STATE OF NEW HAMPSHIRE

BEFORE THE SITE EVALUATION COMMITTEE

Docket No. SEC 2015-02

APPLICATION OF ANTRIM WIND ENERGY, LLC
FOR A CERTIFICATE OF SITE AND FACILITY

SUPPLEMENTAL PREFILED DIRECT TESTIMONY OF ROBERT D. O'NEAL ON BEHALF OF ANTRIM WIND ENERGY, LLC

I. Compliance with Newly Adopted SEC Rules

Q. Have you reviewed the Pre-Filed Testimony of Lisa Linowes?

A. Yes.

Q. In her Pre-Filed Testimony, Ms. Linowes asserts that the Sound Study developed by Epsilon Associates does not comply with the SEC's new rules. Do you agree with this assertion.

A. No I do not. The NH SEC rules were followed in the February 17, 2016 Antrim Wind Sound Level Assessment Report (the "Sound Report"). A detailed discussion of certain comments will follow below.

Q. Have you reviewed the Pre-Filed Testimony of Richard James?

A. Yes.

Q. Mr. James concludes that due to alleged flaws in the Epsilon model, the Sound Report developed is unreliable and unsuitable for making decisions under the SEC Rules. Do you agree with Mr. James' characterization of the Sound Report?

A. No, I disagree with Mr. James. The Sound Report followed the new SEC rules. Moreover, the prediction techniques used by Epsilon Associates here have been used in other cases as well where post-construction measurements confirmed their accuracy, including at a previously approved project in New Hampshire which holds an SEC Certificate.

Q. NH Site 301.18 governs sound study methodology. Did Epsilon follow the newly adopted rules when developing the Sound Report for this Project?

A. Yes, the newly adopted SEC rules were followed. Some specific points, which were raised in the testimony filed by Ms. Linowes or Mr. James, are discussed below:

- 301.18(b)(8) of the rules requires A-weighted and C-weighted sound levels for L10, Leq, and L90 as part of the pre-construction measurement program. Tables 5-2, 5-3, and 5-4 in the Sound Report provide the required data. Since sound levels are not constant, it is useful to provide various indicators of each level (minimum; maximum; average for example) to better describe how sound levels vary over time at each location.
- On October 2, 2015 AWE filed their Application with the SEC. The Sound Study report as part of that Application was dated June 8, 2015. There were five (5) fewer receptors analyzed in the 2016 Sound Report as compared to the 2015 Sound Study report. Four of the properties (both Whittemore properties, the Micheli property and the Ott property) are participating landowners that have agreements with AWE with respect to both sound and flicker and the fifth property, Mr. Courturier, is a dilapidated hunting camp with no running water or electricity and SEC rules do not require that it be evaluated for sound or flicker impacts. In any event, all five of these locations are shown to be less than 40 dBA at any time of the day or night, and thus meet the SEC nighttime sound standard.

Q. In her Pre-Filed Testimony, Ms. Linowes asserts that the Shadow Flicker Study developed by Epsilon Associates does not comply with the SEC's new rules. Do you agree with this assertion.

A. No I do not. The NH SEC rules were followed in the February 17, 2016 (revised) Antrim Wind Shadow Flicker Analysis report (the "Flicker Report"). A detailed discussion of certain comments will follow below.

II. <u>Compliance with ISO Standards</u>

Q. Ms. Linowes asserts that the Sound Report does not properly follow the ISO 9613-2 standards as required pursuant to the NH SEC regulations. Do you agree with this assessment?

A. No. The ISO 9613-2 standard is implemented through the use of a commercial software package (Cadna/A) which incorporates the sound propagation equations presented in the standard. Additional points are discussed below.

Q. Ms. Linowes asserts on Page 6 of her Pre-Filed Testimony that the Report omits the +/- 3 dBA correction included in Clause 9 of ISO 9613-2. Is that correct? If so, why was it omitted?

A. Ms. Linowes' assertion fails to accurately describe Clause 9 of ISO 9613-2. Clause 9 of the ISO 9613-2 standard discusses "Accuracy and limitations of the method." It is not a "correction" factor, therefore it is not necessary to add it to the sound level results. In fact, it would be wrong and improper to apply these accuracy levels to a wind energy project for the following reason. The ISO 9613-2 standard states, for receivers at a distance between 100 meters (328 feet)and 1,000 meters (3,280 feet) from a source AND ranging from 0 to 30 meters (98 feet) high, the model results are estimated to be accurate to +/- 3 dBA. Hub heights of the wind turbines range from 79.5 m (261 feet) to 92.5 m (303 feet) which is well above the 98 foot limit in the accuracy clause. Therefore, this accuracy clause is not applicable. There is no +/- 3 dBA "correction." The Sound Report correctly followed the ISO 9613-2 standard.

