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July 17, 2020

By email: Pamela.Monroe@sec.nh.gov

New Hampshire Site Evaluation Committee (SEC)
Attention: Pamela G. Monroe, Administrator
21 S. Fruit Street, Suite 10
Concord, NH 03301-2429

Re: Antrim Wind Energy – Post-Construction Sound Monitoring Report for Winter 2020

Dear Ms. Pamela G. Monroe,

Ms. Lisa Linowes filed a letter dated May 21, 2020 to the Site Evaluation Committee ("SEC"), providing comments regarding the Post-Construction Sound Monitoring Report for Winter 2020 ("Winter 2020 Sound Report"). Her letter was posted on the SEC website¹ under the Antrim Wind Energy (AWE) post-certificate filings in Docket No. 2015-02. Among other things, Ms. Linowes asserts that the report "*is flawed and should be rejected.*" As shown below, Ms. Linowes is wrong on all the counts set forth in her letter and it should therefore be disregarded.

This letter and its attachment have been prepared with the collaboration of our post-construction sound monitoring consultant, Acentech, who produced the Winter 2020 Sound Report.

1. Technical responses to Ms. Linowes' comments

Ms. Linowes makes seven erroneous comments on various sections of Acentech's Winter 2020 Sound Report. Acentech's responses to Ms. Linowes' comments are attached.

2. Compliance assessment metric

Ms. Linowes also argues that Acentech averaged data in hourly increments in a manner not supported by the SEC rules. She is mistaken on this count as well.

2.1. Type of metric for the sound levels

Site 301.14(f)(2) defines the limit in terms of A-weighted equivalent sound levels, generally denoted as LA_{eq} or A-weighted Leq. A-weighted equivalent sound level is not properly defined in

¹ https://www.nhsec.nh.gov/projects/2015-02/2015-02_post_certificate_filings.html

the SEC Rules. It is however defined in the ANSI S12.9-2013 Part 3², a standard referred to in the SEC Rules, which “*major applications of this Standard include: [...] Measurement of source emissions as equivalent-continuous sound pressure level (LEQ).*” The standard defines equivalent-continuous sound pressure level (LEQ) as follows:

“*Square root of the time average of the integral of the squared sound pressure over a specified time.*” (emphasis added)

The compliance assessment metric is therefore clearly LA_{eq} as per the SEC Rules.

2.2. Time average/specified time for the A-weighted equivalent sound levels

To use the LA_{eq} it is important to identify the *specified time*. Justification for a 1-hour time average/specified time are summarized below.

2.2.1. Minimum measurement duration per Site 301.18(e)(1)

Site 301.18(e)(1) indicates that “[...] *measurements shall include at least one nighttime hour where turbines are operating at full sound power with winds less than 3 meters per second at the microphone*” (emphasis added).

2.2.2. ANSI S12.9-2013 part 3 recommendation

ANSI S12.9-2013 part 3 does not have a strict requirement on the specified time, but recommends/refers to 1 hour:

- Note from the introduction: “*As an example, one hour (1 h) is used as the basic measurement duration in Part 3. One hour is not a measurement duration required by this standard; it is only an example of a basic measurement duration, though a common one.*”
- From introduction of section 6.7 (*Basic procedure for measurement of equivalent-continuous sound pressure level*): “*The basic data collection procedure requires measurement of the continuous background sound for 10 min or more and measurement of the sound with the source(s) in operation for the basic measurement period (e.g., 1 h)*”

Based on the quotes above, a time average/specified time below 10 minutes would be an incompatibility with ANSI S12.9-2013 part 3, a standard referred to in the SEC Rules. Further, the standard recognize that 1 hour is a commonly used period, which aligns as well with Site 301.18(e)(1) reproduced above.

2.2.3. Compatibility with the pre-construction predictive sound modeling requirements

Additionally, the post-construction compliance assessment metric must be compatible with the one imposed for the pre-construction predictive sound modeling as prescribed in the SEC Rules.

² ANSI S12.9-2013 Part 3, *American National Standard – Quantities and Procedures for Description and Measurement of Environmental Sound – Part 3: Short-term Measurements with an Observer Present*, American National Standards Institute, January 15, 2013

Per Site 301.18(c)(1), the predictive sound modeling must “[b]e conducted in accordance with the standards and specifications of ISO 9613-2 [...]” ISO 9613-2³ requires sound emission data for the modeling, preferably from measurements. For wind turbines, the common measurement protocol used is the one defined in IEC 61400-11⁴, another standard referred to in the SEC Rules. The calculations required by IEC 61400-11 are complex, but important aspects regarding time average/specified time are as follows:

