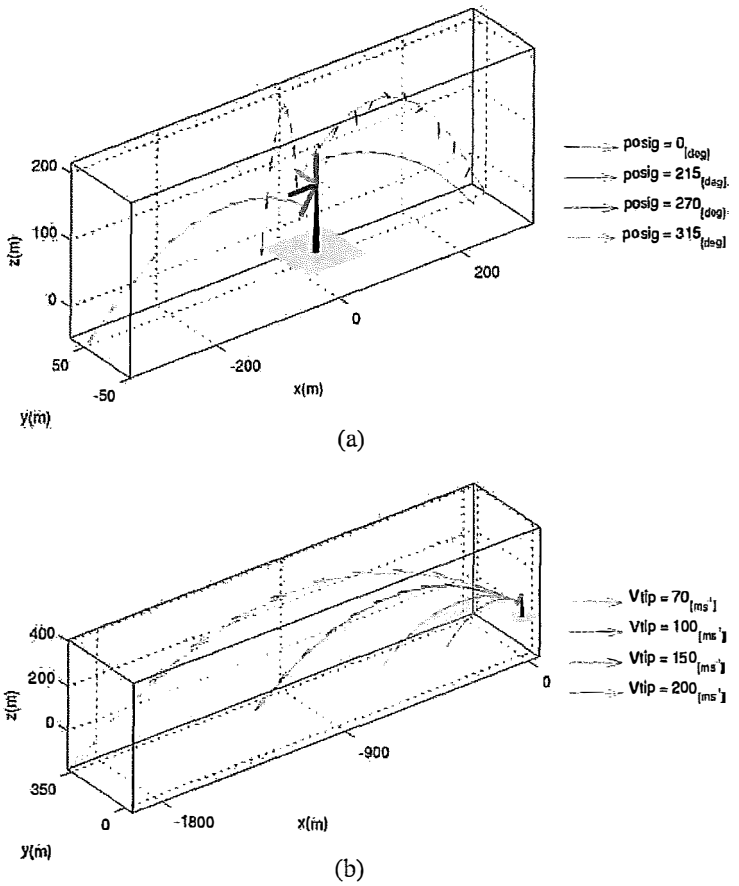


Figure 3. Schematic graphs of the throw distances for half-blade detachment changing (a) the initial release angles (upward-clockwise reference) and (b) the tip speed velocities for the 2.3 MW reference turbine.

where $\mathbf{I} = (I_x, I_y, I_z)$. In the previous relations, $S_I = 1/2$ and S_m depends on actual scaling laws when increasing the size of the rotor. From simple upscaling rules, S_m would be equal to 3 , but because of more elaborate rotor designs, this parameter is usually found to be somewhat smaller. In the present work, we employ $S_m = 2.3$ (see UpWind[20] and TPI Composites[21] for more information on turbine scaling).

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3.2. Full-blade throw analysis

In this section, the throw distance analyses are performed for four different turbine sizes based on the upscaling rules presented previously. Here, the term full blade refers to the case of blade shell including stiffening members (upper and lower shells, spar, etc.). The dimensions and other characteristics of each turbine size are reported in Table II. In accordance with the copyright policies of the turbine manufacturers, the data for the reference turbine (2.3 MW) do not correspond to an existing turbine but are chosen to mimic a real turbine.

The analysis included a parametric study, where the effects of the length of the detached parts, incoming wind speeds, blade tip speeds and wind turbine size on the blade-throw distances were investigated. The height of the tower is in all considered cases assumed to be equal to the rotor diameter. Figure 3 shows three-dimensional visualizations of the throw distances of a half-blade piece thrown of the 2.3 MW machine for different initial conditions. The small colored patches in the figure shows the instantaneous orientation of the detached part. For the sake of clarity, only some selected curves are shown in the figure. Figure 3(a) shows the effect of release angle on the throw distance, and Figure 3(b) shows the effect

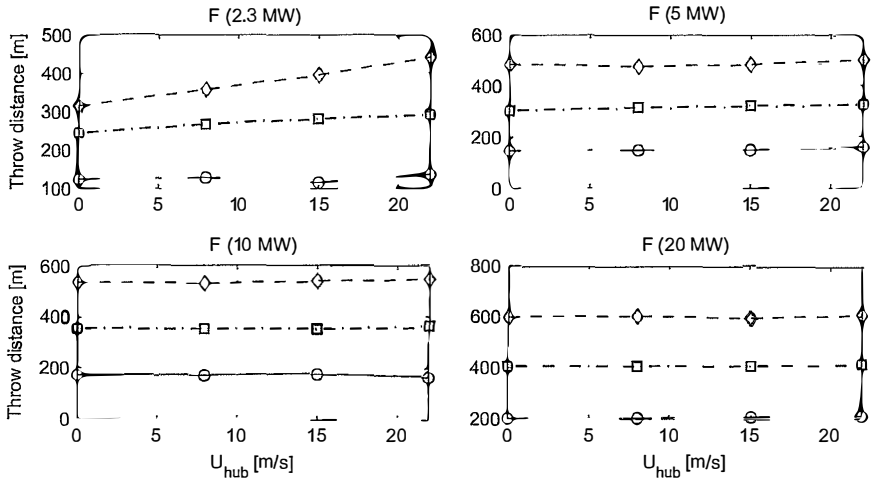


Figure 4. Throw distance calculations of full blade with three different detached lengths for 2.3, 5, 10 and 20 MW turbines at the normal operating condition of V_{tip} = 70 m/s. The horizontal axis shows the wind speed at the hub height and the vertical axis represents the throw distance. ◇ ◇ ◇: L^* = 0.2; □ □ □: L^* = 0.5; and o o o: L^* = 1.

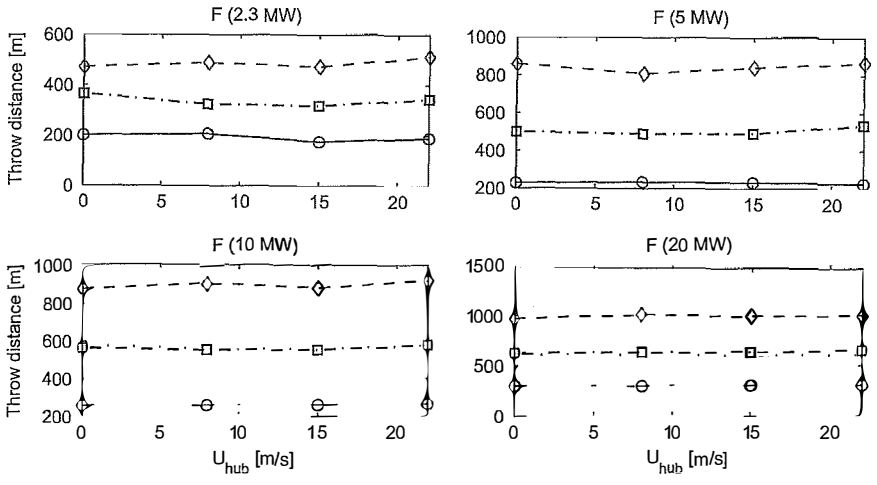


Figure 5. Throw distance calculations of full blade with three different detached lengths at a high tip speed of V_{tip} = 100 m/s. Legends are similar to those in Figure 4.

of release tip velocity. As can be seen, the release tip speed is a very important factor influencing the maximum throw distances. Normal operating conditions with $V_{tip} = 70$ m/s result in throw distances of about 500 m long, whereas a tip speed of $V_{tip} = 150$ m/s may lead to throw distances up to 2 km.

For the quantitative analysis performed in the next section, the fragments are thrown at a release angle of 45° from the horizon (225° measured upward-clockwise) in all calculations. The full-blade and blade-shell throw calculations are performed using flat-plate assumption for the aerodynamic coefficients.

Figures 4, 5 and 6 show the throw distances for three different fragments of the full blade for a combination of three blade tip speeds ($v_{tip} = 70$, 100 150 m/s) and four different incoming wind velocities (with power-law profiles) ranging between 0 and 22 m/s at hub height.

