

**HIBEFOR THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA**

**IN THE MATTER OF THE APPLICATION
OF DEUEL HARVEST WIND ENERGY
LLC FOR A PERMIT OF A WIND
ENERGY FACILITY AND A 345-KV
TRANSMISSION LINE IN DEUEL
COUNTY**

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**APPLICANT'S RESPONSES TO
INTERVENOR GARRETT
HOMAN'S SECOND SET OF DATA
REQUESTS TO DEUEL HARVEST
WIND ENERGY LLC (APPLICANT)**

EL18-053

Below, please find Applicant's responses to Intervenor Garrett Homan's Second Set of Data Requests to Deuel Harvest Wind Energy LLC (Applicant).

- 2-1) Please continue to provide copies of all data requests submitted by PUC staff to Deuel Harvest Wind Energy LLC in this proceeding and copies of all responses to those data requests. Provide this information to date and on an ongoing basis.**

Lisa Agrimonti: Deuel Harvest has already provided this information and will continue to do so. In addition, responses provided by Intervenor to Deuel Harvest's requests to date are available at: <https://fredriksonandbyron.sharefile.com/d-sda7ff44948a40628>.

- 2-2) When responding to the requests below, please indicate the individual making each response by name, company, role of involvement in Project, and qualifications for answering.**

No response required.

- 2-3) In my response to my previous question 1-3), Michael Svedeman responded that "Deuel Harvest will use ADLS [aircraft detection lighting system] for the Project."**

- a) Where is it documented, or where will it be documented, that all towers in the Project will use ADLS and will not be continuously illuminated when aircraft are not detected in the vicinity?**

Lisa Agrimonti: Deuel Harvest objects to this request as vague with respect to "documented" and to the extent that it misstates or misunderstands the ADLS technology.

Michael Svedeman: Deuel Harvest's commitment to using ADLS is stated in the Application and responses to discovery requests (see response to Staff Request No. 3-7).

- 2-4) In response to my previous question 1-4) b) i), Michael Svedeman stated that the net capacity factor assumed for the project financial estimates is 47%.**

- a) How was the 47% estimate calculated?**

Michael Svedeman: Our engineering team utilized data collected from three on-site met towers that were installed in 2015 and 2016. This data was validated and correlated to reference data to create long-term wind distributions at each turbine location. These distributions were then extrapolated to each of the turbines hub height, and spatially to each turbine location. An estimate of the energy production for the wind farm was then generated based on the manufacture provided power curve, with accounting for waking effects, terrain roughness, site air density, and expected losses.

b) Has that estimate been validated from previous experience? If so, please provide objective evidence to substantiate.