- Per section 7.2.2 “at least 180 measurements shall be made overall for both total noise and background noise covering corresponding wind speed ranges” and “at least 10 measurements shall be made in each [hub-height 0.5 m/s] wind speed bin for both total noise and background noise.”
- Per section 7.2.3: “The equivalent continuous A-weighted sound pressure level of the noise from the wind turbine shall be measured at the reference position. Each measurement shall be integrated over a period of 10s.”
- Ultimately, the overall minimum duration of measurement would be 1800 seconds (180 x 10s) and a minimum of 100 seconds (10 x 10s) for each hub-height 0.5 m/s wind speed bins. The standard defines a complex calculation algorithm to get the apparent sound power level at each 10 m height 1 m/s wind speed bin for the wind turbine under test, which corresponds to a series of *integral of the squared sound pressure*.
- In reality, for most wind speed bins, a dataset for a specific wind turbine contains more measurements than the bare minimum required by IEC 61400-11 (to assure the minimum measurement number is reached for all wind speed bins, the more frequent wind speed bins will inevitably have more measurements). For the AWE’s turbine platform (Siemens SWT-3.2-113 2A, Rev. 0), Siemens Gamesa Renewable Energy has confirmed that the total noise measurement duration for each hub-height 0.5 m/s wind speed bins varies from 150 to 1060 seconds and the overall duration is 9330 seconds.

Based on the IEC 61400-11 elements and context summarized above, a time average/specified time below 1800 seconds (30 minutes) would lead to an incompatibility between the prescription imposed for the pre-construction predictive sound modeling and the compliance assessment metric for the post-construction sound monitoring.

In conclusion, the compliance assessment metric of 1-hour LA_{eq} aligns with Site 301.14(f)(2) and 301.18(e)(1) as well as the standards SEC Rules refers to and the standard industry practices.

³ ISO 9613-2:1996, *Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method calculation*, International Organization for Standardization, December 15, 1996.

⁴ IEC 61400-11, *International Standard - Wind Turbines – Part 11: Acoustic Noise Measurement Techniques*, Edition 3.0, International Electrotechnical Commission, 2012-11.

3. Independent assessment of Winter 2020 Sound Report

Ms. Linowes requests additional information “[...] in electronic form as soon as possible” so that she may “[...] independently assess whether the Acentech data are of any utility for determining if Antrim Wind is operating in compliance with Site 301.14(f)(2)a [...].” Ms. Linowes misunderstands her role in the SEC’s process and we believe she seeks to expand the SEC’s rules to pursue her personal aims. Ms. Linowes’ request should be denied because the Winter 2020 Sound Report is fully compliant with SEC Rules. See excerpt of Site 301.18:

“(f) Post-construction sound monitoring reports shall include a map or diagram clearly showing the following:

- (1) Layout of the project area, including topography, project boundary lines, and property lines;*
- (2) Locations of the sound measurement points; and*
- (3) Distance between any sound measurement point and the nearest wind turbine.*

(g) For each sound measurement period during post-construction monitoring, reports shall include each of the following measurements:

- (1) LAeq, LA-10, and LA-90; and*
- (2) LCeq, LC-10, and LC-90.”*

The Winter 2020 Sound Report contains all those:

Item	Location in the Report
Layout of the project area, including topography, project boundary lines, and property lines	Figure 1-1, page 5 of 29
Locations of the sound measurement points	Figure 1-1, page 5 of 29
Distance between any sound measurement point and the nearest wind turbine	Table 5-1, page 14 of 29
LAeq, LA-10, LA-90, LCeq, LC-10, and LC-90 measurement results	Section 6, tables and text, pages 18 to 28 of 29 and Appendix B

Ms. Linowes’ request for additional data is not supported by the SEC Rules. It would also be impractical to provide the data requested. Of note, for one location the fast-response LA_{eq, 100ms} alone for 14 days would represent 12,096,000 datapoints⁵ and the audio files about 19.35 GB;

⁵ To put this number in perspective, Excel 365 has a limit of 1,048,576 rows, about 12 times less than what it would be needed to store this metric in a single column in a comprehensive single excel file. Additionally, performing sound source identification and confirming accountability beyond a reasonable doubt for each single 0.100-seconds (or 0.125-second) samples (about 60 millions datapoints) would be impractical, if not impossible.

these numbers represent only a fraction⁶ of the extremely large amount of data that would be required to allow a complete impartial reanalysis by a third-party⁷. Some of the information requested such as the 1-second SCADA data are not even available as most operational data such as hub-height wind speed and direction are recorded/archived only at each 10-minutes.

The Winter 2020 Sound Report as any deliverables cannot reasonably present all the raw data; even if possible, this would be onerous and inapplicable, as the Winter 2020 Sound Report compiles already all information required by the SEC Rules. The Winter 2020 Sound Report is presented in a concise way and includes the methodology and instrument descriptions and all data necessary for a legitimate peer review by an independent and impartial third-party acoustical expert.