The figures are divided into three groups, the first group (Figure 4) shows the throw distances, relative to the tower position, for different incoming wind speeds (shown on the horizontal axis) and different detachment lengths at a tip speed of $V_{tip} = 70$ m/s. The detachment length L^*, shown with markers, is the length of the detached piece, measured from the blade tip and normalized by the blade length. The throw distances are calculated and plotted for the four considered wind turbine sizes ranging from 2.3 to 20 MW. As can be seen, except for the 2.3 MW machine, the effect of the incoming wind on the throw distance is almost negligible. Similarly, the effect of turbine size on the throw distance is minimal and the main

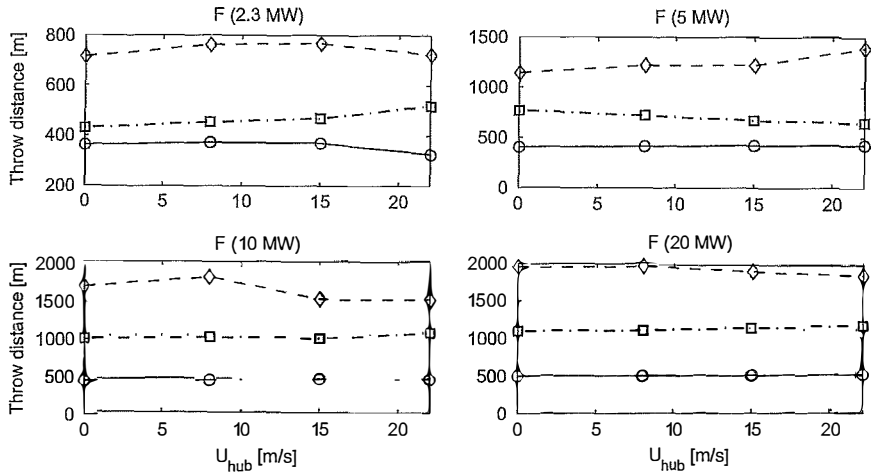


Figure 6. Throw distance calculations of full blade with three different detached lengths at an extreme tip speed of $V_{tip} = 150$ m/s. Legends are similar to those in Figure 4.

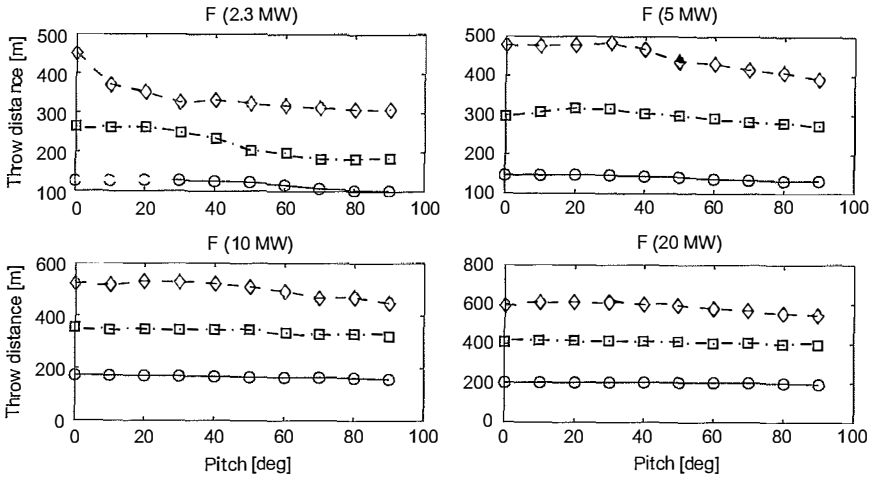


Figure 7. Sensitivity of throw distances of full blade to the initial pitch setting for 2.3, 5, 10 and 20 MW turbines operating at $V_{tip} = 70$ m/s. ◇ ◇ ◇: $L^* = 0.2$; □ □ □: $L^* = 0.5$; and o o o: $L^* = 1$.

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parameter governing the throw distance is the detachment length. The minimum throw distance is obtained for the heaviest fragment ($L^* = 0.2$) thrown from the 2.3 MW turbine, while the maximum throw distance of all cases at $V_{tip} = 70$ m/s is around 600 m for the lightest fragment ($L^* = 0.2$).

Figure 5 shows the same graphs for the higher tip speed of $V_{tip} = 100$ m/s, where the maximum throw distances for the smallest and largest turbines are about 500 and 1000 m, respectively, while the minimum throw distance is reached for a full-blade throw ($L^* = 1$) of a 2.3 MW turbine. Also, it is clear that the effect of the hub-height wind velocity is still very small. Figure 6 shows the same plots for the most extreme case considered, i.e., using a tip speed of $V_{tip} = 150$ m/s. Here, the thrown pieces reach throw distances ranging from approximately 350 m for the full-blade throw for a 2.3 MW turbine to about 2000 m for the lightest fragment thrown from the 20 MW turbine.

As can be seen from the red curve in Figure 6 for the 10 MW turbine (bottom-left), the throw distance has unexpectedly decreased when increasing the wind speed from 10 to 15 m/s. This behavior is somehow repeated to a smaller extent in other cases, especially at higher tip velocities. The unexpected results can happen because of the fact that a small change in the initial conditions can change the force/moment distributions on the fragments, thereby changing the trajectory drastically. To investigate the erratic motion further, the effect of initial pitch setting on the trajectory is analyzed in the next section.

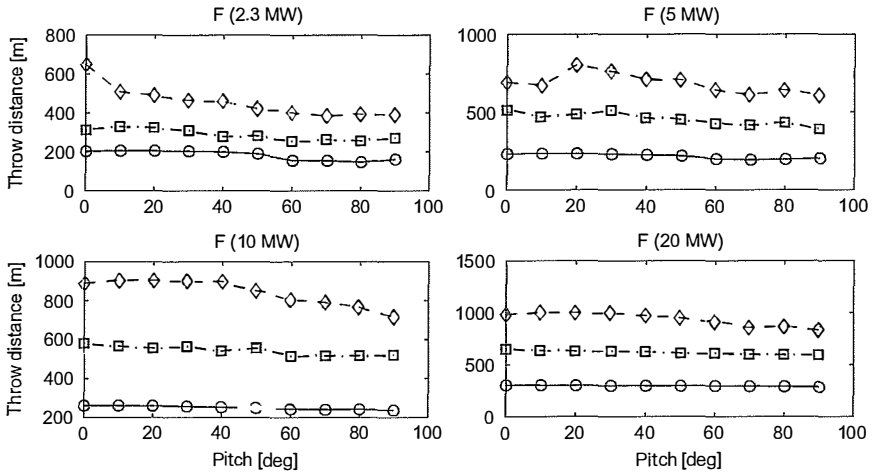


Figure 8. Sensitivity of throw distances of full blade to the initial pitch setting at $V_{tip} = 100$ m/s. Legends are similar to those in Figure 7.

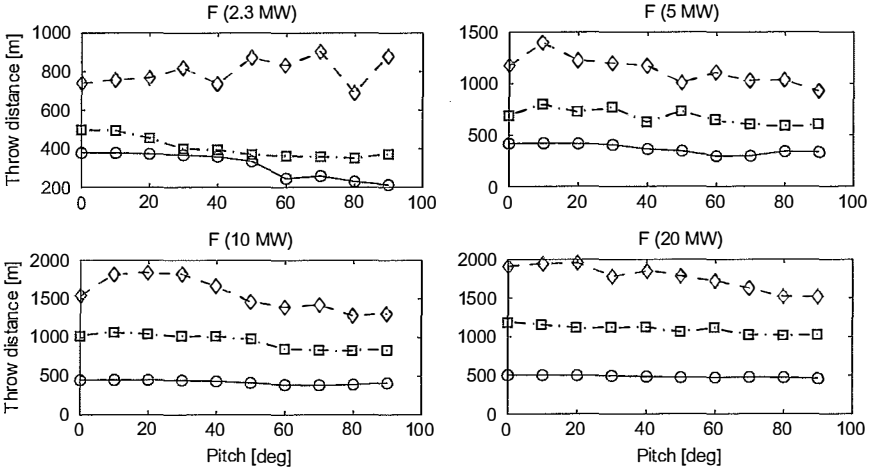


Figure 9. Sensitivity of throw distances of full blade to the initial pitch setting at $V_{tip} = 150$ m/s. Legends are similar to those in Figure 7.

3.2.1. Effect of initial pitch settings.

As explained earlier, analyses of the throw trajectories show that the throw distance for a particular wind turbine sometimes exhibits an erratic behavior going from one dominant solution to another with only a slight change in the initial conditions.

Table III. Aspect ratios, reference chord length C_{ref} and detached mass m of the blade shells (ρ_{shell} = 1700 kg/m^3) used for throw simulation from turbines of different sizes.

