ATTORNEY GENERAL
DEPARTMENT OF JUSTICE

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CONCORD, NEW HAMPSHIRE 03301-6397

MICHAEL A. DELANEY
ATTORNEY GENERAL

[redacted]

March 31, 2011

NH Site Evaluation Committee
c/o Jane Murray, Secretary
29 Hazen Drive, PO Box 95
Concord, New Hampshire 03301-0095

Re: Application of Groton Wind, LLC
Docket No. 2010-01

Dear Ms. Murray:

In accordance with the representation and agreements made on the record by Counsel for the Public on November 3, 2010 enclosed is the original and three copies of the Addendum dated November 12, 2010 to the Supplemental Testimony of Gregory Tocci. See Trans., day 3, PM at 84.

Thank you for your attention to this matter.

Very truly yours,

Manuela Perry
Paralegal II
Environmental Protection Bureau
(603) 271-3679

/MP
Enclosure

THE STATE OF NEW HAMPSHIRE
SITE EVALUATION COMMITTEE

In the matter of the	)	
Application for Certification	)	
Pursuant to RSA 162-H of	)	**Docket No. 2010-01**
GROTON WIND LLC	)	
	)	

ADDENDUM to Supplemental Pre-Filed Testimony
Gregory C. Tocci, INCE Bd. Cert., FASA, F-INCE
Cavanaugh Tocci Associates, Inc.
Sudbury, Massachusetts
October 22, 2010 (Addendum November 12, 2010)

Q. Please state your name, position, and business address.

A. Gregory C. Tocci. I am a Senior Principal Consultant with and President of Cavanaugh Tocci Associates, Inc., 327 F Boston Post Road, Sudbury, Massachusetts. My qualifications have not changed since my pre-filed direct testimony.

Q. On whose behalf are you testifying?

A. I am testifying on behalf of the Attorney General of the State of New Hampshire pursuant to RSA 162-H:10 to assist Counsel for the Public and the Committee with the review of acoustics-related information pertaining to the proposed Groton Wind LLC project.

Q. What is the purpose of your supplemental pre-filed testimony?

A. The purpose of my testimony is to summarize the results of sound measurements conducted during October 2010, to describe methods for analyzing collected data, to evaluate potential noise impacts on nearby residential type uses produced by the operation of the

proposed Groton Wind Farm, and to discuss additional information on infrasound and ultrasound.

Q. When and how did you monitor sound levels?

A. Sound levels were continuously monitored in 10-minute intervals beginning mid-day, Monday, October 4 and continuing to mid-day, Tuesday, October 19, 2010. The Rion NL-31 sound monitors used were calibrated before use and installed with wind screens. Sound level data were recorded by each instrument onto a flash card that was removed from each unit and downloaded into a PC.

Q. Where did you monitor sound levels in October 2010?

A. Sound level monitoring was conducted at Epsilon locations 1 (Halls Brook Road), 2 (Groton Hollow Road), 4 (Tenney Mountain Ski area), and at Campsite 31 at Baker River Campground. I have designated this last location as location 7 in my discussions.

Q. Why did you monitor sound levels at locations 1, 2, and 4 as Epsilon Associates previously monitored sound levels at these locations?

A. On my review of measured sound level data described in "Sound Level Assessment Report, Groton Wind Farm, Groton, NH" dated January 14, 2010 by Epsilon Associates, it appeared to me that locations 1, 2, and 4 might have been influenced by insect and/or water flow sound. During mid-winter months background sounds would typically be lower than during summer and fall months. Accordingly, I recommended that sound levels should be re-monitored during mid-winter months. However, in the interest of expediting consideration of this application, we agreed to conduct sound monitoring prior to the October 22, 2010 submission deadline, believing that insect sound would be abated. It was also

hoped that lower water flow sound, as would be expected during mid-winter conditions, might be replicated by relocating ~~the~~ my firm's monitors further from water flow sources than did Epsilon in their August 2009 monitoring.

Q. Why was location 7 at Baker River Campground added?

A. Location 7 was added at the request of the Baker River Campground owner who argued that her property has special sensitivity beyond that customary for residential areas. Moreover, tent campers do not obtain the same level of sound isolation afforded by residential structures to those living inside. The existing quiet environment of the campground is an important attribute that attracts those wishing a quiet woodland experience. She has indicated that noise produced by the Groton Wind Farm might diminish that attribute and adversely impact her business.