4. Conclusion

TransAlta is committed to continue to comply and meet all the conditions of our certificate⁸, and has demonstrated as such with the Winter 2020 Sound Report. We believe we have been responsive to all stakeholder inquiries and commit to continue with open and transparent dialogue and engagement going forward. Even though the 2020 Winter Sound Report demonstrates compliance, if a stakeholder still believes the sound is above prescribed limits, we are committed to support the SEC to accommodate the independent evaluation of that complaint by a third-party noise expert⁷, as required per our certificate.

Finally, we believe that these responses should give you confidence that we have fully satisfied the post-construction sound monitoring requirements for the first campaign of the first year of operation. Accordingly, Ms. Linowes' claim that the Winter 2020 Sound Report is flawed should be disregarded.

Regards,

TRANSALTA CORPORATION



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Specialist, environment | Wind & Solar Operations

Encl.

⁶ Just to list a few: LA10, LA90, LCeq, LC10, LC90, 33 different 1/3 octave sound pressure levels, etc. for sound data, hub-height wind speed and direction, electrical power generation, etc. for operational data.

⁷ The independent and impartial complaint validation by a third-party noise expert as indicated in section 4 further void the relevance of submitting all raw data that led to the Winter 2020 Sound Report. We maintain that raw data submission would be unreasonable and impractical as explained previously herein.

⁸ Docket 2015-15 - Order and Certificate of Site and Facility with Conditions, March 17, 2017, issued by SEC.

Attachment – Acentech Letter



July 16, 2020

Jean-Francois Latour
Antrim Wind Energy LLC / TransAlta Corporation
26 Tuttle Hill trail
Antrim, NH 03440

Subject: Antrim Wind Project – Responses to Comments Submitted Regarding the Winter 2020 Post Construction Sound Study

Dear Jean-Francois:

Acentech submitted a post construction sound monitoring compliance report dated May 12, 2020. This report was uploaded to the New Hampshire Site Evaluation Committee (SEC) website on May 13, 2020. Comments from Lisa Linowes were received on the NHSEC website in a letter sent electronically dated May 21, 2020. This letter provides clarifying responses to her comments.

SUMMARY OF COMMENTS AND CLARIFYING REPONSES

We have summarized each comment described in numbered text followed by our response in the lettered subsections below.

1. A comment has questioned the use of 1-hour LAeq for assessment of project compliance.

- a. We have reviewed NHSEC Site Rule 301.14(f)(2) and this code refers to the A-weighted equivalent sound levels (Leq or LAeq) as the metric used to define the sound limit/standard for wind energy systems. Additionally, NHSEC Site Rule 301.18(e)(1) indicates that *“measurements shall include at least one nighttime hour where turbines are operating at full sound power with winds less than 3 meters per second at the microphone”*.
- b. We have also reviewed ANSI S12.9-2013 Parts 2 and 3 and there are no requirements for measuring or reporting of data in 0.125 second sampling periods.
- c. The NHSEC Site Rule 301.18(e)(6) states that *“All sound measurements during post-construction monitoring shall be taken at 0.125-second intervals measuring both fast response and Leq metrics”*. The measurements performed in the context of the winter 2020 post construction sound monitoring used fast response which corresponds to a 0.125-second time weighting. The short sample intervals were used to establish the 1-hour LAeq, as detailed in ANSI S12.9-2013 Part 3. Section 6.7.2 of this document notes that *“small blocks of time are used so that if a transient background sound occurs during a block, then only a small part of the total measurement period is lost.”* This was important for analysis at monitoring Location 1, where there were frequent car and truck sounds at all hours.
- d. In regards to averaging hourly conditions, for each hour that is presented for compliance assessment the turbine operational data was inspected to insure that all 10-minute sub-periods within the hour met the stated conditions for greatest sound (full sound power emission from the turbine, downwind condition).

2. A comment has questioned the format in which audio files of the sound level meter's microphone were saved.

- a. Per the NHSEC Site Rule 301.18, there is no specific requirement for audio recording for the post construction monitoring. There is such a requirement for the preconstruction sound background study per NHSEC Site Rule 301.18(a)(2) in order "*to clearly identify and remove transient sound sources from the data*". Nevertheless, identification and removal of transient sound from the data was done successfully by listening to the MP3 audio files.
- b. Note that the ANSI standard doesn't have a strict requirement for audio recording. ANSI S1.3-2005(R2010), referred to by ANSI S12.9-1992 (R2013) Part 2, has non-mandatory recommendations for recordings: "*It is sometimes desirable to record the sound of interest at the measurement position in the field for later analysis in the laboratory.*" These recommendations are based on the assumption that frequency analysis would be done on the recorded audio waveform at a later date, which is not a requirement for the current measurements. One-third octave band frequency data is already directly captured by the sound level meter.