	2.3 MW		5 MW		10 MW		20 MW	
Cases – AR	C_{ref} (m)	m (kg)	C_{ref} (m)	m (kg)	C_{ref} (m)	m (kg)	C_{ref} (m)	m (kg)
$AR = 1$		34		83		184		408
$AR = 5$	1	170	1.5	415	2.1	920	3	2040
$AR = 10$		340		830		1840		4080

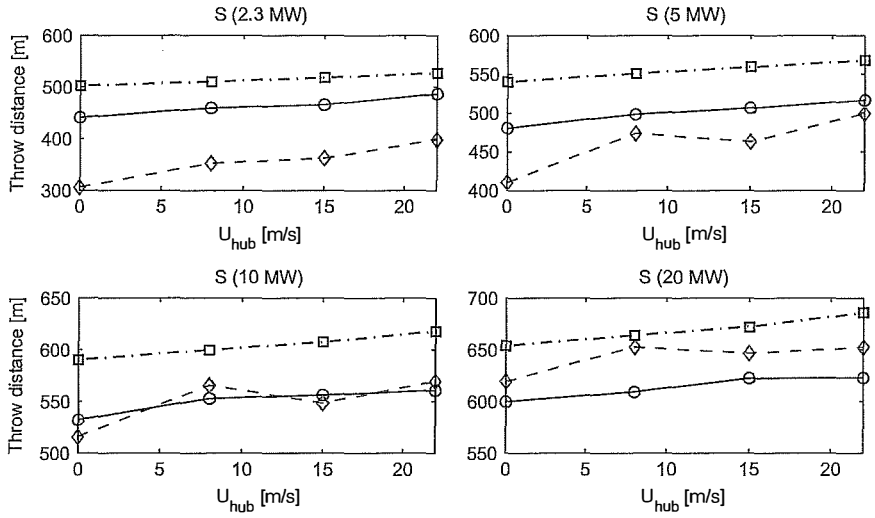


Figure 10. Throw distance calculations of blade shell with three different aspect ratios (invariant chord length for each turbine) for 2.3, 5, 10 and 20 MW turbines at a normal operating condition of V_{tip} = 70 m/s. ◇ ◇ ◇: $AR = 1$; □ □ □: $AR = 5$; and o o o: $AR = 10$.

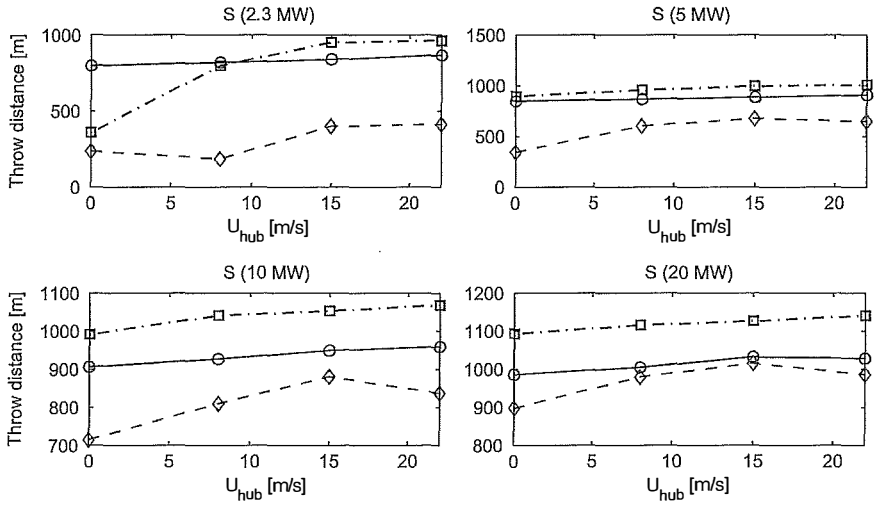


Figure 11. Throw distance calculations of blade shell at high tip speed of V_{tip} = 100 m/s. Legends are similar to those in Figure 10.

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To understand this behavior, a sensitivity study is performed to investigate the effects of the initial pitch settings on the trajectory. Figures 7–9 demonstrate the pitch angle dependence of the full-blade throw distances for different turbine sizes and tip speeds, where the throw distances are obtained for release pitch angles ranging from 0° to 90°. As can be seen, the pitch setting has a substantial impact especially for the lighter parts. In general, higher throw distances are achieved using fragments thrown at lower pitch angles, which are due to the reduced drag. The effect of pitch angle on the heavier pieces (green and blue curves) is, however, smaller. The reason for this is that the aerodynamics plays a less significant role for the heavy parts in the throw distance calculation and the distance is mainly governed by the inertial forces. For the extreme tip velocity, and especially for the 2.3 MW turbine, increasing the pitch angle produces erratic throw distances for the lightest fragments. The exact reason for such erratic behavior has not been yet understood, but it is most likely explained by the physics of the problem, as explained earlier.

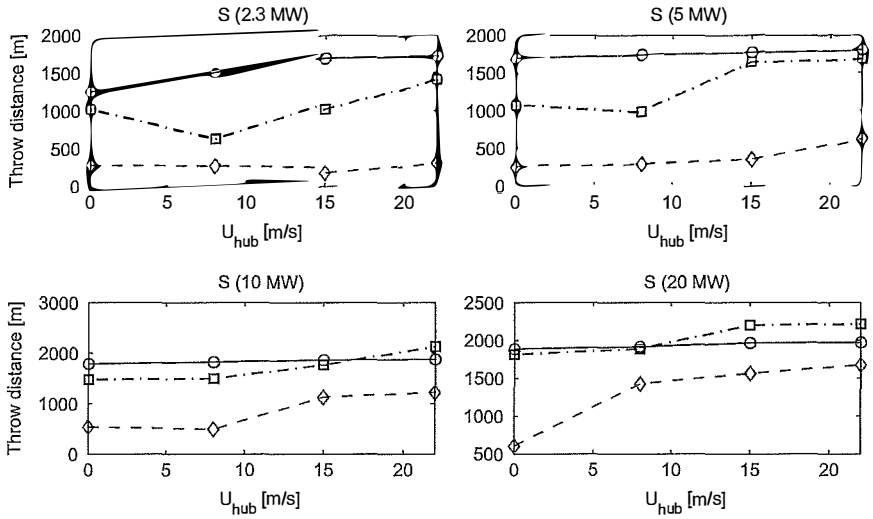


Figure 12. Throw distance calculations of blade shell at an extreme tip speed of V_{tip} = 150 m/s. Legends are similar to those in Figure 10.

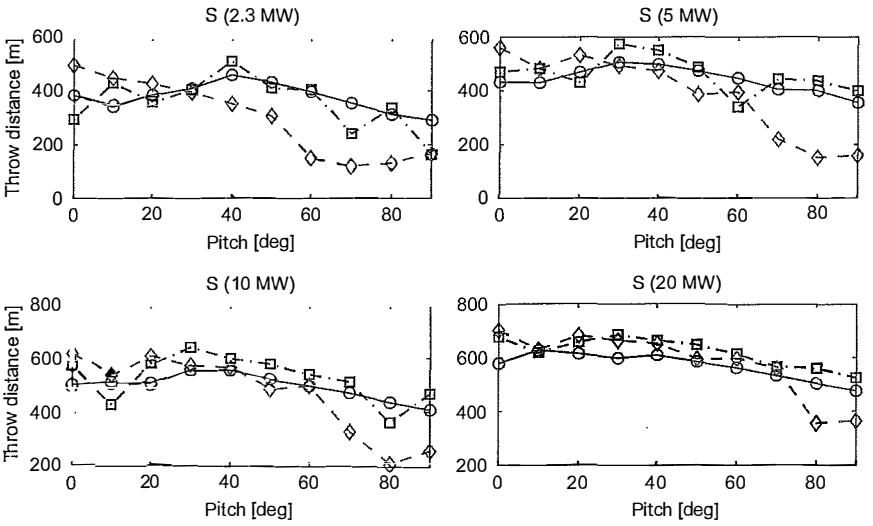


Figure 13. Sensitivity of throw distances of blade shell to the initial pitch setting at V_{tip} = 70 m/s. Legends are the same as in Figure 10.

3.3. Blade-shell throw analysis

An analysis of available data from blade failure accidents shows that depending on the manufacturing method and the structural integrity of the blade, it might first shatter into lighter parts, with the consequence that the shell layer is most likely to be thrown away. Three cases of different aspect ratios are considered for the shell throw analyses. For the reference case of 2.3 MW turbine, an average chord of 1 m and a shell thickness of 2 cm are chosen, and three aspect ratios (where AR is defined as the ratio of span to average chord) of 1, 5 and 10 are investigated. Then keeping the same AR, the analysis is repeated for each of the turbines introduced in the preceding sections. The density of the shell, consisting of fiber and glass, is assumed to be 1700 kg/m^3. Table III shows the test cases used for blade shell throw simulations.