Q. Does Epsilon's decision not to apply the +/- 3 dBA "correction" result in non-compliance with the standard?

A. No. The Project has followed the ISO 9613-2 standard, and there is no +/- 3 dBA "correction" required by the standard. For reasons detailed above, the +/- 3 dBA item mentioned

by Ms. Linowes is an estimated accuracy parameter which does not apply to the sources in this Project.

Q. Ms. Linowes asserts on Page 6 of her Pre-Filed Testimony that the predicted sound levels only apply under wind speeds less than 2 m/s. Is this true?

A. No. Clause 5 of the ISO 9613-2 standard states that downwind conditions for this method apply when "wind speed is between approximately 1 m/s and 5 m/s, measured at a height of 3 m to 11 m above the ground."

Q. On Page 9 of his Pre-Filed Testimony Mr. James asserts that the model used by Epsilon does not include adjustments to account for ISO confidence limits. Is this correct?

A. No. It is unclear what Mr. James is referring to in his comment. The ISO 9613-2 standard does not contain any discussion of confidence limits. As noted by Mr. James, the measurement uncertainty in the sound power levels of the turbines (as provided by the manufacturer Siemens) was included in the modeling as required by 301.18(c)(2).

Q. In his assessment of the Wallace paper Mr. James notes that +2 dBA must be added to account for uncertainty and +3 dBA must be added to reflect mathematical limitations inherent in ISO 9613-2. Was this done in the Sound Report? If not, why not?

A. The manufacturer's uncertainty was included in the Sound Report. However, as noted on Page 7-1 of the Sound Study, it is +1.5 dBA, not +2 dBA as mistakenly reported by Mr. James. In addition, as discussed above, there is no +/- 3 dBA "correction" required by the ISO 9613-2 standard. The +/- 3 dBA term is an "accuracy" estimate. Significantly, it does not apply to this Project for reasons mentioned above. More importantly, a careful reading of the Wallace et al. paper confirms the SEC methodology as used by Epsilon. The Stetson Mountain I wind

farm mentioned in the Wallace paper is a ridgeline wind farm. Antrim Wind is also a ridgeline wind farm. Figure 16 of that paper compares the modeled pre-construction and measured post-construction sound levels at a nearby residence under strong wind shear conditions. At the highest sound power level, the highest measured Leq (A-weighted) was 4 dBA LESS than the modeled Leq (A-weighted). The modeling had assumed the 2 dBA manufacturer's uncertainty plus an additional 3 dBA for a total of a 5 dBA margin. Thus the modeling over predicted reality by 4 dBA. The 2 dBA uncertainty from the manufacturer was more than enough to make the model prediction overly conservative. Even if the preconstruction sound modeling for Stetson had not included the additional 3 dBA, it still would have over predicted the actual measured sound levels by 1 dBA. These facts confirm that the ISO 9613-2 standard as implemented by Epsilon in this study yields reliable, realistic results. The values cited above from the Wallace Study are summarized below in Table 1. The values if that study had not added an additional 3 dBA to the modeling are summarized below in Table 2.

Table 1 Summary of Wallace paper results (CP-4 at Stetson Mountain I)

Scenario	**Sound level (dBA)**
Pre-construction model without any adjustment	45.5
Turbine manufacturer's uncertainty	+/- 2
Accuracy estimate	+/- 3
Total pre-construction model with uncertainty & accuracy estimate	50.5
Post-construction measurement	46.5
Amount of over estimation by model	4.0

Table 2 Summary with 3 dBA accuracy removed

Scenario	**Sound level (dBA)**
Pre-construction model without any adjustment	45.5
Turbine manufacturer's uncertainty	+/- 2
Accuracy estimate	--
Total pre-construction model with uncertainty & accuracy estimate	47.5
Post-construction measurement	46.5
Amount of over estimation by model	1.0

There are more examples of actual, measured sound levels from operating wind farms that confirm adding an additional 3 dBA is not appropriate to accurately predict sound levels in the real world. For example, post-construction sound level measurements at Groton Wind, a New Hampshire ridgeline site, found that the predicted sound levels from pre-construction modeling were conservative (higher) than post-construction measurements.[1] In addition, data from a recent acoustical research study found using the manufacturer's uncertainty yielded similar results between pre-construction modeling and post-construction measurement.[2] None of these studies added an additional 3 dBA as suggested by Mr. James.