Q. Please describe the data that you collected.

A. Monitors were programmed to measure several 10-minute interval A-weighted sound level descriptors. These descriptors include the A-weight 90th percentile (L_{90}) sound level of primary interest in this study. Monitored L_{01}, L_{90}, and L_{eq} sound levels are reported in Figures 1a through 1d. These figures also report wind speed in 20-minute intervals, and the presence of precipitation if any, as reported by the nearest weather station—Plymouth Airport, Plymouth, New Hampshire (K1P1). ~~Since the~~The airport is located 1½ miles east of Baker River Campground. ~~several miles from monitoring locations, I have not explored a relationship between airport wind speed and monitored sound levels.~~

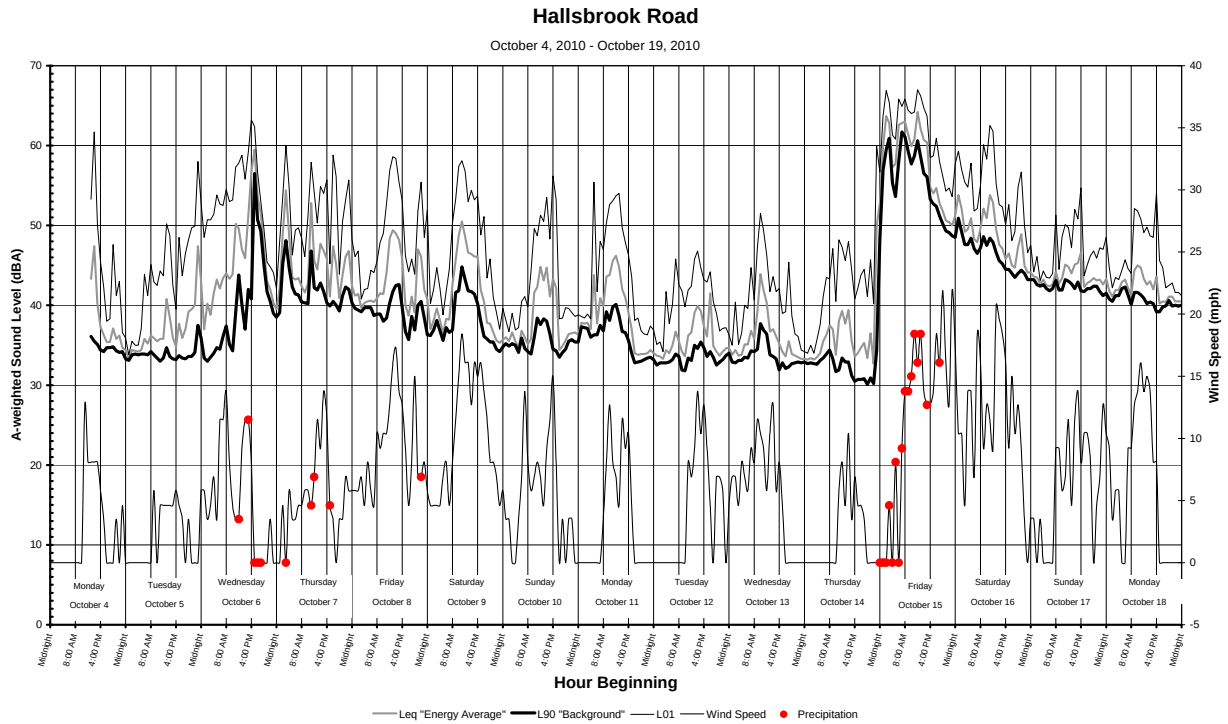

Figure 1a. Sound monitoring data—Epsilon Location 1 Halls Brook Road—
October 4 to 19, 2010
Proposed Groton Wind Farm, Groton, New Hampshire

