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July 15, 2010

Mr. Warren L. Brown  
EnRad Consulting  
516 Main Street  
Old Town, ME 04468

**Project: Spruce Mountain Wind Project:  
DEP Application Number L-24838-24-A-N and L-24838-2G-B-N  
Response to June 23, 2010 Peer Review of Noise Study**

Dear Mr. Brown:

Thank you for your above-referenced peer review comments regarding the Spruce Mountain Wind noise study, which appeared as Section 5 of the Site Location of Development permit application that Spruce Mountain Wind, LLC (Spruce Mountain Wind) submitted to the Maine Department of Environmental Protection (DEP) on January 14, 2010. We also appreciate you promptly meeting with our acoustic engineer, staff from Spruce Mountain Wind, and the Maine DEP on June 29<sup>th</sup> to discuss your findings. This letter is in response to your written comments and our subsequent discussions.

**Summary of Acoustic Modeling Assumptions**

The Spruce Mountain acoustic assessment was performed using the Project design layout as included in the Site Location of Development permit application filed on January 14, 2010 (the original model). The acoustic modeling analysis employed the most recent version of DataKustic GmbH's CadnaA, the computer-aided noise abatement program (v 4.0.136). In doing so, Tetra Tech exerted due care and applied calculation methodologies generally recognized throughout the wind energy industry. The acoustic modeling results, inclusive of a number of conservative model input assumptions, showed that the Project was adequately designed to operate in compliance with the sound regulations of both Maine DEP (within 500 feet of all existing inhabited structures) and the Town of Woodstock (at property lines). (Specifics on these sound regulations can be found in the Spruce Mountain Wind permit application.) Several of the key conservative modeling assumptions incorporated in the acoustic modeling are summarized below.

1. Omnidirectional downwind sound propagation was always assumed. Lower sound levels are expected in directions away from the predominant wind direction, but actual sound pressure levels depend on wind velocities, speed, direction, and gustiness.
2. The acoustic modeling was completed for all wind turbines operating concurrently at maximum rotational speeds (i.e. maximum sound output).
3. Inclusion of the 2 dBA safety (k) factor to account for unit-to-unit product variation and the overall measurement testing reproducibility as defined per IEC 61400-11.
4. Acoustic modeling was performed at the previous maximum noise level of 105.3 dB. Gamesa G90 turbines for the Spruce Mountain Wind Project are now warrantied at a maximum sound power level of 105.0 dB



5. Ground absorption factor of  $GA = 0.5$ , which is representative of a semi-reflective ground surface.
6. Defoliate seasonal conditions.
7. An adjustment, in the form of a  $C_{met}$  factor, to account for anomalous meteorological conditions that are conducive to long range sound propagation.

#### **Adjustments to Noise Model and Demonstration of Compliance**

As stated in your June 23<sup>rd</sup> review report and then clarified at our June 29<sup>th</sup> meeting, you have asked Tetra Tech to reevaluate and consider incorporating additional or different assumptions into our model to increase the level of conservatism. Based on the options you presented and we discussed, we have modified the acoustic modeling input parameters as follows:

1. An additional 3 dBA engineering safety factor was added, resulting in a total 5-dBA k-factor above the overall expected mean sound levels as warranted by the turbine manufacturer. (Ground absorption was left at 0.5.) This additional level of conservatism has been added to account for potential uncertainties in predicted turbine performance in complex terrain and the sound propagation algorithms as defined under ISO 9613.2 that may result in higher than the daily expected received sound pressure levels under certain conditions.
2. The model was revised to consider sound propagation limited to standard daytime conditions to be consistent with recent Department approvals (i.e. the  $C_{met}$  factor was removed).
3. The wind turbine sound power emission was modeled as an idealized point source in place of a distributed area source to be consistent with recent Department approvals.
4. Selected turbines have been modeled in reduced sound power mode to demonstrate compliance with noise regulations, depending on time of day. The noise-restricted operation will have a negative impact on the power output of the wind turbine. These adjustments were made with particular emphasis on meeting compliance standards at the closest receptors (10, 11 and 12) and the nearby property boundary associated with receptor 12.