Throw distances for the four different turbine sizes with the same working conditions as those for the full-blade case are plotted in Figures 10–12. Here, the non-dimensional length is replaced by the aspect ratio of the blade shell and three different aspect ratios are considered. As can be seen, increasing the hub-height wind speed and the turbine size generally results in larger throw distance. Nevertheless, an erratic behavior, as mentioned in the previous section, appears in the

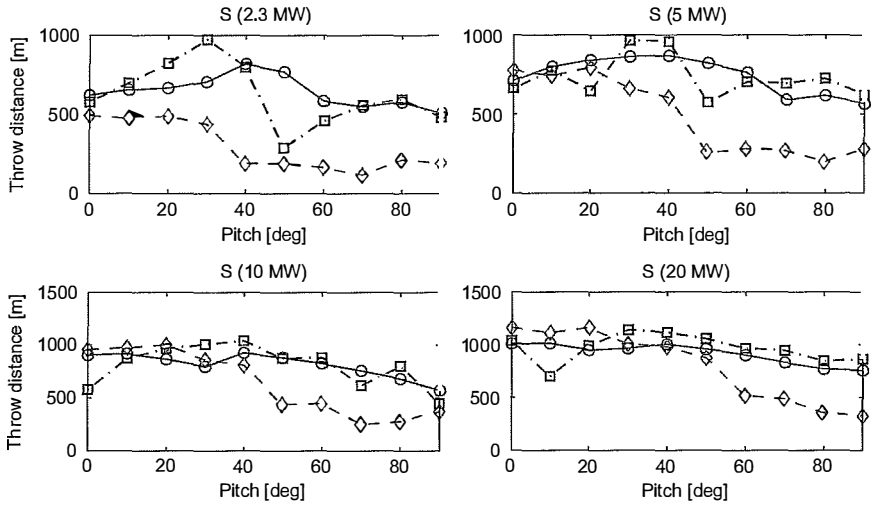


Figure 14. Sensitivity of throw distances of blade shell to the initial pitch setting at V_{tip} = 100 m/s. Legends are the same as in Figure 10.

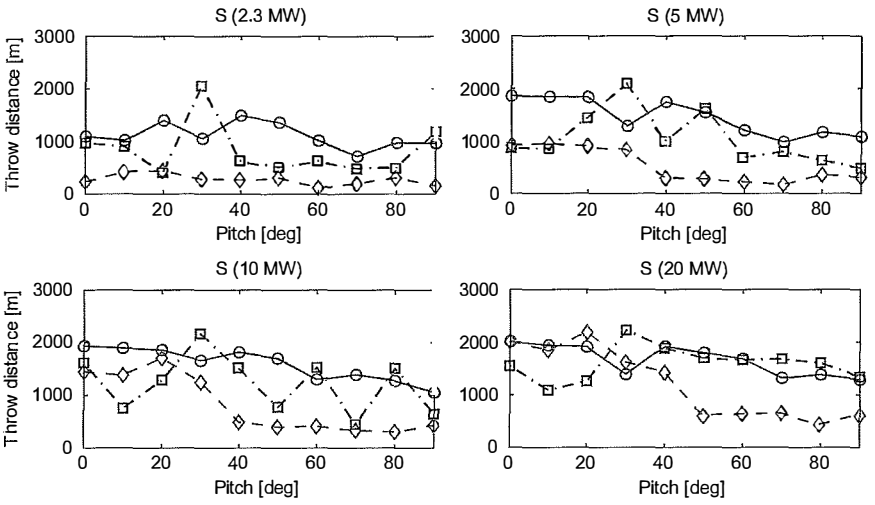


Figure 15. Sensitivity of throw distances of blade shell to the initial pitch setting at V_{tip} = 150 m/s. Legends are the same as in Figure 10.

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simulation results. By comparing the shell-throw graphs with the corresponding figures from the full-blade analysis, the throwing range of the blade shells and that of the full-blade structure are seen to be of the same order of magnitude. That is, the range is between 300 m for the 2.3 MW turbine operating at $V_{tip} = 70$ m/s and a maximum of 2200 m obtained for the 20 MW turbine in the extreme case of $V_{tip} = 150$ m/s. However, unlike the full-blade throw cases, the case with the smallest length ($AR = 1$) reaches the least throw distance, whereas for the full blade, the smallest fragment reaches the highest distance. This is most probably due to the fact that the small shell object is lighter and the corresponding inertial force is relatively small as compared with the drag forces.

As a comparison, the throw distances obtained for the ballistic motion of an equivalent particle in vacuum was also performed (results not shown), in which case there is no aerodynamic forcing on the objects. The results revealed that the ballistic throw distances are the most extreme cases in terms of throw distance.

3.3.1. Effect of initial pitch settings.

Similar to Section 3.2.1, the role of initial pitch setting on the trajectory of thrown blade-shell debris is assessed. Figures 13–15 show the pitch angle dependence of the throw distances for different turbine sizes and tip speeds for the blade-shell cases. Similar to the full-blade throw cases, the pitch setting has a substantial impact on the throw distance of thrown blade-shell structures. One major difference with the full-blade cases is, however, that the effect of the shell aspect ratios on the throw distance is much less significant and all of the cases show similar behavior with AR = 1 cases (red diamonds), predicting smaller throw distances in general.

3.4. Ice throw

For the analysis of the ice throw, the same procedure as for the blade throw is applied except that the throw analysis is not performed for the extreme tip speed conditions but only for the standstill where the tip speed is zero, and the running conditions, where the turbine is assumed to rotate in its normal operational mode at a tip speed of 70 m/s. For the icing case,

Table IV. Aspect ratios, reference chord length C_{ref} and detached mass m of the ice fragments ($\rho_{ice} = 0.7$ kg/m^3) used for throw simulation of turbines of different sizes.

	2.3 MW		5 MW		10 MW		20 MW	
Cases – AR	C_{ref} (m)	m (kg)	C_{ref} (m)	m (kg)	C_{ref} (m)	m (kg)	C_{ref} (m)	m (kg)
$AR = 1$		0.18		0.43		0.97		2.16
$AR = 2$	0.1	0.36	0.15	0.87	0.2	1.95	0.3	4.33
$AR = 3$		0.54		1.31		2.94		6.49

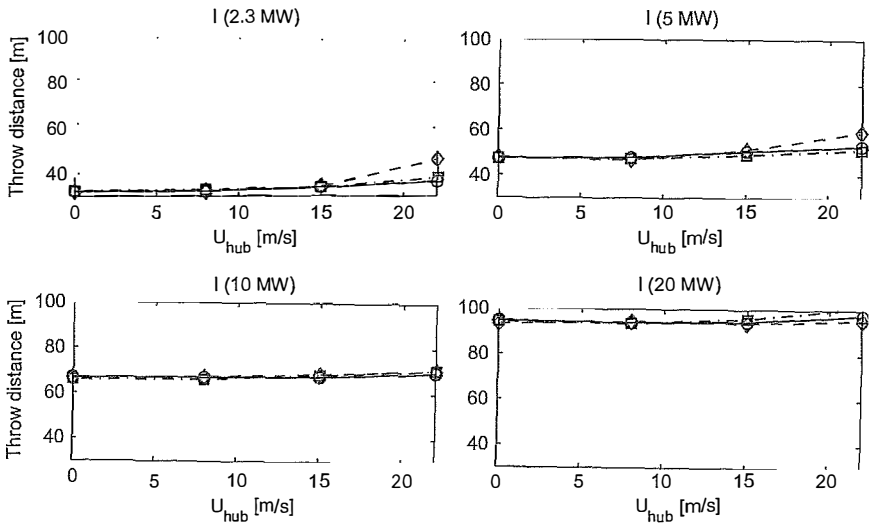


Figure 16. Throw distance calculations of ice fragments for three different aspect ratios for 2.3, 5, 10 and 20 MW turbines in standstill operation ($V_{tip} = 0$ m/s). ◇ ◇ ◇: $AR = 1$; □ □ □: $AR = 2$; and o o o: $AR = 3$.

a density of 700 kg/m^3 is used (see also Seifert *et al.*[11]). The dimensions of the tested ice fragments and corresponding turbine sizes are shown in Table IV. According to field studies performed by, e.g., Cattin *et al.*,[22] most of the ice fragments thrown away from turbine are broken into objects that typically are smaller than 1 kg. However, fragments as heavy as up to 1.8 kg have also been observed. Because the pieces are so light, the throw distance of an ice piece is mainly governed by the drag forces applied on it (which are only functions of mass–area ratio) and the incoming wind.