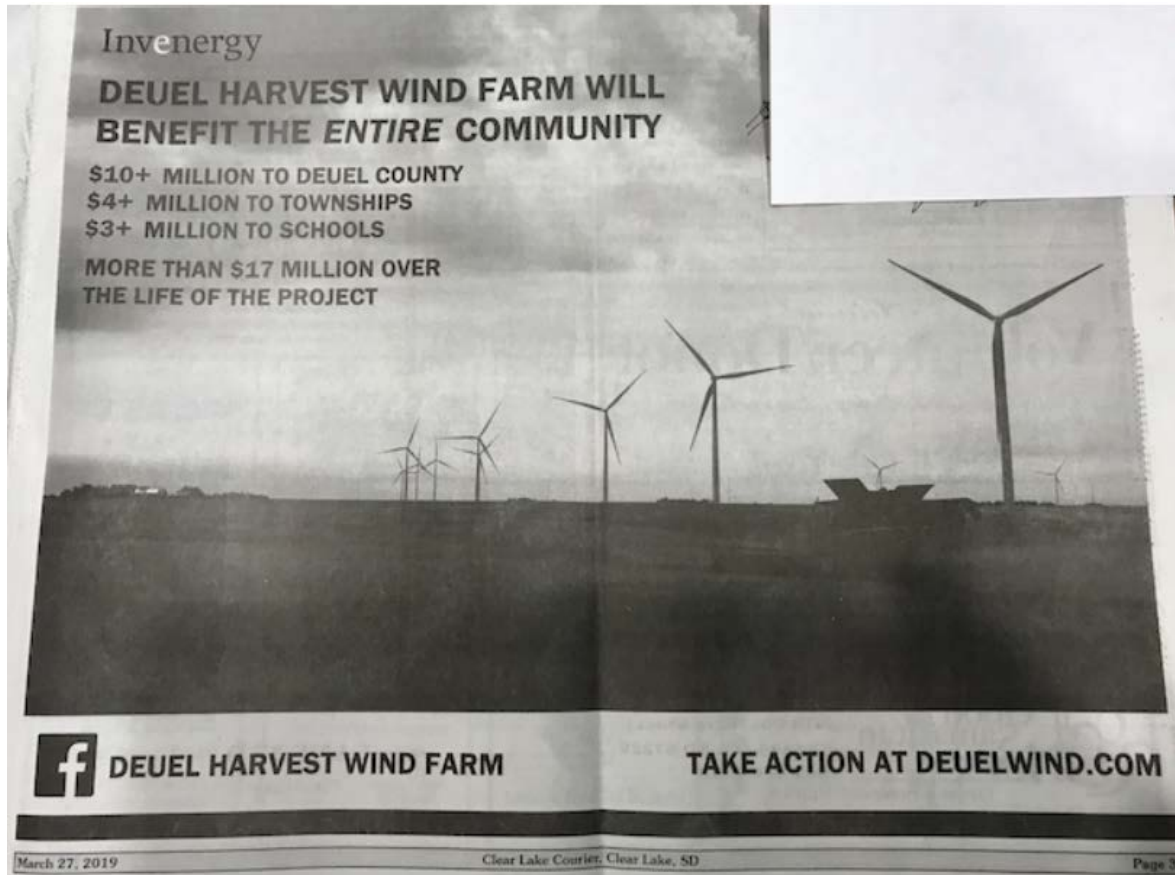
Michael Svedeman: The estimate has been validated using the above methodologies, and Invenergy's experience in developing 93 wind projects totaling 13,288 megawatts.

c) How have Invenergy wind farms performed regarding net capacity factor over the last 5 years?

Lisa Agrimonti: Deuel Harvest objects to this request as seeking confidential proprietary information.

2-5) Did Deuel Harvest or Invenergy put the following ad in the Clear Lake Courier (March 27th)?

Michael Svedeman: Yes.



- a) **If so, please explain the significant discrepancy in the county benefits claimed between the application (\$4.5M x 30yrs = \$135M in benefits to the county over the life of the project) and this public ad (\$17M in benefits to the county over the life of the project) and which is factually based?**

Michael Svedeman: There is no discrepancy; Intervenor misunderstands the Application. On page 6-1 of the Application, it states, "Over the estimated 30-year life of the Project, the Project is expected to directly generate more than \$4.5 million in annual local revenue, including taxes, lease payments, and local staff salaries." As stated directly in that sentence, the \$4.5 million estimate includes not only local taxes, but also lease payments and staff salaries. The estimates included in the ad provided by Intervenor are consistent with Section 20.1.2.1 of the Application, which states, "Approximately \$10.9 million to Deuel County, an average of approximately \$365,000 every year" and "Approximately \$3.6 million to the local school district in the first 10 years of Project operations."

- 2-6) **Regarding my previous questions under 1-6), which is not intended to seek confidential information, please describe how much oil or hydraulic fluid waste will be generated by operating the wind turbines, if any.**

Jacob Baker: A total quantity of 100-150 gallons of oil/hydraulic fluid/grease is required in the wind turbine. The typical annual use per WTG is approximately 13

gal/turbine/year. Old oil/grease is removed from the turbine and properly disposed of. Every 10-15 years (depending on the oil analysis) the gearbox oil will be changed. During that time each tower will generate 90-120 gallons of waste oil and flushing oil that will be properly disposed of per the EHS policy. This does not include oil used in the pad mount transformer next to the turbine, which can be several hundred gallons (if an oil-filled style pad mount transformer is used). Pad mount transformers do not require any oil additions or changes in the life of the unit.

a) Do the wind turbines require any regular or on-condition maintenance in the form of oil or hydraulic fluid changes, flushes, cleaning, or similar actions?

Jacob Baker: Every 6 months grease is applied to the bearings; once per year the oil filter on the gearbox will be changed; and every 2 years the hydraulic filter will be changed.

b) If so, how much fluid is removed or replenished per turbine and where will that fluid be disposed of?