Tetra Tech maintains that the original model incorporated an acceptable level of conservatism and that the additional 3-dBA safety factor is unnecessary. The conservatism of a 5-dBA safety factor was recently demonstrated by the results of post-construction monitoring of the Stetson Wind Project (Attachment A, dated July 27, 2009), where measured sound pressure levels were 2.5-8.6 dBA below sound pressure levels predicted by a model incorporating the 5-dBA safety factor. As indicated in the Oakfield Wind Project Amendment Sound Level Assessment Peer Review (Attachment B, dated December 18, 2009), the sound assessment at one of these measurement locations was conducted under “‘worst case’ array geometry, line-of-sight and meteorological conditions.”

#### **Noise Model Operating Schedule**

Modeling results are presented below to show compliance within each of three daily periods with differing noise requirements.

Period 1 – Daytime Hours (7:00 am – 7:00 pm)

The acoustic modeling analysis shows that the Project will comply with both the Town of Woodstock and DEP daytime noise requirements. All wind turbines were modeled operating at full power, with sound power outputs of 110 dBA (105.0 +5 dBA safety factor) for each turbine. See Figure 1.

Period 2 – Nighttime Hours (7:00 pm – 10:00 pm)

The DEP nighttime noise standard of 45 dBA, within 500 feet from residential receptors, is applicable from the hours of 7:00 pm to 7:00 am. Operational restrictions on wind turbines were analyzed using the adjusted sound model. To achieve compliance, Turbines 9, 10, and 11\* would be programmed to operate in noise restricted mode with all other turbines in normal operation mode (110 dBA maximum including a 5 dBA safety factor). See Figure 2. The maximum sound power outputs according to manufacturer specifications for these three turbines are as follows:

Turbine 9:	107.2 dBA maximum (including 5 dBA safety factor) – a 2.8 dBA reduction
Turbine 10:	107.2 dBA maximum (including 5 dBA safety factor) – a 2.8 dBA reduction
Turbine 11:	108.2 dBA maximum (including 5 dBA safety factor) – a 1.8 dBA reduction

\*Turbine numbers used here are the same as those used in the originally proposed layout submitted to the DEP. Because Spruce Mountain Wind plans to build only 10 turbines, Turbine 4 is not included in the sound level maps produced from the adjusted sound model. Turbine 11 is the northernmost turbine in the layout.

Period 3 – Nighttime Hours (10:00 pm – 7:00 am)

The DEP noise standard within 500 feet from receptors remains applicable from the hours of 7:00 pm to 7:00 am. In addition, The Town of Woodstock sound regulations are in effect from 10:00 pm to 7:00 am. The Town of Woodstock waiver at the Project property boundary allows for sound pressure level limits of 50 dBA at most of the boundary during these hours; it also allows for sound pressure level limits of 55 dBA in two select areas of the Project property boundary (see orange property lines on Figure 3). Operational restrictions on wind turbines were analyzed using the adjusted sound model. To achieve compliance with sound regulations during these operating hours, Turbines 9, 10, and 11 would be programmed to operate in noise restricted mode as in Period 2, above (from 7:00 pm to 10:00 pm); and Turbines 6, 7, and 8 would also be turned down. All other turbines would run in normal operation mode (110.0 dBA, including 5 dBA safety factor). See Figure 3. The maximum sound power outputs according to manufacturer specifications for these six turbines are as follows:

Turbine 6:	107.2 dBA maximum (including 5 dBA safety factor) – a 2.8 dBA reduction
Turbine 7:	107.2 dBA maximum (including 5 dBA safety factor) – a 2.8 dBA reduction
Turbine 8:	108.2 dBA maximum (including 5 dBA safety factor) – a 1.8 dBA reduction
Turbine 9:	107.2 dBA maximum (including 5 dBA safety factor) – a 2.8 dBA reduction
Turbine 10:	107.2 dBA maximum (including 5 dBA safety factor) – a 2.8 dBA reduction
Turbine 11:	108.2 dBA maximum (including 5 dBA safety factor) – a 1.8 dBA reduction

Received sound pressure levels at 500 feet from receptors for all three operating periods are summarized in Table 1. The tabulated results and attached contour plots are independent of the existing acoustic environment (i.e. they are representative of Project-generated sound levels only).