Similar to the previous section, studies of the effects of different parameters on throw distances are performed and plotted in Figures 16 and 17 with the graphs structured in the same way as in the previous sections.

For the simulations, no lift is considered and the drag coefficient according to the flat-plate assumption is used. Figure 16 shows that the throw distances of the standstill case range from 30 to 100 m for different turbine sizes and incoming wind speeds. For the running conditions however, the fragments can reach distances up to 600 m. It is also clear from the figure that in many cases the aspect ratio does not play a significant role in the determination of throw distances.

3.5. Maximum throw distances

This section presents a summary of the previous results in terms of maximum throw distances. The maximum throw distances are obtained from the entire set of previous simulations regardless of the size and upcoming wind speed and plotted in Figure 18 for the full-blade and blade-shell cases and in Figure 19 for the ice-throw cases, respectively. In all

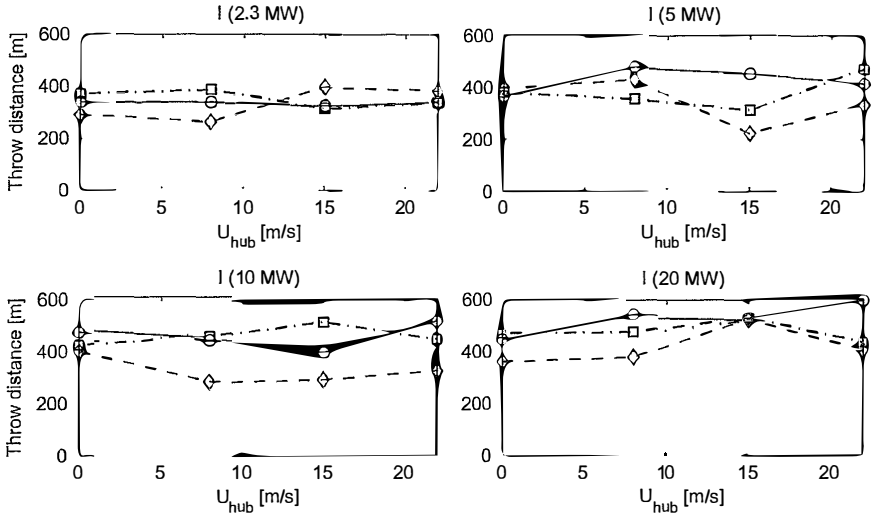


Figure 17. Throw distance calculations of ice fragments for three different aspect ratios for turbines in normal operation (V_{tip} = 70 m/s). Legends are the same as in Figure 16.

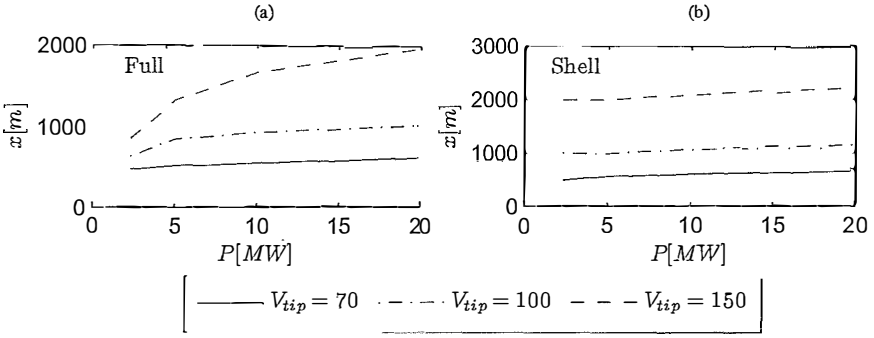


Figure 18. Maximum throw distances obtained for (a) full blade and (b) blade shell in different operating conditions. Blue line: V_{tip} = 70 m/s as a function of turbines power.

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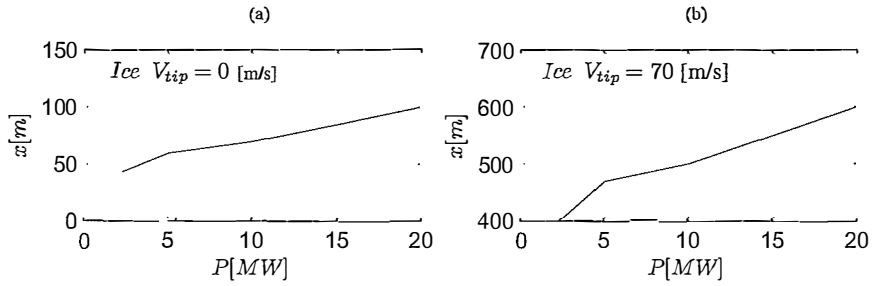


Figure 19. Maximum throw distances obtained for the ice throw in (a) standstill operation, i.e., $V_{tip} = 0$ m/s and (b) normal operating condition, i.e., $V_{tip} = 70$ m/s as a function of turbines power.

figures, the horizontal axis shows the turbine capacity and the vertical axis represents the maximum throw distance. It can be concluded that, in general, the tip speed has a large impact on the throw distances. From Figure 18(a), the turbine size does not affect the throw distances drastically for the lower tip speeds, whereas throw distances at high tip speeds experience a significant growth with increasing turbine size. Figure 18(b), on the other hand, shows that the effect of turbine size on the throw distance for the shell parts is almost negligible.

4. CONCLUDING REMARKS

Trajectory analysis of detached parts of blades and ice fragments thrown from horizontal-axis wind turbines was studied extensively using Newton's and Euler's equations of motion and rotation, employing a blade element approach for the aerodynamics. Full-blade and blade-shell analyses were performed for turbines running under different tip velocities. Turbine upscaling laws were derived, and simulations of throw distances were performed for four different turbine sizes, ranging from existing 2.3 MW machines to future 20 MW turbines.

In some cases, erratic behavior was observed in the computations, where a small change in one parameter could influence throw distance drastically. The behavior was believed to depend highly on the initial conditions. A likely explanation is that a small change in positioning and velocity components in some cases alters the distribution of forces on the detached objects and causes significant changes in the trajectory.

Maximum throw distances obtained at different tip speeds and detachment sizes were analyzed, and it was shown that the tip speed plays the most important role in the throw distance. From the full-blade throw analysis, it was shown that, when released at extreme tip speeds, throw distance picks up more rapidly with the tip speed rather than throw at lower tip speeds (looking at the absolute throw distances). The considered [thrown] full-blade pieces reached approximately 700, 900 and 2000 m at tip speeds of 70, 100 and 150 m/s, respectively. For the blade shell, throw distances were found to be approximately constant as turbine size escalates, and of the same order of magnitude as in the full-blade throw. Throw calculations were also obtained at the tip speeds of $V_{tip} = 0$ and $V_{tip} = 70$ m/s for ice pieces of three different aspect ratios and it was seen that the maximum throw distances scaled almost linearly with the turbine size irrespective of the tip speed. The ice-throw distances reached about 100 and 600 m in standstill $V_{tip} = 0$ m/s and normal operating conditions $V_{tip} = 70$ m/s, respectively. The throw distances presented by this study were obtained with respect to a set of initial parameters without taking into account their probabilities of occurrence. The authors are extending the current study to include the risk levels associated with each of the cases.

