

**STATE OF VERMONT
PUBLIC SERVICE BOARD**

Docket No. 7156

Petition of UPC Vermont Wind, LLC, for a)
Certificate of Public Good, pursuant to 30 V.S.A.)
§ 248, authorizing the construction and operation)
of a 52 MW wind electric generation facility,)
consisting of 26 wind turbines, and associated)
transmission and interconnection facilities, in)
Sheffield and Sutton, Vermont)

October 14, 2015

**COMMENTS OF THE DEPARTMENT OF PUBLIC SERVICE IN RESPONSE TO
PAUL BROUHA/RIDGE PROTECTORS' REQUEST FOR RELIEF FROM
WIND TURBINE NOISE PURSUANT TO
CONDITION NINE OF THE CERTIFICATE OF PUBLIC GOOD**

The Department of Public Service (“Department” or “DPS”), by and through undersigned counsel, submits the following comments to the Public Service Board (“Board” or “PSB”) in response to the request of Paul Brouha, on behalf of Ridge Protectors, for “relief from wind turbine noise pursuant to Condition #9 of the Certificate of Public Good,” (“Relief Request”) filed on March 3, 2014 in the above-referenced proceeding. See Letter from Paul Brouha to Susan Hudson, Clerk of PSB, *re Docket 7156 – Request for relief from wind turbine noise pursuant to Condition #9 of the Certificate of Public Good*, Feb. 28, 2014. The Department concludes, after extensive review of Mr. Brouha’s request and undertaking its own sound measurements and analysis, that the outdoor-to-indoor sound attenuation findings of Mr. Brouha’s sound consultant under windows fully open conditions are reasonable, and indoor sound pressure levels at the Brouha residence may have been within 3 dBA of the Sheffield Wind Project (“Project”) Certificate of Public Good (“CPG”) sound during the 2012 Project quarterly monitoring sessions. As a result, the Department recommends that the Board open an

investigation in response to the Relief Request. However, the relevant CPG conditions are not sufficiently detailed to be enforceable, absent further clarification and guidance from the Board.

BACKGROUND

On August 8, 2007, the Board Issued a CPG and final order approving the Project. The Project CPG contains three (3) conditions related to noise associated with Project operation:

8. UPC shall construct and operate the Project so that it emits no prominent discrete tones pursuant to the American National Standards Institute (ANSI) standards at the receptor locations, and indoor sound levels at any King George School structure and any surrounding residences do not exceed 30 dBA(Leq)(1).

9. In the event noise from operation of the Project exceeds the maximum allowable levels, UPC shall take all remedial steps necessary to bring the sound levels produced by the turbine(s) into compliance with allowable levels, including modification or cessation of turbine(s) operation.

10. UPC shall submit to the Board for review and approval a noise monitoring plan to be implemented during the first full year of operation. The Plan shall establish a monitoring program to confirm under a variety of seasonal and climactic conditions compliance with the maximum allowable sound levels described above.

Docket 7156, *Certificate of Public Good Issued Pursuant to 30 V.S.A. Section 248*, dated Aug. 8, 2007 at 2.¹

The Board approved Vermont Wind, LLC's ("Vermont Wind") revised Noise Monitoring Plan ("Monitoring Plan"), submitted pursuant to Project CPG Condition 10, on September 20, 2010.

See *PSB Order Re Compliance Filings*, Sept. 20, 2010 at 1-3; *Revised Noise Monitoring Plan, Sheffield Wind Project*, May 26, 2010. The Monitoring Plan states that interior sound levels will be calculated from exterior sound and attenuation measurements. *Monitoring Plan* at 3. Outside

¹ Condition 8 of the Project CPG dated August 8, 2007 initially required the Project to operate below 30 dBA using 24 hour day-night averaging (Ldn). The Board later amended Condition 8 to utilize one hour averaging (Leq)(1) in response to concerns raised by the petitioner and the Department. See *Order Re Motions and Requests for Modification, Amendment, Clarification and Correction*, Oct. 1, 2007 at 3-6.

to inside level reduction (“OILR”) testing was to take place during the first quarterly sound survey pursuant to ASTM E966-04 field measurement procedures at each of the four proposed monitoring locations, and testing was to be performed “under both windows open and windows closed conditions, weather permitting.” *Id.* at 3, FN 4. Mr. Brouha’s residence is located approximately 5,000 feet from the closest monitoring location, a vacant dormitory at the King George School (“SM3”).