Q. Please explain the ISO standard for the ground factor. Do you agree with Mr. James' evaluation of ground factor on Page 17 of his Pre-Filed Testimony? Why did Epsilon choose to use a ground factor of 0.5?

A. No, I disagree with Mr. James' evaluation of the ground factor and I believe his assertions are inconsistent with the ISO standard. The ISO standard is very clear on the type of ground (porous; mixed; hard), and values for each, which were followed in the Sound Report. In addition, post-construction sound level measurements at many operating wind farms have confirmed that Epsilon's ground factor is valid.

The ground effect is one of several attenuation terms in the ISO 9613-2 standard (Section 7.3). As part of the ground effect attenuation, a "ground factor" or "G" factor is part of the equation. The acoustical properties of the ground between the source and receiver are taken into account through this G factor, which can range from 0 to 1. A G=0 is for hard ground including paving, water, ice, concrete, and all other ground surfaces having a low porosity. A G=1 is for

[1] *http://www.nhsec.nh.gov/projects/2010-01/documents/140723sound_report.pdf*
[2] *RSG et al, "Massachusetts Study on Wind Turbine Acoustics," Massachusetts Clean Energy Center and Massachusetts Department of Environmental Protection, 2016.*

porous ground, which includes ground covered by grass, trees or other vegetation, and all other ground surfaces suitable for the growth of vegetation. The area around the Antrim Wind Project is almost exclusively "porous" ground, however, to be conservative, "mixed ground" with a G=0.5 was used in the sound modeling.

The Wallace et al paper cited earlier used a G=0.5 (mixed ground) and found that the actual sound levels were 4 dBA LOWER than the modeled sound levels. This was for a ridgeline wind farm largely surrounded by woods and vegetation very similar to the Antrim Project.

Q. On Page 11 of his Pre-Filed Testimony Mr. James makes some comments about the conservative modeling assumptions used by Epsilon. Are these correct?

A. No. None of Mr. James' comments are supported by the ISO 9613-2 standard. Mr. James makes the claims that Epsilon's report is not conservative because:

1. wind turbine noise source exceeds the height above the receiver permitted for the model,
2. receivers are more than 1 km from the wind turbines, and
3. that the meteorological conditions defined for use of the ISO standard within the +/- 3dB tolerance assume wind turbines are operating in calm winds….

These unsupported claims are responded to as follows:

1. There is no "limit" on the height above receiver in the model. This applies to the accuracy estimate in Section 9 of the standard as previously discussed. And as demonstrated by post construction studies, the ISO 9613-2 standard for wind turbine modeling has proven to be conservative, when used with the settings used by Epsilon in this study.

2. Most receivers are more than 1 km (3,280 feet) from a wind turbine (which is why the sound levels are all quite low). However, once again, Mr. James has incorrectly suggested that the ISO 9613-2 standard is not valid. This 1 km limit only applies to the accuracy discussion in Section 9 of the standard as previously discussed, and as demonstrated, using the ISO 9613-2 standard for wind turbine modeling with the settings used by Epsilon in this study, has proven to be quite accurate.
3. Finally, as demonstrated earlier, Section 5 of ISO 9613-2 states the model is valid for wind speeds of 1 m/s to 5 m/s as measured at a height of 3 to 11 meters above the ground. These are not "calm" winds as Mr. James claims.

III. Methodology for the Sound Report and Shadow Flicker Report

Q. On Page 3 of his Pre-Filed Testimony, Mr. James suggests a number of deficiencies in the methodology used in the Sound Report developed by Epsilon Associates, please comment on Mr. James assessment.

A. Mr. James is wrong in his suggestion that the Sound Study is deficient for the following reasons.

With regard to the selection of the background measurement locations, ANSI S12.9-1992/Part 2 (R2013) is clear in Section 5.1.1 that "deterministic spatial sampling," the method used by Epsilon, is perfectly valid. This allow sites to be selected as representative of the sound levels in the total area. These sites were selected to represent the closest residential areas in each direction around the wind farm, as well as residences on a busy road (NH Route 9), less traveled roads (Salmon Brook Rd; Reed Carr Rd; Loveren Mill Rd), and a recreation area (Gregg Lake). In addition, Section 7.2 of ANSI S12.9-1992/Part 2 clearly directs that measurement of the total

ambient sound in an area is desired, and "all noises at a site are included in the measurement." By its very definition, the L90 statistic is used to remove all transient sounds (see ANSI S12.9-2013/Part 3 Section 6.6(3) which states "use of the L-90 will automatically remove transient background sounds from the result."). The L90 background sound level was measured at each site and these results are in the Sound Study.