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ATTACHMENT 17

From: Brunken, Tamara
To: Elsberry, Eric; Brian McGinnis; Bruce Voigt
Subject: Fw: SD Public Utilities Commission
Date: Thursday, April 26, 2018 10:14:19 AM

FYI

Tamara Brunken
Bon Homme County Auditor
P.O. Box 605
Tyndall, SD 57066
Phone: (605)-589-4212
Fax: (605)-589-4202
E-mail: tamara.brunken@state.sd.us

From: PUC
Sent: Wednesday, April 25, 2018 4:56 PM
To: kris@sdcountycommissioners.org; Urban, Susan; Barker, Phyllis; bdesersa@trippcounty.us; Williams, Susan; Brunken, Tamara; Brookings Deputy; Brookings Finance Officer; Brown Auditor; Brule Auditor; Wulff, Elaine; Jensen, Elaine; Campbell Auditor; Carri.Crum@claycountysd.org; Charles Mix Auditor; Tarbox, Christine; Codington Auditor; Corson Auditor; Custer Auditor; Susan Kiepke; Day County Auditor; Deuel Auditor; Lemburg, Kyrie; Diane Murtha; Schurr, Keith; Ganje, Sue; Toennies, Kelly; Layher, Karen; Waterbury, Jim; Haakon Auditor; Opdahl, Dixie; Hand Auditor; Trabing, Lesa; Hanson Deputy - Janice Kayser; Glines, Kathy; Jane Naylor; Hyde Auditor; Wilson, Vicki; Peterson, Cindy (WS-Auditor); Jill Hanson; Jones Auditor; Julie Pearson; Kingsbury Auditor; Lake Auditor; Lawrence Auditor; Lincoln Auditor; Lyman Auditor; Marshall Auditor; McCook Auditor; McPherson Auditor; auditor@meadecounty.org; Mellette County; Mellette County Auditor - Jenny Galbraith; Miner Auditor; Minnehaha Auditor; Moody Auditor; Perkins Finance Officer; Potter Auditor; Sattler, Dawn; Sanborn Auditor; scauditor@midconetwork.com; Spink Auditor; Stacy Steffensen; Sully Auditor; iw.net, turcoaud; Union Auditor - Jackie Sieverding; Walworth Auditor; Yankton Auditor; Longbrake, Cindy; Bruce Outka; Carol Muller; Craig Dewey; Gary Vetter; Holli Hennies; Jerry Derr; Marty Skroch; Shelli Gust - Lake County
Subject: SD Public Utilities Commission

Folks – The South Dakota Public Utilities Commission recently learned that two documents attributed to the PUC – Draft Model Ordinance for Siting of Wind Energy Systems and Model Ordinance for Siting of Wind Energy Systems Overview – were distributed to you in March 2018. The PUC did not directly provide the information to you nor is it currently available from the PUC. Wind and wireless tower zoning models were developed in 2008 by a task force that included the PUC at the request of numerous municipal zoning boards and county governments in South Dakota. The models have since been deemed no longer valuable or useful given technological advancements and a variety of zoning ordinances that have been developed and adopted to address the latest wind and wireless technology. **Therefore, this information should not be used as a resource.** We encourage you to remove this outdated reference material from your information archives. We further encourage you to let others with whom you have shared the information know that the content is no longer relevant.

Thank you.

Patricia Van Gerpen, Executive Director
South Dakota Public Utilities Commission
500 E. Capitol Ave.
Pierre, SD 57501
Phone: (605) 773-3201
www.puc.sd.gov

ATTACHMENT 18

fm puc site 2008

DRAFT MODEL ORDINANCE FOR SITING OF WIND ENERGY SYSTEMS (WES)

1. **Purpose**
2. **Authority and Jurisdiction**
3. **Federal and State Requirements**
4. **Definitions**
5. **Requirements for Siting Small Wind Energy Systems**
6. **Requirements for Siting Large Wind Energy Systems**

1. Purpose

The purpose of this ordinance is to ensure that the placement, construction and modification of a Wind Energy System (WES) facility is consistent with the County's land use policies, to minimize the impact of WES facilities, to establish a fair and efficient process for review and approval of applications, to assure a comprehensive review of environmental impacts of such facilities, and to protect the health, safety and welfare of the County's citizens.

2. Authority and Jurisdiction

South Dakota Codified Law 11-2-2 delegates the responsibility to the Board of County Commissioners of each county to adopt and enforce regulations designed for the purpose of promoting health, safety, and general welfare of the county.

3. Federal and State Requirements

All WES facilities shall meet or exceed standards and regulations of the Federal Aviation Administration and South Dakota State Statutes and any other agency of federal or state government with the authority to regulate WES facilities.

4. Definitions

1. **Board** – The County Commission, City Commission, or other governmental body governing the district this ordinance refers to.
2. **Construction** – Any clearing of land, excavation, or other action that would adversely affect the natural environment of the site or route but does not include changes needed for temporary use of sites or routes for non-utility purposes, or uses in securing survey or geological data, including necessary borings to ascertain foundation conditions.
3. **High Voltage Transmission Line** – A conductor of electric energy and associated facilities.
4. **Large Wind Energy System** or **LWES** – All WES facilities excluding Small Wind Energy Systems.
5. **Person** – An individual, partnership, joint venture, private or public corporation, association, firm, public service company, cooperative, political subdivision, municipal corporation, government agency, public utility district, consumers power district, or any other entity, public or private, however organized.

EXHIBIT
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6. **Route** – The location of a High Voltage Transmission Line between two end points. The route may have a variable width of up to 1.25 miles.
7. **Small Wind Energy System** or **SWES** – A WES facility with a single Tower Height of less than seventy-five (75) feet used primarily for on-site consumption of power.
8. **Tower Height** – The height above grade of the fixed portion of the tower, excluding the wind turbine itself
9. **System Height** – The height above grade of the tallest point of the WES, including the rotor radius.
10. **Turbine** – The parts of the WES including the blades, generator and tail.
11. **Utility** – Any person engaged in the generation, transmission or distribution of electric energy in this state including, but not limited to, a private investor owned utility, a cooperatively owned utility, a consumers power district and a public or municipal utility.
12. **Wind Energy System** or **WES** – A commonly owned and/or managed integrated system that converts wind movement into electricity. All of the following are encompassed in this definition of system:
    (a) Tower or multiple towers, including foundations;
    (b) Generator(s);
    (c) Blades;
    (d) Power collection systems, including padmount transformers;
    (e) Access roads, meteorological towers, on-site electric substation, control building, and other ancillary equipment and facilities; and
    (f) Electric interconnection systems or portion thereof dedicated to the WES.

5. Requirements for Siting Small Wind Energy Systems

1. Standards

   A Small Wind Energy System shall be a permitted use in all zoning districts subject to the following requirements:

   (a) Setbacks. The minimum setback distance between each wind turbine tower and all surrounding property lines, overhead utility or transmission lines, other wind turbine towers, electrical substations, public roads and dwellings shall be equal to no less than one point one (1.1) times the system height, unless written permission is granted by each affected person.

   (b) Access. All ground mounted electrical and control equipment shall be labeled or secured to prevent unauthorized access, and the tower shall be designed and installed so as to not provide step bolts or a ladder readily accessible to the public for a minimum height of eight (8) feet above the ground.

   (c) Lighting. A SWES shall not be artificially lighted unless such lighting is required by the Federal Aviation Administration.

(d) Noise. SWES facilities shall not exceed fifty-five (55) dBA, as measured at the closest neighboring inhabited dwelling. The level, however, may be exceeded during short-term events such as utility outages or wind storms.

(e) Appearance, Color, Finish. The SWES shall remain painted or finished the color or finish that was originally applied by the manufacturer, unless approved in the building permit.

(f) Signs. All signs, other than the manufacturer's or installer's identification, appropriate warning signs, or owner identification on a wind generator, tower, building, or other structure associated with a SWES visible from any public road shall be prohibited.

(g) Code Compliance. A SWES shall comply with all applicable state construction and electrical codes, and the National Electrical Code.

(h) Utility Notification. No SWES shall be installed until evidence has been given that the utility company has been informed of the customer's intent to install an interconnected customer-owned generator. Off-grid systems shall be exempt from this requirement.

2. Permit Requirements

(a) Building Permit. A building permit shall be required for the installation of a SWES.

(b) The building permit shall be accompanied by a plot plan which includes the following:

(1) Property lines and physical dimensions of the property;

(2) Location, dimensions, and types of existing major structures on the property;

(3) Location of the proposed SWES;

(4) The right-of-way of any public road that is contiguous with the property;

(5) Any overhead utility lines;

(6) Wind system specifications, including manufacturer and model, rotor diameter, tower height, and tower type (monopole, lattice, guyed);

(7) Tower foundation blueprints or drawings;

(8) Tower blueprint or drawing;

(9) Proof of notification to the utility in the service territory in which the SWES is to be erected, consistent with the provisions of 5(3)(h) herein; and

(10) The status of all necessary interconnection agreements or studies.

(c) Expiration. A permit issued pursuant to this ordinance shall expire if:

(1) The SWES is not installed and functioning within twenty-four (24) months from the date the permit is issued; or

(2) The SWES is out of service or otherwise unused for a continuous 12-month period.

3. Abandonment

   (a) A SWES that is out-of-service for a continuous 12-month period will be deemed to have been abandoned. The Board may issue a Notice of Abandonment to the owner of a SWES that is deemed to have been abandoned. The owner shall have the right to respond to the Notice of Abandonment within thirty (30) days from Notice receipt date. The Board shall withdraw the Notice of Abandonment and notify the owner that the Notice has been withdrawn if the owner provides information that demonstrates the SWES has not been abandoned.