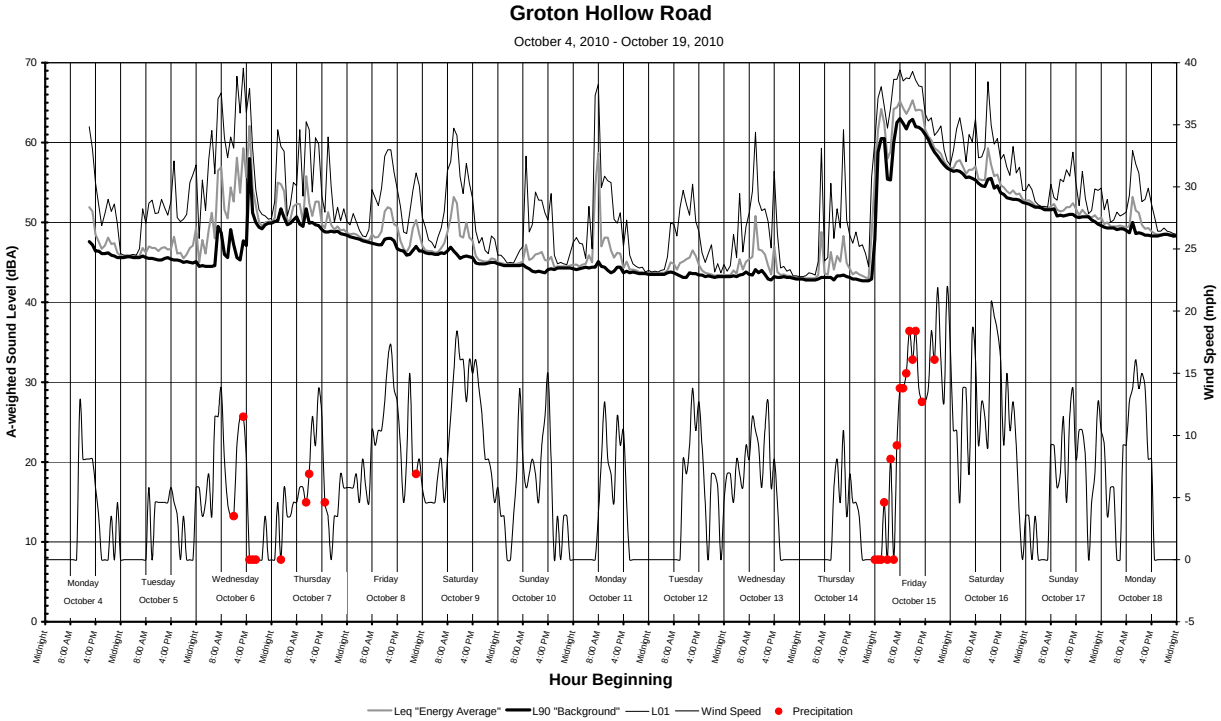

Figure 1b. Sound monitoring data—Epsilon Location 2 Groton Hollow Road—October 4 to 19, 2010
Proposed Groton Wind Farm, Groton, New Hampshire

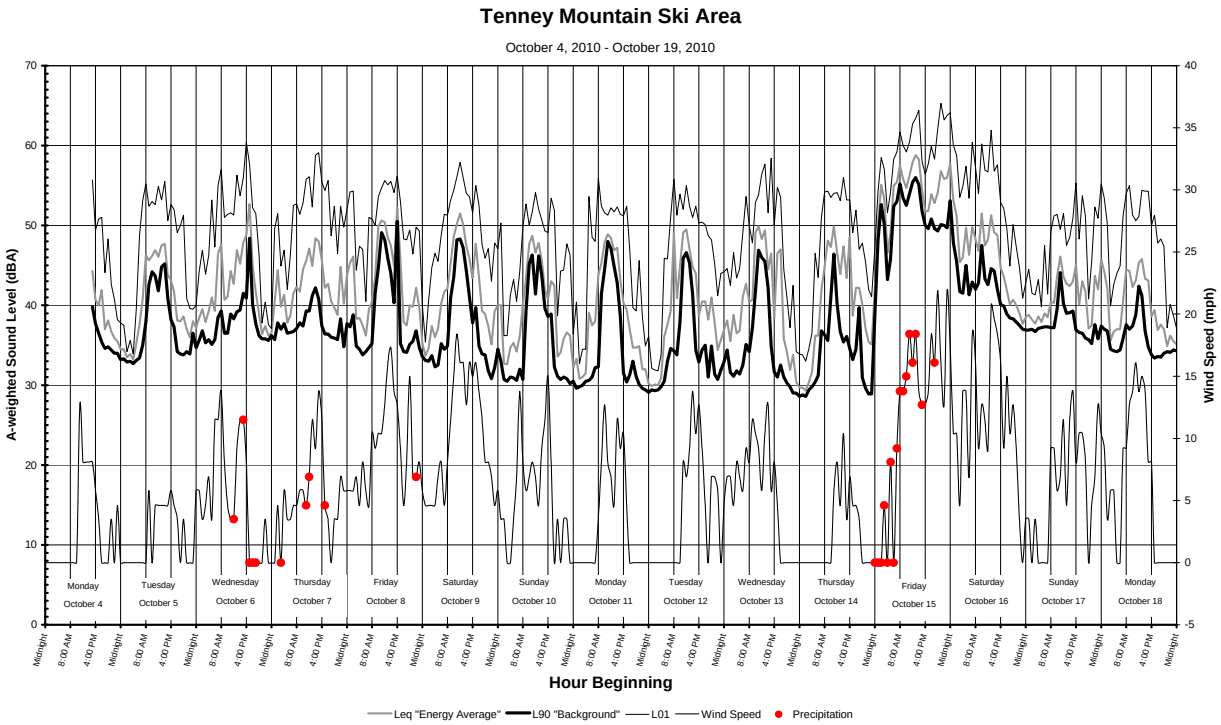

Figure 1c. Sound monitoring data—Epsilon Location 4 Tenney Mountain Ski Area—October 4 to 19, 2010
Proposed Groton Wind Farm, Groton, New Hampshire