Mr. James is also incorrect regarding his assertion that the sound propagation modeling is only valid during "calm" winds. The SEC regulations require the use of the ISO 9613-2 propagation standard to conduct the predictive sound modeling and that is what Epsilon used. Furthermore, the ISO 9613-2 standard is very clear in Section 5 that the model is valid for "wind speed between approximately 1 m/s and 5 m/s, measured at a height of 3m to 11m above the ground."

Finally, the Sound Study used the manufacturer's Leq sound levels, and their associated uncertainty, in accordance with the IEC 61400 Part 11 standard, and the SEC regulations. Mr. James' suggestion that different wind turbine data should have been used in the modeling is not supported by the rules or common professional practice.

Q. On Page 3, Mr. James asserts that the background sound study used improper locations for test instruments and that testing protocols were used that do not meet the New Hampshire SEC regulatory requirements. Do you agree with this assessment? How were locations chosen?

A. No. Please see the answer provided above.

Q. Mr. James asserts on Page 4 that the sound propagation modeling used under-estimates the sound levels that will be received. Has the modeling used for this Project been used for other projects?

A. Yes.

Q. Has the accuracy of this modeling methodology been tested?

A. Yes it has, and the examples discussed earlier in my testimony concerning the Stetson I and Groton wind farms confirm that post-construction testing has found that actual sound levels, post-construction, are lower than the pre-construction model predictions.

Q. Mr. James concludes his Pre-Filed Testimony by asserting that the Sound Report developed by Epsilon is unreliable because of flaws in the methodology. Do you agree with Mr. James' characterization?

A. No I do not. The methodology is not "flawed" but rather follows the SEC rules and applicable ISO and ANSI standards, which have proven reliable as shown by actual results at many other wind farms including Groton Wind, a NH ridgeline wind farm approved by the SEC.

Q. Mr. James asserts on Page 18 of his Pre-Filed Testimony that 18 receptors will experience noise levels at 43 dBA. Do you agree with Mr. James assessment and evaluation? What accounts for the difference between the Epsilon assessment and Mr. James' prediction?

A. No, I disagree with Mr. James. As an initial matter, the June 2015 report has been replaced by the updated February 17, 2016 Sound Report so Mr. James's comments pertain to the wrong report. The updated Sound Report shows maximum predicted sound levels at a residence will be 38 dBA, not 43 dBA. Mr. James has erroneously added an additional "accuracy" factor of 3 dBA, plus an additional 3 dBA to change the ground attenuation factor, for a total of an additional 6 dBA on top of the manufacturer's uncertainty level. Neither of these "adjustments" are valid for reasons discussed earlier in this testimony. The addition of an extra 6 dBA is not supported by the science or the rules. To take the Stetson I example again, if

that preconstruction study had included his additional 6 dBA, the model would have over predicted actual measured results by 7 dBA. This is the equivalent of expecting the sound levels to be more that 5X higher than they actually were. There is no rational basis for this. Therefore, no residential locations in the study will experience sound levels of 43 dBA, rather the model shows that the maximum will be 38 dBA and this is highly likely to be a conservative estimate, given the results of post construction studies that have been performed on other ridgeline wind projects in New England that have employed similar preconstruction modeling methodologies.

Q. Mr. James notes in his testimony that "One paper provides a historical review of other types of noise sources with similar sound emission characteristics to wind turbines that have known adverse health effects on people exposed to their sound." Can you comment on this assertion?

A. I am not a health expert. However, through many years of extensive experience working in this field, I am aware of many peer-reviewed publications that have been published worldwide examining the relationship between wind turbines and possible human health impacts. These studies have concluded that there is no causal relationship between wind turbines and any adverse health effects. Examples of some studies include:

- Health Canada. Wind Turbine Noise and Health. The Government of Canada. 2014. Available online: http://www.hc-sc.gc.ca/ewh-semt/noise-bruit/turbine-eoliennes/summary-resume-eng.php
- Michaud, DS. 2015. Wind Turbine Noise and Health Study: Summary of Results. 6th International Meeting on Wind Turbine Noise, Glasgow.