   (b) If the SWES is determined to be abandoned, the owner of the SWES shall remove the wind generator from the tower at the Owner's sole expense within three (3) months of receipt of Notice of Abandonment. If the owner fails to remove the wind generator from the tower, the Board may pursue legal action to have the wind generator removed at the owner's expense.

4. Building Permit Procedure

   (a) An owner shall submit an application to the Board for a building permit for a SWES. The application must be on a form approved by the Board and must be accompanied by two (2) copies of the plot plan identified.

   (b) The Board shall issue a permit or deny the application within one month of the date on which the application is received.

   (c) The Board shall issue a building permit for a SWES if the application materials show that the proposed SWES meets the requirements of this ordinance.

   (d) If the application is approved, the Board will return one signed copy of the application with the permit and retain the other copy.

   (e) If the application is rejected, the Board will notify the applicant in writing and provide a written statement of the reason why the application was rejected. The applicant may reapply if the deficiencies specified by the Board are resolved.

   (f) The owner shall conspicuously post the building permit on the premises so as to be visible to the public at all times until construction or installation of the SWES is complete.

5. Violations. It is unlawful for any person to construct, install, or operate a SWES that is not in compliance with this ordinance or with any condition contained in a building permit issued pursuant to this ordinance. SWES facilities installed prior to the adoption of this ordinance are exempt.

6. Severability. The provisions of this ordinance are severable, and the invalidity of any section, subdivision, paragraph, or other part of this ordinance shall not affect the validity or effectiveness of the remainder of the ordinance.

6. Requirements for Siting Large Wind Energy Systems

1. Mitigation Measures

   (a) Site Clearance. The permittees shall disturb or clear the site only to the extent necessary to assure suitable access for construction, safe operation and maintenance of the LWES.

   (b) Topsoil Protection. The permittees shall implement measures to protect and segregate topsoil from subsoil in cultivated lands unless otherwise negotiated with the affected landowner.

   (c) Compaction. The permittees shall implement measures to minimize compaction of all lands during all phases of the project's life and shall confine compaction to as small an area as practicable.

   (d) Livestock Protection. The permittees shall take precautions to protect livestock on the LWES site from project operations during all phases of the project's life.

   (e) Fences. The permittees shall promptly replace or repair all fences and gates removed or damaged by project operations during all phases of the project's life unless otherwise negotiated with the fence owner.

   (f) Roads

      (1) Public Roads. Prior to commencement of construction, the permittees shall identify all state, county or township "haul roads" that will be used for the WES project and shall notify the state, county or township governing body having jurisdiction over the roads to determine if the haul roads identified are acceptable. The governmental body shall be given adequate time to inspect the haul roads prior to use of these haul roads. Where practicable, existing roadways shall be used for all activities associated with the WES. Where practicable, all-weather roads shall be used to deliver concrete, turbines, towers, assemble nacelles and all other heavy components to and from the turbine sites.

      The permittees shall, prior to the use of approved haul roads, make satisfactory arrangements with the appropriate state, county or township governmental body having jurisdiction over approved haul roads for construction of the WES for the maintenance and repair of the haul roads that will be subject to extra wear and tear due to transportation of equipment and WES components. The permittees shall notify the County Zoning Office of such arrangements.

      (2) Turbine Access Roads. Construction of turbine access roads shall be minimized. Access roads shall be low profile roads so that farming equipment can cross them and shall be covered with Class 5 gravel or similar material. Access roads shall avoid crossing streams and drainage ways wherever possible. If access roads must be constructed across streams and drainage ways, the access roads shall be designed in a manner so runoff from the upper

portions of the watershed can readily flow to the lower portion of the watershed.

(3) Private Roads. The permittees shall promptly repair private roads or lanes damaged when moving equipment or when obtaining access to the site, unless otherwise negotiated with the affected landowner.

(4) Control of Dust. The permittees shall utilize all reasonable measures and practices of construction to control dust during construction.

(g) Soil Erosion and Sediment Control Plan. The permittees shall develop a Soil Erosion and Sediment Control Plan prior to construction and submit the plan to the County Zoning Office. The Soil Erosion and Sediment Control Plan shall address the erosion control measures for each project phase, and shall at a minimum identify plans for grading, construction and drainage of roads and turbine pads; necessary soil information; detailed design features to maintain downstream water quality; a comprehensive re-vegetation plan that uses native plant species to maintain and ensure adequate erosion control and slope stability and to restore the site after temporary project activities; and measures to minimize the area of surface disturbance. Other practices shall include containing excavated material, protecting exposed soil, stabilizing restored material and removal of silt fences or barriers when the area is stabilized. The plan shall identify methods for disposal or storage of excavated material.

2. Setbacks

LWES shall meet the following minimum spacing requirements.

(a) Distance from currently occupied off-site residences, business and public buildings shall be not less than one thousand (1,000) feet. Distance from the residence of the landowner on whose property the tower(s) are erected shall be not less than five hundred (500) feet or one point one (1.1) times the system height, whichever is greater. For the purposes of this section only, the term "business" does not include agricultural uses.

(b) Distance from right-of-way (ROW) of public roads shall be not less than five hundred (500) feet or one point one (1.1) times the system height, whichever is greater.

(c) Distance from any property line shall be not less than five hundred (500) feet or one point one (1.1) times the system height, whichever is greater, unless appropriate easement has been obtained from adjoining property owner.

3. Electromagnetic Interference. The permittees shall not operate the LWES so as to cause microwave, television, radio, or navigation interference contrary to Federal Communications Commission (FCC) regulations or other law. In the event such interference is caused by the LWES or its operation, the permittees shall take the measures necessary to correct the problem.

4. Lighting. Towers shall be marked as required by the Federal Aviation Administration (FAA). There shall be no lights on the towers other than what is required by the FAA.

This restriction shall not apply to infrared heating devices used to protect the monitoring equipment.

5. Turbine Spacing. The turbines shall be spaced no closer than is allowed by the turbine manufacturer in its approval of the turbine array for warranty purposes.

6. Footprint Minimization. The permittees shall design and construct the WES so as to minimize the amount of land that is impacted by the WES. Associated facilities in the vicinity of turbines such as electrical/electronic boxes, transformers and monitoring systems shall to the extent practicable be mounted on the foundations used for turbine towers or inside the towers unless otherwise allowed by the landowner on whose property the LWES is constructed.

7. Electrical Cables. The permittees shall place electrical lines, known as collectors, and communication cables underground when located on private property except when total distance of collectors from the substation require an overhead installation due to line loss of current from an underground installation. This paragraph does not apply to feeder lines.

8. Feeder Lines. The permittees shall place overhead electric lines, known as feeders, on public rights-of-way if a public right-of-way exists or immediately adjacent to the public right-of-way on private property. Changes in routes may be made as long as feeders remain on public rights-of-way or immediately adjacent to the public right-of-way on private property and approval has been obtained from the governmental unit responsible for the affected right-of-way. If no public right-of-way exists, the permittees may place feeders on private property. When placing feeders on private property, the permittees shall place the feeder in accordance with the easement(s) negotiated. The permittees shall submit the site plan and engineering drawings for the feeder lines to the Board before commencing construction.

9. Height from Ground Surface. The minimum height of blade tips at their lowest possible point shall be twenty-five (25) feet above grade.

10. Towers

    (a) Color and Finish. The finish of the exterior surface shall be non-reflective or matte.

    (b) All towers shall be singular tubular design, unless approved by the Board.

11. Noise. Noise level produced by the LWES shall not exceed 55 dBA, average A-weighted sound pressure at the perimeter of occupied residences existing at the time the permit application is filed, unless a signed waiver or easement is obtained from the owner of the residence.

12. Permit Expiration. The permit shall become void if no substantial construction has been completed within three (3) years of issuance.

13. Required Information for Permit Application.

    (a) Boundaries of the site proposed for LWES and associated facilities on United States Geological Survey Map or other map as appropriate.

    (b) Map of easements for LWES.

(c) Map of occupied residential structures, business and public buildings within one half mile of the proposed LWES site boundaries.

(d) Preliminary map of sites for LWES, access roads and utility lines. Location of other LWES within five (5) miles of the proposed LWES site.

(e) Project-specific environmental and cultural concerns (e.g. native habitat, rare species, and migratory routes). This information shall be obtained by consulting with the following agencies:

(1) South Dakota Department of Game, Fish and Parks;

(2) U.S. Fish and Wildlife Service; and

(3) South Dakota State Historical Society

Evidence of such consultation shall be included in the application.

(f) Project schedule.