Jacob Baker: See prior responses above.

2-7) Regarding Lisa Agrimonti's response to my previous question 1-7) b), what are the full titles of the documents referred to as "Safety Manual" and "Operating Manual" that have been produced to the Commission Staff?

Lisa Agrimonti: Technical Documentation Wind Turbine Generator Systems 1&2 MW Platform: Safety Manual; Technical Documentation Wind Turbine Generator Systems 2 MW Platform – 50/60 Hz: Operating Manual Application for Wind Turbine Generators from 2.0 MW to 2.8 MW.

2-8) Since my previous request was unanswered, please respond to my previous question under 1-7) c) by providing copies of the New Hire and Long Term training material referenced by Jacob Baker.

Lisa Agrimonti: Deuel Harvest objects to this request as seeking confidential information. The referenced training materials are highly confidential and business proprietary, have substantial economic value through not being readily known and available to Invenergy's competitors, and are the subject of reasonable efforts by Invenergy to maintain the confidentiality of such documents.

2-9) Regarding Jacob Baker's response to my previous question 1-7) c) that "Deuel Harvest is not aware of a General Electric document outlining training requirements," is Deuel Harvest aware of any requirements in the aforementioned "Safety Manual" similar to "the safety manual must be read and understood by the operating and maintenance personnel and the owner, in order to guarantee safety in and on the wind turbine generator system and to prevent accidents and personal injury."

Lisa Agrimonti: Deuel Harvest objects to this request as ambiguous and is unable to discern what is being requested. In addition, to the extent this request seeks information

within referenced Safety Manual, Deuel Harvest objects to this request as seeking confidential information.

2-10) Regarding Jacob Baker's response to my previous question 1-7) d) regarding the ice detection system(s) incorporated into the turbines.

a) What is the minimum vibration or blade imbalance threshold(s) the system can detect?

Jacob Baker: While there is no defined minimum; the turbine is typically set to shut down when the tower accelerometer reaches 1500-2000 mm/s² for 2 seconds.

b) How does the system detect ice accretions that are symmetric enough to not cause a blade imbalance?

Jacob Baker: See Supplemental Testimony at lines 48-67.

c) What is the minimum blade ice accretion mass the detection system will detect before shutting down the wind turbine?

Jacob Baker: That is not known. The turbine will shut down when enough ice forms on the blades that it causes a deviation in aerodynamic behavior.

d) What specific "meteorological data from on-site permanent meteorological towers, on-site anemometers, and other relevant sources" are used to determine if ice is accumulating on the blades?

Jacob Baker: The following is a list of data points that will be used: Wind speed, temperature, barometric pressure, precipitation, and our weather service, as well as onsite observation by Deuel Harvest staff.

e) Regarding the statement that "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."

i. How does the system "no longer detect an imbalance" when the wind turbine is shut down (not spinning) due to ice accumulations on the blades?

Jacob Baker: Once a turbine shuts down due to ice detection, an individual, manual reset is required prior to retuning to operation. The turbine is visited and a visual inspection is performed to ensure ice is no longer present before the reset is performed.

ii. What specific weather conditions are required for the system to determine all icing has been removed from the blades or that icing is no longer a concern?

Jacob Baker: See prior response.

2-11) The following questions are for Linden Goldfarb and Kevis Justis.

- a) Please provide any piloting experience you have in terms of any training you have received, ratings held currently or in the past, and hours flown in type and model of aircraft.**
- b) Please describe your depth of knowledge or education relating to the effects on aviation due to wake turbulence, wind shear, and vortices.**
- c) Are you aware of the COPA / SMS Report and aviation safety related issues described therein that has been provided to the docket? If so, describe your knowledge of the report.**
- d) Are you aware of the downstream waking effects of turbines referred to by Steven Gordon in response to my previous question 1-8) b)? If so, describe your knowledge of those effects.**

Lisa Agrimonti: Deuel Harvest objects to these requests as not reasonably calculated to lead to the discovery of admissible evidence, overbroad, and unduly burdensome. In addition, the testimony and report provided by Mr. Benjamin Doyle of Capitol Airspace Group supersedes the report referenced by Intervenor.