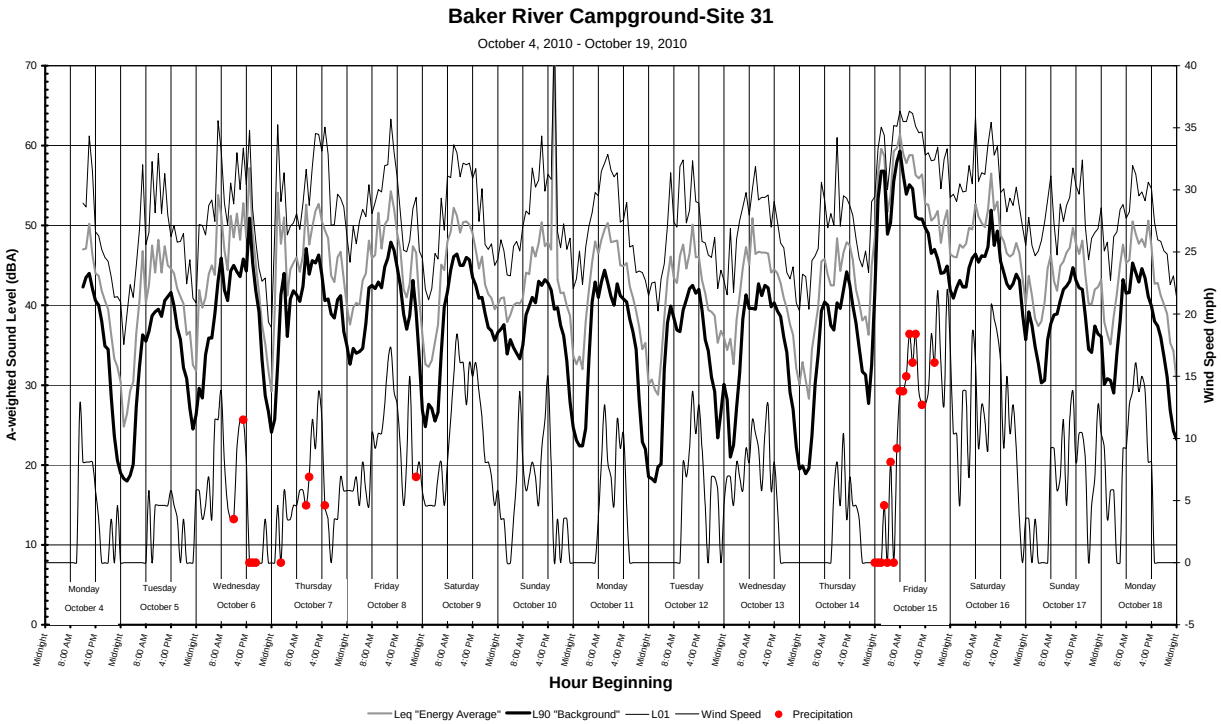

Figure 1d. Sound monitoring data—CTA designated Location 7 Baker River Campground (Campsite 31)—October 4 to 19, 2010
Proposed Groton Wind Farm, Groton, New Hampshire

Q. What are the L_{01}, L_{90}, and L_{eq} sound levels?

A. The 90th percentile sound level, i.e. the L_{90}, is the background or residual sound level in an area and is the lowest level of sound typically occurring. It is the A-weighted sound level exceeded 90% of each time interval monitored. The equivalent sound level (L_{eq}) is the energy average sound level for each time interval monitored. The first percentile sound level, i.e. the L_{01}, is the sound level exceeded one percent of each time interval monitored and is representative of the highest sound levels reached ~~in each hour~~during each time interval monitored.

Q. What have you concluded regarding sound levels that you monitored during October 2010 at each of the four locations?

A. The following are my observations and conclusions:

~~a.Background sound in Halls Brook Road area (Epsilon Location 1) is dominated by water flow sound. Because of the quantity of water flowing I am not certain that sound levels would be appreciably lower mid-winter. I also observed that the original Epsilon monitoring location in this area was the quietest without being far removed from existing residences in this area. The baseline sound level of 32.9 dBA that I determined from the October 2010 measurements is nearly 2 dBA higher than 31.1 dBA sound level measured by Epsilon in August 2009.~~

~~b.~~a. Background sound at ~~Groton Hollow~~Halls Brook Road (Epsilon Location ~~2~~1) appears to be dominated by foliage sound ~~not~~ and, to a lesser extent, water flow sound. To further minimize contributions of water flow sound, I located the CTA

monitor about 100 yards further up the access road to a point where I perceived that water flow sound was at a minimum, and slightly lower than perceived at the original Epsilon location. Further up the road from the CTA monitoring location water flow sound seemed to increase slightly. Mid-winter background sound levels may be lower in the area monitored. The baseline I determined from sound levels measured in October 2010~~,~~ is ~~43.2~~32.9 dBA, about ~~3~~ 2 dBA higher than the ~~40.2~~31.1 dBA baseline I determined using sound levels measured by Epsilon in August 2009.