Table 1 Summary of Spruce Mountain Wind Turbine Acoustic Model Output at Receptors (dBA)

Receptor ID	Receptor		Closest Wind Turbine UTM Coordinates (m)		Closest Wind Turbine No.	Distance (feet)	Sound Pressure Levels (dBA) within 500 Feet of Receptor		
	UTM Coordinates (m)		Easting	Northing			Period 1 7am to 7pm	Period 2 7pm to 10pm	Period 3 10pm to 7am
	Easting	Northing							
1	377,928	4,919,830	376,545	4,920,113	11	4137	40	38	38
2	378,076	4,919,730	376,545	4,920,113	11	4685	39	38	37
3	378,119	4,919,740	376,545	4,920,113	11	4813	40	38	38
4	378,032	4,919,741	376,545	4,920,113	11	4531	40	38	38
5	378,139	4,919,743	376,545	4,920,113	11	4879	39	38	37
6	378,003	4,919,752	376,545	4,920,113	11	4432	40	38	38
7	377,652	4,920,260	376,545	4,920,113	11	3169	40	38	37
8	377,510	4,919,923	376,545	4,920,113	11	2749	42	40	40
9	377,593	4,920,069	376,545	4,920,113	11	2940	41	39	39
10	377,336	4,920,174	376,545	4,920,113	11	2103	43	41	41
11	377,309	4,919,808	376,545	4,920,113	11	2195	44	42	42
12	376,993	4,919,545	376,449	4,919,921	10	1686	47	45	45
13	377,864	4,920,027	376,545	4,920,113	11	3832	40	38	38
14	377,830	4,919,975	376,545	4,920,113	11	3740	40	38	38
15	378,022	4,920,404	376,545	4,920,113	11	4446	39	38	37
16	378,145	4,920,342	376,545	4,920,113	11	4806	39	38	37
17	377,579	4,920,348	376,545	4,920,113	11	2982	40	38	38
18	377,627	4,920,061	376,545	4,920,113	11	3081	41	39	38
19	378,098	4,919,738	376,545	4,920,113	11	3356	40	38	38
20	377,708	4,920,284	376,545	4,920,113	11	4003	39	37	37
21	377,902	4,919,961	376,545	4,920,113	11	4741	40	38	38
22	377,869	4,920,104	376,545	4,920,113	11	3845	40	38	38

The results of the original acoustic assessment submitted on January 14, 2010 indicated that the Project was designed to operate in compliance with the applicable limits prescribed by the Maine DEP regulations on Control of Noise (06-096 CMR 375.10) and the local Town of Woodstock noise ordinance and waivers. While the original acoustic modeling was conducted in accordance with generally accepted practices, we have adjusted the original model to incorporate additional safety factors at the Department's request. The results of the revised sound assessment employing a higher safety factor indicate that the Project will operate in compliance with applicable noise regulations when certain turbines are run in reduced sound power mode.

Spruce Mountain Wind will actively work with the Department in designing and executing an operational sound monitoring program. If DEP requires that we operate according to the reduced-sound-power levels described above, Spruce Mountain Wind requests that any post-construction sound monitoring plan includes a provision to demonstrate compliance with some or all of the six turbines noted in Periods 2 and 3 set in the normal operating mode (i.e., without reduced sound-power restrictions). Should the project demonstrate compliance in the normal operating mode, we request that any reduced sound-power conditions in the permit be revised or terminated. Spruce Mountain Wind would monitor sound levels within one year following any such permit modification to ensure that sound regulations are continuing to be met.

If required to run in reduced-sound-power mode, the turbines for the Spruce Mountain Wind Project would be "locked" by the manufacturer, Gamesa, to operate at the reduced noise levels outlined in this memo. Spruce Mountain Wind would not have the capability to adjust the sound level output of the turbines at will. Gamesa would be authorized to adjust the sound power output of the turbines only with advanced notice from the Department.

You also requested additional information concerning the potential for impacts related to short duration repetitive sounds (SDRS), particularly during worst-case meteorological conditions. Attached to this letter is a separate discussion of SDRS for the Spruce Mountain Wind project (Attachment C, Spruce Mountain Short Duration Repetitive Sounds Memorandum).

Warren, thank you again for providing your insight, and we look forward to working further with you should you have additional questions. Please feel free to contact me if you have any further questions. I can be reached by telephone at 207-240-0907 or via email at [rob.mitchell@tetrattech.com](mailto:rob.mitchell@tetrattech.com).