- Massachusetts Department of Environmental Protection and Department of Public Health. Wind Turbine Health Impact Study: Report on Independent Expert Panel. Department of Environmental Protection and Department of Public Health (2012).
- Merlin T, Newton S, Ellery B, Milverton J, Farah C. Systematic Review of the Human Health Effects of Wind Farms. Canberra, ACT: Australia National Health and Medical Research Council (2014).
- McCunney, Robert J., K. Mundt, W. D. Colby, R. Dobie, K. Kaliski, and M. Blais. "Wind Turbines and Health: A Critical Review of the Scientific Literature." Journal of Occupational and Environmental Medicine 56 (11), November 2014.

Q. In his Testimony, Mr. James' claims that certain requirements in the ANSI standard were not met by the Epsilon Sound Study, can you comment on this assertion?

A. Yes, Mr. James' claims are incorrect for the reasons outlined below, which highlight Mr. James' assertions, the actual requirements in the ANSI standard, and how Epsilon met them:

a. Mr. James claims, testing sites should be in "people's back yards." The ANSI S12.9-1992/Part 2 (R2013) standard has no such requirement. Rather the standard states "…these sites to be representative of the sound levels in the total area from which the sites are selected." Mr. James mistakenly assumes that all residents who live along a busy road such as NH Route 9 do not experience the sound currently generated by traffic noise at their houses, and somehow this noise should not "count." This is incorrect.

b. Mr. James claims that Epsilon did not meet ANSI requirements because "test locations were near reflecting objects, trees, shrubs and other vegetation." The ANSI S12.9-2013/Part 3 standard requires microphones be at least 7.5 meters from a reflecting surface

such as a house – all equipment met this requirement. The standard states that reflecting objects with small dimensions (trees, posts, bushes, etc) should not be within 1.5 meters of the microphone – all equipment met this requirement.

c. Mr. James claims, transient noise was not excluded from sounds collected during the monitoring period. Section 7.2 of ANSI S12.9-1992/Part 2 clearly directs that measurement of the total ambient sound in an area is desired, and "all noises at a site are included in the measurement." By its very definition, the L90 statistic is used to remove all transient sounds (see ANSI S12.9-2013/Part 3 Section 6.6(3) which states "use of the L-90 will automatically remove transient background sounds from the result."). The L90 background sound level was measured at each site and these results are in the Sound Study.

d. Mr. James claims on Page 5 of his Pre-Filed Testimony, inclusion of extraneous data (L A90) is misleading. Section 301.18(b)(8) of the SEC rules requires A-weighted and C-weighted sound levels for L10, Leq, and L90 as part of the pre-construction measurement program. Tables 5-2, 5-3, and 5-4 in the Sound Report provide the required data. Since sound levels are not constant, it is useful to provide various indicators of each level (minimum; maximum; average for example) to better describe how sound levels vary over time at each location. The inclusion of additional data in the report does not make it misleading or inappropriate.

e. In his Pre-Filed Testimony, Mr. James provides a list of selected items from several parts of ANSI standards with the assertion that the Epsilon Sound study did not meet these requirements. This is not correct as all the selected items noted by Mr. James were

properly accounted for and Mr. James' list has no bearing on how the Antrim Wind background sound testing was conducted. For example:

- Transient sounds were removed (see L90 data),
- Microphones were more than 7.5 m from a reflecting surface, and more than 1.5 m from trees, and there were no leaves on the trees in January.
- Any data collected during periods of precipitation were excluded
- Any data collected during periods of 5 m/s winds (ANSI limit) or 4 m/s winds (SEC limit) were excluded
- Proper windscreens were used over each microphone.

Q. Mr. James' state in his Pre-Filed Testimony that, "It is a myth that wind induced noise will mask the noise of wind turbines in high wind conditions." Do you have any comments on this statement?

A. There is no requirement in the SEC rules to discuss or analyze whether a wind turbine will be audible or not at a residence. The NH SEC sound level standard is 45 dBA during the day, and 40 dBA at night at residential structures. The Sound Study has analyzed Antrim Wind with respect to that standard. For perspective, the World Health Organization (WHO) Community Noise Guidelines recommend an 8-hour nighttime sound level (Leq) of 45 dBA outside a home to prevent sleep disturbance. The SEC nighttime limit of 40 dBA is significantly less than the WHO sleep disturbance guideline, and the Antrim Project will meet the stricter SEC standard.