2-12) Regarding Steven Gordon’s answer to my previous question 1-8)b), what evidence has Deuel Harvest provided that the “effects of downstream waking” that are known to Invenegy and accounted for during layout design will not affect the safety of flight or structural integrity of aircraft flying through those wakes?

Lisa Agrimonti: Deuel Harvest objects to this request as ambiguous. See response to Request 2-31 below.

2-13) Regarding Michael Svedeman’s response to my previous question 1-9) i), please provide the documentation substantiating the claim that “the Project has received a Determination of No Hazard for each proposed turbine location.”

Michael Svedeman: All FAA Determinations of No Hazard are publicly available on the oiaa.faa.gov website. To access, click “Circle Search for Cases,” select “An Off Airport Case,” and enter the ASNs for the turbines. The Project’s ASN numbers are 2018-WTE-11290-OE through 2018-WTE-11413-OE.

2-14) Regarding Jeff Kopp’s response to my previous question 1-10) b) that “Burns & McDonnell has not managed or executed any wind energy system decommissioning or demolition projects to date.”

- a) Since Burns & McDonnell have no experience managing or executing any wind energy system decommissioning or demolition projects, please describe how the estimates provided have been validated to accurately address the full decommissioning or demolition process and activities that will be required at the Project’s end of life?**

Jeff Kopp: Burns & McDonnell has developed our process of preparing decommissioning and demolition estimates over the years by working with demolition contractors as part of our team, having demolition contractors review our estimates and methodologies, relying on our experience working as owner's engineer on demolition projects, and leveraging our experience preparing construction cost estimates. Our vast construction experience, including over \$1 billion dollars of construction last year alone, provides Burns & McDonnell with significant insight on actual costs for labor and equipment as well as methods for all types of construction and demolition activities. Furthermore, in order to execute over \$1 billion dollars of construction projects on an annual basis, Burns & McDonnell has to win this work through competitive bidding processes, which requires Burns & McDonnell to be able to accurately prepare cost estimates. If costs were routinely estimated too high, Burns & McDonnell would not be successful in winning projects. If costs were routinely estimated too low, Burns & McDonnell would not be able to execute projects profitably and would no longer be active in this market. The long history, large market presence, and top industry rankings of Burns & McDonnell demonstrate its ability to effectively and accurately estimate costs.

Lastly, Burns & McDonnell has experience as the Owner's Engineer on several wind farm construction projects. This experience provides Burns & McDonnell with a thorough understanding of the activities, personnel, and equipment involved in the wind farm construction process, as well as direct access to contractor pricing. Many of the methods, crews, and equipment for dismantling the wind turbines are the same as for wind farm erection, for which we have insights into methods and costs from our wind farm construction owner's engineer experience. Then processing the parts once they are on the ground, sorting, hauling, and recycling or disposing of at a landfill would be no different from processing equipment at any other demolition project, for which we have insights from our demolition project owner's engineer experience. The combined experience gives Burns & McDonnell the ability to prepare reasonable and reliable cost estimates for wind farm decommissioning.

b) What tolerances (in terms of percent or total dollars) are appropriate to be applied to the costs estimates provided in the decommissioning analysis report?

Jeff Kopp: Because this is a planning level estimate, Burns & McDonnell has included a ten percent contingency cost to account for project unknowns and variables. Burns & McDonnell believes this is an appropriate level of contingency for a planning level estimate.

2-15) How many Invenergy wind farms have been decommissioned since the company's (Invenergy's) inception?

Michael Svedeman: None.

2-16) What specifications of oil and/or hydraulic fluid were assumed for the decommissioning analysis and how were those determined?

Jeff Kopp: A specific brand of oil is not assumed as it is generally not applicable to this type of analysis. A generic gear oil is assumed to be used for turbines, and a mineral oil is assumed to be used for transformers, which are both consistent with industry standards. All oils are assumed to be free of polychlorinated biphenyls.

2-17) Regarding Jeff Kopp’s response to my previous question 1-10) f).

a) Please provide the individual labor rates (in dollars per hour) used to calculate costs by labor type and crew.

Jeff Kopp: Equipment rental rates were only provided on a per-day basis.

The following crews and equipment were used to estimate turbine decommissioning costs:

Category	Labor	Labor Rate
B-8 Equipment & (7-man) Crew	Cutting/Dismantling	\$6,363/day
Crane Equipment & (2-man) Crew	Removal	\$3,499/day

b) Please provide the equipment rental rates or costs (in dollars per hour) for cranes and other special equipment used in the decommissioning analysis.