b. Background sound in Groton Hollow Road area (Epsilon Location 2) is dominated by water flow sound. Because of the quantity of water flowing, I am not certain that sound levels would be appreciably lower mid-winter. I also observed that the original Epsilon monitoring location was the quietest without being far removed from existing residences in this area. The baseline sound level of 43.2 dBA that I determined from the October 2010 measurements is 3 dBA higher than 40.2 dBA baseline sound level that I determined using sound levels measured by Epsilon in August 2009.

c. Background sound at Tenney Mountain Ski Area (Epsilon Location 4) was dominated by insect sound. Despite the insect activity, the baseline sound level that I determined from data measured in October 2010 is 30.8 dBA, about 6 dBA lower than the 36.5 dBA baseline sound level that I determined using sound levels

measured by Epsilon in August 2009. The baseline sound level would be even lower during the winter when insect activity has been completely abated.

d. Background sound levels at the Baker River Campground (CTA designated Location 7) were monitored at Campsite 31. This location is 175 feet from the river and 960 feet from Route 25 across the river. The baseline sound level determined (the 90th percentile of the L_{90} sound levels) is 24.8 dBA. This is much lower than monitored at other locations and is the result of very low sound levels typically occurring between midnight and 3:00 AM.

Q. You have referred to a "baseline sound level." What is a baseline sound level and how are you defining it?

A. The baseline sound level is used to characterize the existing environment at its typically quietest. Sound impact is the amount by which Groton Wind Farm sound levels exceed this baseline. In analyzing data provided in the Epsilon report, I have defined the baseline sound level as the higher of the 90th percentile of the L_{90} A-weighted sound levels occurring at measurement locations when the wind velocity at the Epsilon met station exceeded 9.7 m/s at hub-height and the 90th percentile of the entire data population without respect ~~for~~ to wind speed.

Q. Did Epsilon Associates define a similar baseline sound level?

A. Yes they did.

Q. What was that baseline?

A. Epsilon defined the baseline sound level as the lower of the average and median L_{90} A-weighted sound levels occurring at measurement locations when the wind velocity at their met station exceeded 9.7 m/s at hub-height.

A. By how much does your baseline sound level determined from the Epsilon data collected in August 2009 vary from that determined by Epsilon Associates?

Q. Our recommended baseline ranged between 0.5 dBA and 10 dBA lower than that determined using the method employed by Epsilon. The discrepancy between Epsilon's baseline and my baseline in part results from the negligible correlation between wind speed as measured at the met tower and L_{90} A-weighted sound levels measured at study locations. Epsilon's method for determining a baseline is reasonable, but requires good correlation between wind speed and measured background sound levels, which was not the case.

Q. Can you summarize your evaluation of Epsilon and your own data using the baseline sound level has you have defined it?

A. Yes. The summary is presented in Table 1.

1	2	3	4	5	6
Receptor	Table 7-2 Wind Farm Only (All Turbines) (dBA)	Tocci Baseline Sound Level (dBA)	Total: Wind Farm +Baseline (dBA)	Increase Over Baseline (dBA)	Comments
Monitored by Epsilon August 6-21, 2009					
1 – Halls Brook Rd	39.0	31.1	39.7	8.6	Background dominated by water flow noise
2 – Groton Hollow Rd	38.3	40.2	42.4	2.2	Suspected water flow noise
3 – Plain Jane's Diner	31.7	40.3	40.9	0.6	
4 – Tenney Mtn Ski Area	34.6	36.5	38.7	2.2	Suspected insect or other constant noise source
5 – NH Audubon Society	23.4	22.3*	25.7	3.8	
6 – Groton Town Hall	28.8	25.9	30.6	4.7	
Monitored by Cavanaugh Tocci Associates, Inc. October 4-19, 2010					
1 – Halls Brook Rd	39.0	32.9	40.0	7.1	Location slightly further up road from where Epsilon completed August 2010 measurements. Water flow noise sometimes barely audible. Distant traffic audible, but probably does not affect L_{90}. L_{90} probably dominated by foliage and other indigenous sound. ~~Water flow sound dominates. Representative of nearly all residences which are near or on river bank.~~
2 – Groton Hollow Rd	38.3	43.2	44.4	1.2	Water flow sound dominates. Representative of nearly all residences which are near or on river bank.~~Location slightly further up road from where Epsilon completed August 2010 measurements. Water flow noise sometimes barely audible. Distant traffic audible, but probably does not affect L_{90}. L_{90} probably dominated by foliage and other indigenous sound.~~
4 – Tenney Mtn Ski Area	34.6	30.8	36.1	5.3	Insect sound dominates L_{90}. Sound levels would be lower in the winter.
7 – Baker River Campground	~~36~~32-~~38~~ 33 (est.)	24.8	~~36~~33-~~38~~34	~~12~~8-~~13~~9	During the day, Route 25 traffic and foliage noise appear to have dominate L_{90}.

*The original table provided in our response to data request was 21.9 dBA instead of 22.3 dBA as it should be to conform to our recommended method for determining a baseline.