Q. On Page 7 of her Pre-Filed Testimony Ms. Linowes claims, "a separate model for predicted sound emissions from the substation was omitted from the 2016 report." Do

you agree with this statement? If so, why were sound emissions form the substation omitted?

A. The SEC rules do not require a separate model for sound emissions from the substation. Information on sound levels from the substation was included in the model and is discussed in Section 7.2 of the Sound Study filed initially with the Application and the updated Sound Study filed with the Committee on February 19, 2016. Sound levels from the proposed substation are included in the total modeling results in the Sound Report.

Q. Ms. Linowes asserts that Epsilon "failed to appropriately account for a pure tone emanating from the substation," and "given the likelihood of pure tone sound emissions, the substation may be subject to noise penalties required in Site 301.18(h)." Do you agree with her assertions?

A. No. The SEC rules in Site 301.18(h) do discuss pure tone sounds, however this discussion is in the context of post construction sound measurements. The rule specifically states, "Noise emissions shall be free of audible tones, and if the presence of a pure tone frequency is detected, a 5 dB penalty shall be added to the measured dBA sound level" (emphasis added). The rule is clear that pure tone sounds are to be addressed in post construction sound measurements and not in preconstruction sound modeling. Epsilon's modeling is consistent with all of the requirements of the SEC rules, including with respect to substation sound and pure tone sounds.

Q. Ms. Linowes makes a number of assertions about alleged inaccuracies or errors in the shadow flicker study, can you address those concerns?

A. Yes. Ms. Linowes raises these issues in Section 8 of her Pre-Filed Testimony, and I will address them in order.

- Section 8.a of her testimony references five properties that were removed from the 2016 updated shadow flicker study that had been previously included in the 2015 version of the study. These five properties were removed from the flicker report for the same reasons as the Sound Study. Four of the properties (both Whittemore properties, the Micheli property and the Ott property are participating landowners that have agreements with AWE with respect to both sound and flicker and the fifth property, Mr. Courturier, is a dilapidated hunting camp with no running water or electricity and is not required to be evaluated for sound or flicker impacts by the SEC rules.
- Section 8.b. of her testimony claims that the Epsilon study "does not establish that the "rotor-plane of the turbine is always perpendicular to the sun" with respect to the definition of astronomical maximum. In Epsilon's study, astronomical maximum calculations are performed where the rotor plane of the turbine is always perpendicular to the line between the sun and the receiver.
- Section 8.c. of her testimony takes issue with limiting shadow flicker calculations to 1 mile. Ms. Linowes real issue here seems to be with the language of the SEC rules rather than Epsilon's study. The Epsilon Flicker study analyzed potential flicker impacts at all locations out to one mile in accordance with SEC rules. Ms. Linowes' argument that she can "demonstrate" that shadow flicker will occur beyond 1 mile by comparing the 2016 results to the original 2015 results is baseless. In the 2015 study, Epsilon calculated shadow flicker effects out to 10 times the rotor diameter, in accordance with industry standards. In order to comply with the new SEC rules to increase the evaluation out to 1 mile, Epsilon is essentially telling the model to show shadow flicker effects at all locations out to 1 mile at any time there is a line of sight between a receptor and the

turbine/sun. This artifact of the model does not mean that actual shadow flicker will occur. Epsilon's study meets all requirements in the SEC rules.

Q. Are there any other comments you would like to make in response to any intervenor's testimony in this Docket?

A. Yes. Given the technical nature of the sound and flicker studies performed by Epsilon and to avoid any confusion relating to assertions made by Ms. Linowes and Mr. James in their Pre-Filed Testimony, I would like to briefly summarize my responses below:

- The preconstruction sound study and shadow flicker study were performed in accordance with all SEC rules and all applicable ISO/ANSI standards;
- All of the model inputs used in the sound and flicker models are typical of those used for wind projects in forested hilly terrain such as this;
- The results generated by utilizing the Epsilon sound and flicker methodology are highly reliable and have been found to be conservative in other circumstances and are expected to be conservative here;
- Finally, as an added layer of protection and certainty, the SEC rules require post construction sound testing to ensure compliance with the SEC rules. Thus in the highly unlikely event that any exceedance of sound limits occurs, Antrim Wind will be required to cure the issue. AWE is confident in the results of its modeling and has no issue with a condition of its Certificate requiring that sounds not exceed 45 dBA day/40 dBA night as the rules require.

Q. Does this conclude your testimony?

A. Yes.