Jeff Kopp: See response above.

2-18) Regarding Jeff Kopp’s response to my previous question 1-10) h), please provide details of the local landfills and hauling distances used when you state the “costs for hauling” were included. If this was not the method used for the analysis, please describe what method was used for estimating costs of hauling blade waste to local landfills.

Jeff Kopp: The landfill used for the cost estimate is the Brooking Landfill located at 4101 30th St, Brookings, SD, 57006, which is approximately 50 miles from the expected location of the Project substation. A transportation fee of \$0.50/ton-mile was applied to estimate the hauling costs.

2-19) Regarding Jeff Kopp’s response to my previous question 1-10) n) i), that the total volume of blades was not analyzed, how many truck loads and what size of truck or trailer were used in the analysis to estimate costs of hauling blade waste to local landfills? If this was not the method used for the analysis, please describe what method was used for estimating costs of hauling blade waste to local landfills.

Jeff Kopp: The blades are to be cut into sections and, therefore, do not need an especially large truck to be hauled to the local landfill. The number of truck loads and specific truck sizes were not used to determine costs for hauling; instead, a standard hauling fee of \$0.50/ton-mile was applied, which is consistent with industry standards.

- 2-20) Regarding Lisa Agrimonti’s response to my question 1-10) n) ii) that it is premature and not known and not reasonably calculated to lead to discovery of admissible evidence, this is a key to the decommissioning cost analysis. If there are no local landfills able or willing to accept the waste come time of decommissioning and blade waste must be hauled significant distances or out of state, that can substantially affect the costs presented in the application. Please provide all details regarding which landfills were considered or assumed when costs were estimated for the decommissioning analysis.**

Lisa Agrimonti: Deuel Harvest maintains its objections. Deuel Harvest further objects to this request to the extent Intervenor is testifying. Subject to and without waiving the foregoing objections, see responses to Request No. 2-18.

- 2-21) In Appendix V – General Electric Setback Considerations for Wind Turbine Siting, Table 2 states the annual number of icing days is required data for assessing siting if icing is likely at the wind turbine site.**

- a) What is the annual number of icing days Deuel Harvest is using for this project?**
- b) How was that number established?**
- c) Who established that number and what are their credentials?**

Jacob Baker: That type of analysis would be conducted for the purpose of determining whether a project should employ an ice detection system. The Project has already been designed with an ice detection system.

- 2-22) Regarding the pre-filed testimony of Andrea Giampoli on wildlife and wetland surveys:**

- a) Starting on line 130, Ms. Giampoli stated “Surface waters are present within the Project Area; however, Deuel Harvest will employ various Best Management Practices (“BMPs”) to avoid or minimize any impacts to aquatic habitat, and if determined to be present, will avoid impact to any state or federally protected aquatic species.” Please provide detailed descriptions and specifications of what is referred to as Best Management Practices in this context.**

Michael Svedeman: As stated in response to Staff Request No. 5-9(c), and as stated in Section 13.3.4.4 of the Application, a SWPPP will be prepared and implemented prior to construction, as required by the EPA and implemented by South Dakota Department of Environment and Natural Resources; the plan will include standard sediment control devices (e.g., silt fences, straw bales, netting, soil stabilizers, check dams) to minimize soil erosion during and after construction.

In addition, as stated in Section 13.2.2 of the Application, collector lines that cross delineated wetlands and streams will be directionally bored beneath the wetland. To further protect wetlands and streams, BMPs for sediment and erosion control would be implemented. To limit the risk of contamination of wetlands and streams due to

accidental spilling of fuels or other hazardous substances, construction equipment would be refueled in areas away from wetlands or drainage areas, and a spill kit would be available at the construction site.

- b) On line 145, Ms. Giampoli states more than 800 hours of avian surveys were conducted, but no details of when or how those avian surveys were conducted is given. Please provide the date, time, duration, location, person, and person's training for all of the avian surveys conducted for this project.**

Andrea Giampoli: The reports provided with the Application and in responses to discovery requests provide additional details regarding the surveys conducted for the Project.