**As wind data at the original met tower location was not available, the baselines shown for October 2010 measured sound levels is the 90th percentile of the L_{90} data measured over the 14 day period.

Table 1. Summary of Epsilon (August 2009) and Cavanaugh Tocci Associates, Inc. (CTA, October 2010) sound measurements
Proposed Groton Wind Farm, Groton, New Hampshire

Column 1 is the measurement location. These are the six locations used by Epsilon and the additional seventh location at Baker River Campground. Column 2 is the Groton Wind Farm sound level provided in the Epsilon report. I have estimated the range given for Baker River Campground from the sound contour plot in Figure 7-1 of the Epsilon report. Column 3 is the baseline determined from Epsilon data and my data using the method I have previously described for determining the baseline sound level. Column 4 is the logarithmic sum of the baseline and the Groton Wind Farm sound levels. Column 5 is the arithmetic difference between the values in column 4 and column 3, i.e. the total sound level in column 4 minus the baseline in column 3.

Q. Using the data in Table 1, how would you evaluate the potential sound impact of Groton Wind Farm?

A. To evaluate the potential impact of Groton Wind Farm sound as presented in Table 1, I would apply the following two criteria:

1. Amount that computed Groton Wind Farm sound exceeds the CTA determined baseline sound level:

   5 dBA—No Impact

   10 dBA—Minor Impact

   >10 dBA—Significant Impact

2. In addition, computed Groton Wind Farm sound should not exceed 40 dBA at residential uses.

Criterion 1 in our opinion will guard against most complaints of modulated and low frequency sound, as well as sound in the audible range. Criterion 2 is the WHO Night Noise

Guideline proposed in Night Noise Guidelines for Europe and cited by Acoustic Ecology Institute as the level at which "*A dramatic increase in the proportion of people annoyed by turbine noise took place when the noise was over 40dB(A); here, 25-45% reported annoyance in rural settings.*"1

Q. You have said that your criteria would guard against "modulated broadband sound." What is this and how do you expect that your criteria will provide protection against it?

A. Modulated broadband sound is often described as a "swooshing" sound. When wind turbine sound levels are not more than 5 dBA above background the broadband modulation if it is present, which from the literature is more often *not* present, is greatly reduced, i.e. masked by background sound.

Q. You have said that your criteria would guard against "infrasound." What is infrasound and how do you expect that your criteria will provide protection against it?

A. Infrasound is sound occurring below 20 Hz. Again, holding A-weighted sound levels to a low level, as the criteria intend to do, minimizes the corresponding level of infrasound as well.

Q. What is your evaluation applying your criteria?

A. My evaluation of impact at the seven locations based on data in Table 1 and by implementing the two criteria that I have suggested is provided in Table 2:

[1] Wind Farm Noise: 2009 in Review--research, public concerns, and industry trends, The Acoustic Ecology Institute. http://www.acousticecology.org/docs/AEI_WindFarmNoise_2009inReview.pdf

Location	Noise Impact (Criterion a)	Computed Groton Wind Farm sound level (dBA) (Criterion b)
1 – Halls Brook Rd	Minor impact	Below 40 dBA
2 – Groton Hollow Rd	No impact	Below 40 dBA
3 – Plain Jane's Diner	No impact	Below 40 dBA
4 – Tenney Mtn Ski Area	No impact (may be minor impact in the winter because of lower background sound levels)	Below 40 dBA
5 – NH Audubon Society	No impact	Below 40 dBA
6 – Groton Town Hall	No impact	Below 40 dBA
7 – Baker River Campground	~~Significant~~ Minor Impact (on the basis of my interpolation of Groton Wind Farm sound level contours in Figure 7-1 of the Epsilon report)	Below 40 dBA

Table 2. Noise impact assessment
Proposed Groton Wind Farm, Groton, New Hampshire

Q. Can you provide a verbal description?

A. Briefly, at study locations 1-6 Groton Wind Farm sound will be intermittently but barely audible during the day. At night Groton Wind Farm sound would be minimally audible during quiet interludes that can be lengthy depending on activity in the area. As Groton Wind Farm sound levels fall below the second criterion at all locations most people will find them acceptable. However, those who live in this area specifically for its quiet character may be annoyed by Groton Wind Farm sound. At location 7, Baker River Campground, Groton Wind Farm sound will be ~~the dominant~~a major feature of the acoustical environment for 1 to 3 hours at night beginning at mid-night. However, outside this time frame, wind turbine sound would be intermittently audible.