(g) Mitigation measures.

(h) Status of interconnection studies/agreements.

14. Decommissioning

(a) Cost Responsibility. The owner or operator of a LWES is responsible for decommissioning that facility and for all costs associated with decommissioning that facility and associated facilities. The decommissioning plan shall clearly identify the responsible party.

(b) Useful Life. A LWES is presumed to be at the end of its useful life if the facility generates no electricity for a continuous period of twelve (12) months. The presumption may be rebutted by submitting to the Board for approval of a plan outlining the steps and schedule for returning the LWES to service within twelve (12) months of the submission.

(c) Decommissioning Period. The facility owner or operator shall begin decommissioning a LWES facility within eight (8) months after the time the facility or turbine reaches the end of its useful life, as determined in 14(b). Decommissioning must be completed with eighteen (18) months after the facility or turbine reaches the end of its useful life.

(d) Decommissioning Requirements. Decommissioning and site restoration includes dismantling and removal of all towers, turbine generators, transformers, overhead and underground cables, foundations, buildings and ancillary equipment to a depth of forty-two (42) inches; and removal of surface road material and restoration of the roads and turbine sites to substantially the same physical condition that existed immediately before construction of the LWES. To the extent possible, the site must be restored and reclaimed to the topography and topsoil quality that existed just prior to the beginning of the construction of the commercial wind energy conversion facility or wind turbine. Disturbed earth must be graded and reseeded, unless the landowner requests in writing that the access roads or other land surface areas be retained.

(e) Decommissioning Plan. Prior to commencement of operation of a LWES facility, the facility owner or operator shall file with the Board the estimated decommissioning cost per turbine, in current dollars at the time of the application, for the proposed facility and a decommissioning plan that describes how the facility owner will ensure that resources are available to pay for decommissioning the facility at the appropriate time. The Board shall review a plan filed under this section and shall approve or disapprove the plan within six (6) months after the decommissioning plan was filed. The Board may at any time require the owner or operator of a LWES to file a report describing how the LWES owner or operator is fulfilling this obligation.

(f) Financial Assurance. After the tenth (10^{th}) year of operation of a LWES facility, the Board may require a performance bond, surety bond, letter of credit, corporate guarantee or other form of financial assurance that is acceptable to the Board to cover the anticipated costs of decommissioning the LWES facility.

(g) Failure to Decommission. If the LWES facility owner or operator does not complete decommissioning, the Board may take such action as may be necessary to complete decommissioning, including requiring forfeiture of the bond. The entry into a participating landowner agreement shall constitute agreement and consent of the parties to the agreement, their respective heirs, successors, and assigns, that the Board may take such action as may be necessary to decommission a LWES facility and seek additional expenditures necessary to do so from the facility owner.

15. Pre-construction Filing. At least forty-five (45) days prior to commencement of construction, the applicant/permittee shall submit final maps depicting the approximate location of the proposed wind turbines, access roads and collector and feeder lines. Upon completion, the applicant shall also supply an "as-built" ALTA survey indicating that the proposed facilities are in compliance with the setbacks in the permit.

ATTACHMENT 19

TRANSCRIPT OF PUC COMMISSIONER GARY HANSON'S TESTIMONY FROM THE 1/15/19 LEGISLATIVE SESSION ON SENATE BILL 15

MR. HANSON: Mr. Chairman, gentlemen of the committee, and staff. My name is Gary Hanson. I'm the newly minted and recycled chairman of the South Dakota Public Utilities Commission. I am here to testify in support of SB15, and I will --

CHAIRMAN: Proceed.

MR. HANSON: -- I will try to get through my materials as quickly as I can. Senate -- I wrote this down so that I could try and answer all the questions so the opponents wouldn't have to come before you and take your time.

CHAIRMAN: I'm sure they appreciate that.

MR. HANSON: Senate Bill 15 changes the duration from 6 months to 12 months for the maximum amount of time allowed for a wind farm siting docket. Very simple. Just one cross-out: Change from 6 months to 12 months. This does not increase regulations nor change our regulatory authority. This 12-month deadline is the same as the 12-month deadline for rate cases, permitting energy conversion facilities, AC/DC conversion facilities, transmission facilities, and for pipeline siting permits. The purpose of this bill is to give the citizens of South Dakota the opportunity for due process.

Our citizens are being forced out of the siting process.

This bill is not a restriction to the applicant. In fact, one of last year's applicants did not even plan to begin operations until 2021. The PUC wants to ensure that due process is adequately afforded to all participants and that a hearing can take place without depriving anyone of the opportunity to properly prepare and present their case. All parties must be treated fairly.

Permitting is a complex and often controversial process. The need to change the time line is real. It is a major hurdle to due process. The PUC evidentiary hearing process necessitates public input meetings, interventions, discovery, motions, data requests, settlement discussions, offers and counter offers, subpoenas, prefiled testimony, rebuttal testimony, briefs, oral arguments, a variety of expert witnesses and lay witnesses, local government officials who are cross-examined by all of the parties, plus preparing an issue and order and decision. These are complex hearings. Evidence is presented regarding sound studies, property valuations, environmental considerations, shadow flicker studies, setbacks, wildlife studies, and ice throw. This should not be limited to a 6-month period. We coordinate this onslaught of litigation through a procedural schedule. The schedule's purpose is to provide everyone an opportunity for due process without being robbed of the protections that the law otherwise affords

them to present their calendar.

The pages are handing out a comparison of the 6-month versus the 12-month period; the 12-month period that we now have for all of the other permitting processes that I mentioned earlier. You can see, when you look at the 6-month process, that when the applicant files, the applicant's ready to go. Then the applicant must publish two notices, and they must be published at different times. The PUC then publishes our notices. Then there is a public input hearing that takes, and there's challenges with this. There's basketball season, volleyball, et cetera, that is taking place in small towns in South Dakota. And we need to hold meetings -- public meetings in those areas and arrange them so that large numbers of people can participate. Then we have party status. And oftentimes in order for a citizen to file for party status, they may only have 5 to 8 days in order to go through the process. And it has to be received by the PUC, not mailed to the PUC, during that period of time. So it even cuts back further on their ability to become an intervenor. So you can see how compressed that time line is and the challenges that we face from that time line. I won't go over the rest of it unless there's questions later today on that.

The 6-month deadline gives a significant advantage to the applicant and places a significant disadvantage on the

citizens of South Dakota who are affected by the wind farm and wish to be heard by their government. That is not fair to our citizens. When an applicant presents their application to the PUC, they are thoroughly versed and ready to go. Their attorneys, expert witnesses, and evidence are ready to present. Affected citizens may only have, as I said, 5 to 8 days to decide if they wish to become an intervenor and file the proper paperwork, and they need to find attorneys then who can carry this type of a docket.

The second reason for bringing this bill to you is that the PUC was created by you, the legislature. We are not constitutional officers. We perform the duties that you have created through the laws that you have passed and rules that, with your permission and encouragement, have been promulgated. Your PUC is finding it close to impossible to properly fulfill these statutory requirements regarding the siting of wind farms. We have been accused of being anti-wind and pro-wind. We are neither. We are a nonbiased commission that makes complex decisions based solely on the evidence that is provided during an evidentiary hearing. We do not vote on our emotion or our feelings or -- or whatever. We base our decisions upon the evidence that's presented.

The docket that you see before you -- this stack of

papers -- is one contested docket. This is not -- this is still an open docket. It's not the entire docket. It does not include the 1,455 pages that were transcribed during the public hearing. It has also been appealed so it is in circuit court. It does not include anything from the circuit court that has -- that we are going through at the present time. That circuit court process will include everything that's here plus a great deal more.

Last year we permitted three wind dockets and left the year with two pending. This year we expect to have six new wind dockets plus the two pending. That has to be scheduled in that -- in that schedule process that I showed you with 160 plus additional dockets that we work on during the year. We are your PUC. We are asking you to grant us enough time to do our job properly and to allow everyone enough time for their due process. Thank you for your time. I will stand by for answering any questions.

(End of Commissioner Hanson's testimony.)

STATE OF SOUTH DAKOTA)
:SS
COUNTY OF MINNEHAHA)

CERTIFICATE OF TRANSCRIBER

I, Maxine Risty, hereby certify that I have transcribed the audio file of PUC Commissioner Gary Hanson's testimony from the 1/15/19 legislative session on SB15, and that to the best of my ability, knowledge, and belief, this transcript contains a true and correct transcription of said recording.

To all of which I have hereunto set my hand this 4th day of February, 2019.

/s/ Maxine J. Risty
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