3. A comment was submitted that claims the Rion NL-52 sound level meter does not have the ability to record the LAeq sound level in less than 1 second increments.

- a. The Rion NL-52 sound level meter, with the purchase of what the manufacturer calls an extended function program (NX-42EX), is capable of recording and saving the LAeq in 100 millisecond increments. This reports the fast weighted and LAeq metrics every 0.100 seconds. The measurements are therefore in compliance with NHSEC Site Rule 301.18(e)(6). The information on the NX-42EX extended function program is published on the Rion data sheet for the NL-52.

4. A comment has questioned the exclusion of monitoring hours based on the difference between the L10 and L90 sound levels, calling it a "novel" rule.

- a. This rule is applied so that times in which non-turbine sounds affected the measured results can be excluded. There is precedent for this method in the State of New Hampshire. The Groton Wind project (NHSEC Docket 2010-01) employed this same method during post construction project sound compliance testing without comment that we are aware of.
 - i. The method as stated in the EPSILON Associates post construction sound monitoring report is as follows:

"One of the goals of the analysis was to focus on time periods in which there was a steady noise source (possibly the wind turbines) and a minimal amount of wind noise. The remaining condition attempts to isolate these periods.

The L10 and L90 sound levels [that] were reasonably close together (within 3-4 dBA) indicating a steady sound, possibly from the wind turbines [were examined for compliance]. Based on professional experience; Epsilon has found this relationship exists during periods of steady sound from sources such as wind turbines."

5. The shutdown period in which site ambient conditions were established was taken into question.

- a. The half hour period in which the turbines were shut off was used to establish the ambient sound levels representative of conditions with high hub height wind speeds and low ground level wind speeds. We believe it is reasonable to assume that this half hour ambient sound level is representative of a full hour ambient sound level.
- b. Attendees were stationed at all 5 monitoring locations during the shutdown period from 22:30 to 23:00 on March 8, 2020. Notes from each location and examination of the audio files were used to exclude transient sounds and to confirm that the turbines were off. The final ambient levels are reported in the sound monitoring study under the evaluation data section of each location. We have summarized them in the following table. These ambient levels were

measured with very little ground wind speeds. Site ambient sound conditions would be expected to increase when ground level winds increase.

Location #	Ambient Sound Levels	
	dBA	dBC
1	33	40
2	33	41
3	29	38
4	27	38
5	26	38

6. A comment was submitted wanting an explanation for every instance in which the 1-hour LAeq was higher than the 1-hour LA10.

- a. These instances most often occur when there are short duration high amplitude sounds present (loud vehicles, gun shots, etc.). In a one hour period a sound source must be present for more than 6 minutes for the LA10 to be affected. A loud sound source that is present for less than 6 minutes in an hour can significantly affect the LAeq, thereby causing the LAeq metric to be higher than the LA10 metric. There were no instances of this happening at any location during the final hours identified for compliance. We note that in Figure B-7 of the pre-construction sound study prepared by EPSILON Associates there were several periods of time when the LAeq was higher than the LA10.
- b. One hour at location 4 measured an LAeq approximately 9 decibels higher than the LA10 because of gunshots in the vicinity. Other instances in which this occurred to a lesser extent were 1 hour with two low flying aircraft and another hour with bird calls very close to the microphone position.

7. It was claimed that Acentech provided inconsistent methods for determining background sound levels. It is claimed that Acentech used inconsistent time periods in its turbine sound compliance evaluation at Location 2.

- a. The shutdown measurements on the night of March 8, 2020 were used to establish the background sound level at monitoring locations 2 through 5 as described above.
- b. At location 1 there were too many cars passing on Route 9 during the scheduled shutdown period to be able to get enough valid data to report a true background sound level without significant contribution from transient sound sources. Instead, we examined the 11 hours of time during which the 9 turbines were off because the wind speed was below the cut-in speed for operation. These hours were observed, transient sounds were excluded, and the lowest LAeq values of them all were chosen to represent the ambient. This is a conservative value because the turbine-only sounds are calculated by subtracting the ambient from the total environment (i.e. a lower ambient would subtract less from the total sound level).
- c. Location 2 only experienced 40 minutes during the entire monitoring period in which the turbine power generation and hub height wind speeds and direction were suitable for evaluation (conditions for greatest sound: full sound power emission from the turbine, downwind conditions). These 40 minutes were evaluated with the qualification that it is reasonable to assume under constant conditions the measured values are representative of a full hour period.

Sincerely,

ACENTECH INCORPORATED



Ethan R. Brush
Senior Consultant



Michael Bahtarian, INCE Bd. Cert
Principal Consultant