Q. Do you have any new information regarding infrasound?

A. Figure 2a is a collection of low frequency sound criteria cited in the literature as indicated.

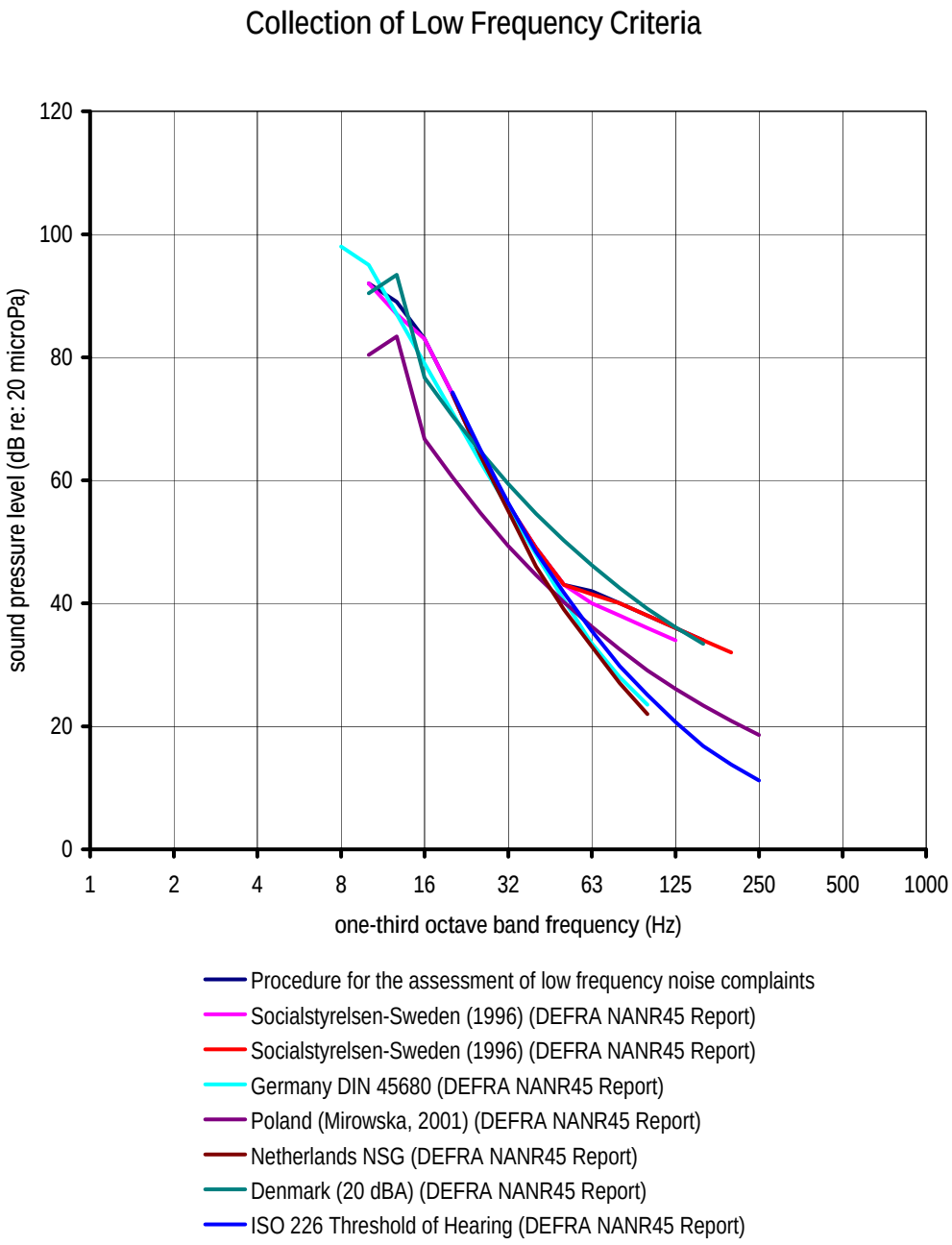

Figure 2a. Range of low frequency criteria

In his supplemental pre-filed testimony dated October 12, 2010, Robert O'Neal introduces a reference to a 2010 NOISECON proceedings paper, co-authored by himself and others, reporting measured infrasound levels in one-third octave bands for what he indicates is a similar wind turbine (Siemens SWT-2.3-93) to those proposed for Groton Wind Farm. Figure 2b compares sound levels measured by the authors of the NOISECON 2010 proceedings paper reporting sound levels for the Siemans wind turbine at a distance of 305 m indicated by Mr. O'Neal as being of comparable size and type to those propose for use at Groton Wind Farm.