- c) What is meant by “terrestrial wildlife species could be impacted during the construction phase of the project” on line 202? What impacts, specifically, are possible?**

Andrea Giampoli: Impacts to wildlife species are discussed in Section 13.3 of the Application.

- 2-23) Does Deuel Harvest have any approval of any kind from a State or Federal agency allowing the proposed project to kill any number of birds, bats, or any other wildlife during the construction, operation, or decommission activities associated with the Project?**

Lisa Agrimonti: Deuel Harvest objects to this request as seeking legal analysis.

- 2-24) What is Deuel Harvest's responsibility if an endangered or protected species is killed by the construction, operation, or decommissioning activities associated with the Project?**

Lisa Agrimonti: Deuel Harvest objects to this request as seeking legal analysis.

Andrea Giampoli: Subject to and without waiving the foregoing objection, see the Bird and Bat Conservation Strategy developed for the Project, attached to my Rebuttal Testimony as Exhibit A15-1.

- 2-25) Regarding Michael Hankard's prefiled testimony:**

- a) On line 31, Mr. Hankard states “I used the results of my real-world studies to validate the accuracy of the noise model I employed to predict noise emissions from the Deuel Harvest North Wind Farm.” Please provide the validation report substantiating this claim, specifically showing the location of the studies, the measurement locations relative to wind turbines, instrumentation and setup used, calibration records for the instrumentation used, and the resulting accuracy/error associated with the predictions made before the real-world measurements were taken.**

Mike Hankard: There is no one report of mine that substantiates this claim. The measurement studies and reports that I produce for my clients and submit to regulatory agencies focus only on the measured levels and how they compare to the applicable standard. Comparisons to modeling results are not documented in these reports. The comparison of measurement and modeling results is something I do professionally for my use in advising clients on the layout of proposed projects. These results have not been published, and that information is confidential and business proprietary. However, my findings are consistent with two oft cited published papers that do compare measurement and modeling results. Evans and Cooper¹ found that predicted noise levels using ISO 9613-2 with a ground factor of 0.0 were consistently greater than measured levels at sites and distances similar to those in the Deuel Harvest North Wind Farm study area. Hessler² recommends “[a]ssume a ground absorption coefficient (Ag from ISO 9613-2) appropriate to the site area (a moderate value of 0.5 generally works well as an annual average for rural farmland, although higher values specifically for farm fields during summer conditions may be appropriate. A value of 0 (100% reflective ground) is likely to produce highly conservative results).” By conservative, Mr. Hessler means that predictions will be conservatively high if a ground coefficient of 0.0 is used. Thus, both of these studies conclude what I do, that the use of ISO 9613-2 with a 0.0 ground factor provides conservatively high results, and that actual measured results will consistently be lower.

b) Does Mr. Hankard’s noise model account for differences between land covered by water, grass, trees, or other coverings?

Mike Hankard: Yes. The ISO 9613-2 noise level prediction method employed by me accounts for differences in ground cover. The ISO 9613-2 method allows the selection of a “ground factor” ranging from 0.0 (fully reflective, such as water) to 1.0 (fully absorptive, such as tall grass). The Noise Analysis for the Project used a ground factor of 0.0, which results in predicted noise levels that are approximately 3 dBA higher than for absorptive ground. The noise-reducing effect of sound propagating through a tall stand of trees can be modeled in ISO 9613-2. This correction was not taken in the Deuel Wind Farm noise analysis as there is not significant tree cover in the area.

i. And if so, please describe how that was handled for the Deuel Harvest project area.

Mike Hankard: See above.

c) From Mr. Hankard’s “real-world studies” how often did actual measured noise levels exceed the predicted noise levels?

¹ Comparison of Predicted and Measured Wind Farm Noise Levels and Implications for Assessments of New Wind Farms, Tom Evans and Jonathan Cooper, Acoustics Australia, 28 - Vol. 40, No. 1, April 2012

² Hessler NARUC study page 17

Mike Hankard: I have conducted compliance measurements at 11 wind farms across the U.S. On three projects, I found some evidence of maximum wind turbine noise levels exceeding the relevant standards for some portion of the time.