Sincerely,



Rob Mitchell  
Project Manager

cc: Tricia Pellerin (TetraTech EC, Inc.)  
Marybeth Richardson (Maine DEP)  
Dawn Hallowell (Maine DEP)  
Andy Novey (Spruce Mountain Wind, LLC)  
Todd Presson (Spruce Mountain Wind, LLC)

**Figures 1, 2 and 3:**

**Spruce Mountain Wind Project – Gamesa G90 2.0 MW  
Received Sound Levels**

**Figure 1: Period 1 (7 AM – 7 PM)**

**Figure 2: Period 2 (7 PM – 10 PM)**

**Figure 3: Period 3 (10 PM – 7 AM)**

SPRUCE MOUNTAIN WIND, LLC  
 SPRUCE MOUNTAIN WIND PROJECT  
 OXFORD COUNTY, MAINE  
 FIGURE 1 - 7AM TO 7PM  
 GAMESA G90 - 2.0 MW  
 RECEIVED SOUND LEVELS:  
 WTGS AT MAXIMUM ROTATION

12/19

NOTES: ALL TURBINES AT 110.0 DBA  
 (INCLUDES ORIGINAL 2 DBA SAFETY FACTOR +  
 ADDITIONAL 3 DBA ADDED TO NOISE OUTPUT)

JULY 2010



**Legend**

- Turbine Location  
(based on 10-26-09 layout)
- Receptor
- Maine DEP limit of 55 dBA  
up to 500 feet from a residence
- Town of Woodstock dBA Limits  
at Project Property Boundaries
- Commercial Use: 65dBA
- Residential Use: 55dBA
- Sound Level Ranges (dBA)**
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- >50
- 55 dBA Isopleth

0 0.125 0.25 0.5 Miles



TETRA TECH EC, INC

**REFERENCE MAP**



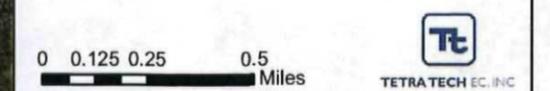
SPRUCE MOUNTAIN WIND, LLC  
 SPRUCE MOUNTAIN WIND PROJECT  
 OXFORD COUNTY, MAINE  
 FIGURE 2 - 7PM TO 10PM  
 GAMESA G90 - 2.0 MW  
 RECEIVED SOUND LEVELS:  
 WTGS AT MAXIMUM ROTATION  
 NOTES: TURBINES 9 AND 10 AT 107.2 DBA  
 TURBINE 11 AT 108.2 DBA  
 ALL OTHER TURBINES AT 110.0 DBA  
 (INCLUDES ORIGINAL 2 DBA SAFETY FACTOR +  
 ADDITIONAL 3 DBA ADDED TO NOISE OUTPUT)  
 JULY 2010

1220



**Legend**

- Turbine Location (based on 10-26-09 layout)
- Receptor
- Maine DEP limit of 45 dBA up to 500 feet from a residence
- Town of Woodstock dBA Limits at Project Property Boundaries
  - Commercial Use: 65dBA
  - Residential Use: 55dBA
- Sound Level Ranges (dBA)**
  - 30 - 35
  - 35 - 40
  - 40 - 45
  - 45 - 50
  - >50
  - 55 dBA Isopleth



**REFERENCE MAP**



**SPRUCE MOUNTAIN WIND, LLC**  
**SPRUCE MOUNTAIN WIND PROJECT**

OXFORD COUNTY, MAINE

FIGURE 3 - 10PM TO 7AM  
 GAMESA G90 - 2.0 MW 1221  
 RECEIVED SOUND LEVELS:  
 WTGS AT MAXIMUM ROTATION

NOTES: TURBINES 6, 7, 9 AND 10 AT 107.2 DBA  
 TURBINES 8 AND 11 AT 108.2 DBA  
 ALL OTHER TURBINES AT 110.0 DBA  
 (INCLUDES ORIGINAL 2 DBA SAFETY FACTOR +  
 ADDITIONAL 3 DBA ADDED TO NOISE OUTPUT)



**Legend**

- Turbine Location (based on 10-26-09 layout)
- Receptor
- Maine DEP limit of 45 dBA up to 500 feet from a residence

Town of Woodstock dBA Limits at Project Property Boundaries

- - - Commercial Use: 55dBA
- Residential Use: 50dBA (by waiver)
- Residential Use: 55dBA (by waiver)

**Sound Level Ranges (dBA)**

- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- >50
- 55 dBA Isopleth

0 0.125 0.25 0.5 Miles

TETRA TECH EC, INC

**REFERENCE MAP**