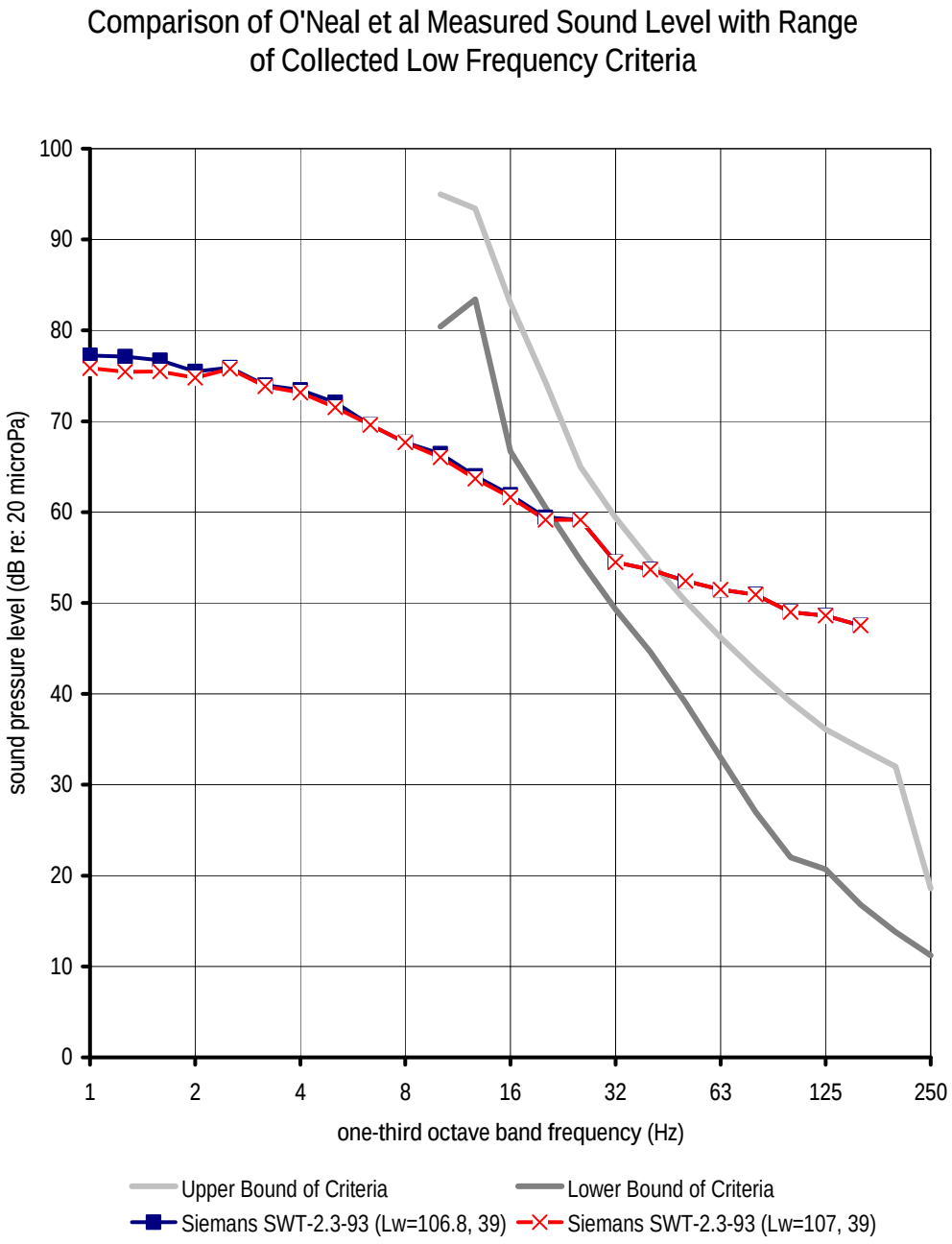

Figure 2b. Comparison of Siemans wind turbine sound at 305 m with range of collected low frequency sound level criteria.

Q. What implications does this new information have regarding the proposed Groton Wind Farm?

A. The data presented in the NOISECON 2010 paper have been mentioned to be for a wind turbine comparable to the type wind turbine proposed for Groton Wind Farm. If this is the case the data suggests that wind turbine infrasound will be acceptable at receptor locations, most of which are located further than 305 m from Groton Wind Farm turbines.

Q. In his supplemental pre-filed testimony dated October 12, 2010, Mr. O'Neal indicates, *"…because there are no evaluative criteria for modulated broadband sound, Mr. Tocci's suggestion that it should be addressed in the applicant's sound reports is unfounded."*

A. I agree that there are no applicable criteria for modulated broadband sound often cited as being produced by wind turbines. However, there being no applicable criteria is not an argument for leaving it unexplored, especially as it is a widely cited phenomenon.

Q. What is ultrasound and what impact might it have at receptor locations?

A. Ultrasound is sound at frequencies higher than the normal range of human hearing that nominally extends from 20 to 20,000 Hz. Ultrasound sound at frequencies above 20,000 Hz is not normally perceptible to humans and is rapidly absorbed by the atmosphere along its propagation path at an approximate rate of 0.5 dB/m. Moreover, we are not aware of any mechanism in a wind turbine that can generate ultrasound. Hence, ultrasound is not an environmental impact issue with respect to the operation of the proposed Groton Wind facility.

Q. Does this complete your supplemental pre-filed testimony.

A. Yes.