1. On one project, noise levels were found to exceed the standard by 2 to 3 dBA for about 1 to 3% of the time. I did not conduct pre-construction modeling on this project. This project demonstrated compliance during permitting, but used a less conservative analysis method than I have on this project. Using my methods would have demonstrated non-compliance pre-construction.
2. On a second project, noise levels were found to exceed the standard by 1 to 2 dB up to 5% of the time. I did conduct pre-construction modeling on this project, but I used a different method than for Deuel Harvest. We took a -2 dB correction in one octave band during modeling. I no longer take that correction, and did not on Deuel Harvest.
3. On the third project there was an ambient relative standard, which was found to be exceeded by 1 to 4 dB less than 10% of the time. In all three cases the project took corrective action to bring the noise levels into compliance. I did not conduct the pre-construction modeling on this project.

i. And by how much?

Mike Hankard: See above.

ii. And for how long?

Mike Hankard: See above.

2-26) Does Deuel Harvest intend to respect the safety of users of private airstrips in or around the proposed project?

Lisa Agrimonti: Deuel Harvest objects to this request as vague and ambiguous with respect to the phrase “respect the safety”. Subject to and without waiving the foregoing objections, see Deuel Harvest’s responses to Intervenor’s Requests 2-30 and 2-31, below.

2-27) Does Deuel Harvest contend that if there are no applicable laws and rules regarding wind turbine setbacks from private airstrips, then there is no burden to prove the project will not adversely affect the safety of users of private airstrips?

Lisa Agrimonti: Deuel Harvest objects to this request to the extent it seeks legal analysis.

Michael Svedeman: Subject to and without waiving the foregoing objections, Deuel Harvest will comply with all applicable federal, state, and local regulations. In addition, see the Rebuttal Testimony of Benjamin Doyle.

- 2-28) What physics-based evidence or data has Deuel Harvest produced in an attempt to prove that wake turbulence, wind shear, or vortices from turbines within 10 rotor diameters from the runway or approach surfaces of any airport will not adversely affect the safety of users of that airport?**

Lisa Agrimonti: Deuel Harvest objects to this request as vague and ambiguous. Subject to and without waiving these objections, see responses to Request 2-31 below.

- 2-29) Can Deuel Harvest produce evidence of a statistically relevant number of airports anywhere that have wind turbines within 10 rotor diameters of runways and approach surfaces where the safety of users of those airports has not been adversely affected?**

Lisa Agrimonti: Deuel Harvest objects to this request as vague and ambiguous with respect to “safety” and “adversely affected.” Deuel Harvest further objects to this request as overly broad and unduly burdensome.

- 2-30) What rule or law does Deuel Harvest claim grants them the right to affect the airspace above neighboring property with a private airport on it?**

Lisa Agrimonti: Deuel Harvest objects to this request as seeking legal analysis and to the extent that Intervenor is testifying. Deuel Harvest further objects to this request to the extent that it assumes that Deuel Harvest has claimed that it has “the right to affect the airspace above neighboring property.”

Michael Svedeman: Subject to and without waiving the foregoing objection, participating landowners in the Project have chosen to lease their wind rights to Deuel Harvest. The FAA has issued Determinations of No Hazard for the Project’s turbine locations. As noted in the FAA’s notice to Mr. John Homan, “[t]he FAA cannot prevent the construction of structures near an airport. The airport environs can only be protected through such means as local zoning ordinances, acquisitions of property in fee title or aviation easements, letters of agreement, or other means.”

- 2-31) The following questions are for Benjamin Doyle of Capitol Airspace Group:**

- a) Does the report “Deuel Harvest Wind Project, Invenenergy, Deuel County, South Dakota, Obstruction Evaluation and Airspace Analysis” dated March 26, 2019 make any claims that the downstream waking effects (wake turbulence, wind shear, vortices, etc.) of wind turbines are safe for aircraft to fly through at any specific distances downwind?**

i. If so, please provide physics-based evidence to support this claim.

- b) Do you intend to provide testimony on the distances away from wind turbines where waking effects will not affect the safety of flight of small aircraft?**

i. If so, what are those safe distances you claim? And please provide physics-based evidence to support this claim.

- c) **Are you personally a pilot or aviation safety expert? If so, please describe any education or training you have received and your level of proficiency.**
- d) **Please describe any education or training you have received specifically related to wake aerodynamics and any aviation safety related effects of wake turbulence, wind shear, or vortices.**

Benjamin Doyle: In the interest of providing a more comprehensive answer to the questions posed by Intervenor, the following response is provided, which focuses on the issue of downstream wakening effects.

I do not intend to introduce evidence or testimony regarding wake turbulence, wind shear or blade tip vortices created by wind turbines. Nor will I address the wakening effects on aircraft operations. I do not claim to be an expert in the science of aerodynamics nor do I claim to be an authority on wake turbulence, wind shear or vortices. I am, however, an expert in the FAA's regulatory policies that govern the safety of flight as it applies to tall structures. I have worked on tens of thousands of aeronautical studies. Nearly all of these tall structures were in proximity to airports, both public and private-use. I have identified impacts and developed mitigation solutions to resolve those impacts. With 20 years of experience working with the FAA on aeronautical studies, I understand the regulations and the logic behind them.

Mr. Homan is asserting that operations at his father's airport will be unsafe if the Deuel Harvest North Wind Farm is constructed. He is making this claim based on an academic report that aircraft flying within 7-10 rotor diameters of a wind turbine may experience wakening effects. He believes that, because of the conclusions of this paper, he will not be able to fly safely in and out of his airport. I believe that his assertion is based on a fundamental misunderstanding of how air traffic operations are conducted in the United States and the associated safety protections afforded to them. Whether wind turbines create wakening is not relevant to the discussion of what safety standards are appropriate for Homan Field Airport. What is relevant is a discussion of what the current aviation safety standards are and how they are applied to different types of air traffic operations.

The FAA has established a program through which tall structures are studied to determine whether or not they will be a hazard to air navigation. This program relies upon hundreds of FAA engineers, pilots and air traffic controllers to use a set of decision making tools to ultimately conclude whether a structure is a hazard or not. The tools that these aviation professionals use are documented in FAA orders and handbooks. These regulations are the result of decades of practical knowledge gleaned from assessing operations, accident data, flight characteristics, and an understanding of technological capabilities. This program assesses in excess of one hundred thousand structures each year.

These policies and regulatory guidelines are not static. They change from time to time as the FAA conducts safety studies, updates operating rules and accounts for improvements in technology. When a deficiency is identified, the FAA Flight Standards organization will take steps to study the issue and amend the rule as deemed necessary. The result of

this process has helped make the United States National Airspace System not only the busiest, but the safest in the world.

The safety standards established by the FAA are applicable to public-use airports and private-use airports with an FAA-approved instrument approach procedure. It's important to understand why this is the case. The FAA is responsible for the overall safety of the entire National Airspace System ("NAS"). This includes all aviation operations, regardless of whether they are operating into and out of commercial, public, or private-use airports. However, the FAA does not apply a uniform safety standard to all types of air traffic operations. Different sets of standards are applied to different types of air traffic operations.

In the case of private-use airports, the FAA expects that the pilot will use his or her own judgement as to whether it is safe or unsafe to take off or land. FAR 91.3 states that the pilot in command is directly responsible for, and is the final authority for the safe operation of, an aircraft. In other words, if the pilot deems an area unsafe to fly, it is their responsibility to not fly in those areas or in those situations. Additionally, the VFR (visual flight rules) pilot is obligated to see and avoid other aircraft, obstacles and terrain. Unlike in controlled airspace or during instrument operations where the FAA takes on the responsibility of separation, the VFR pilot operating into and out of a private airport is responsible for his or her own separation. This is true in all cases except when a pilot is flying an instrument approach procedure to a private-use airport. In this case, the pilot is relying on the FAA to ensure obstacle clearance. It is for this reason that the FAA will protect the obstacle evaluation areas for an instrument approach to a private-use airport. The FAA is applying appropriate regulatory airspace protections based on the type of operations that are envisioned to be conducted in the area of Homan Field Airport.

Mr. Homan believes that certain turbines should not be allowed to be constructed because, in his opinion, they would create an unsafe flying environment around his father's airport. His opinion is based on an academic study that concluded that there would be a moderate likelihood of an aircraft experiencing waking effects from a wind turbine. There has never been an aircraft accident or incident in the United States that was found to be the result of wind turbine waking.

The FAA, which is the authority on and establishes safety standards for the United States has determined that the proposed turbines are not a hazard to air navigation.

Dated this 11th day of April, 2019.

By /s/ Lisa Agrimonti

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