Hessler Associates, Inc. (“Hessler”) conducted the first quarterly monitoring session, on behalf of Vermont Wind, from January 18 to February 1, 2012. Hessler conducted OILR testing at two of the monitoring locations, including the SM3 location. See Hessler Associates, Inc., *Operational Sound Level Compliance Test, Wintertime Conditions* (“Wintertime Sound Report”), Feb. 27, 2012 at 7. The Wintertime Sound Report concluded that the final OILR value at the SM3 receptor was 33 dBA, resulting in an indoor nominal Leq project sound level maximum of 20 dBA(Leq). *Id.* at 32, 36.

On March 6, 2013, Mr. Brouha filed a motion requesting an order from the Board to require Vermont Wind to conduct sound monitoring and OILR measurements – with windows closed and open – at his residence, and “relief from wind turbine noise.” See Letter from Paul Brouha to Susan Hudson, Clerk of PSB, *re: Docket 7156 – Request for CPG compliance by Vermont Wind and for relief from wind turbine noise*, Mar. 5, 2013; see also Letter from Paul Brouha to Susan Hudson, Clerk of PSB, *re Docket 7156 – Response to Vermont Wind’s attorney’s letter of March 28, 2013 concerning the outside-to-inside noise testing*, Apr. 1, 2013. The letter stated that, “[c]learly, the noise level reduction of 33 dBA reported on Page 36 is with the windows closed and no disclosure is made of noise level reductions with the windows open as ordered by the Board.” *Id.* at 3. Vermont Wind responded by explaining that “[t]he weather

during this testing period was extremely cold and windy. When the Outside to Inside Test was conducted at two residential structures, the windchill was below zero degrees with winds between 20-40 mph; clearly, conditions that were not conducive to open window testing.” Letter from Andrew Raubvogel, on behalf of Vermont Wind, to Susan Hudson, Clerk of PSB *re: Docket No. 7156 – Sheffield Wind Project*, Mar. 28, 2013 at 2.² On May 1, 2013, the Board denied Mr. Brouha’s motion by concluding, in part, that “Vermont Wind has, to date, complied with the requirements contained in the Noise Monitoring Plan.” *PSB Order re Motion for Relief*, May 1, 2013 at 3.

On March 3, 2014, Mr. Brouha filed his Relief Request with the Board. The Relief Request included a report entitled “Outside to Inside Attenuation at the Brouha Bedroom,” prepared by Les Blomberg of Noise Pollution Clearinghouse (“NPC Report”). The NPC Report reflects OILR measurements taken at a second story bedroom facing the Project at the Brouha residence using ASTM E966-04 procedures on May 2, 2012, and concludes that “[t]he attenuation was 1 dBA” under windows fully open conditions. NPC, *Outside to Inside Attenuation at the Brouha Bedroom*, Feb. 25, 2014 at 5. Mr. Brouha later filed a letter from

² The Department filed a letter with the Board on April 17, 2013, stating that “Vermont Wind’s decision not to conduct open window testing in sub-zero degree temperatures is reasonable and permitted under the revised Sound Monitoring Plan.” Letter from Aaron Kisicki, on behalf of DPS, to Susan Hudson, Clerk of PSB, *re Docket No. 7156 – Sheffield Wind Project – Board Request for Monitoring Comments*, Apr. 17, 2013 at 1. The Department made that conclusion based on its limited understanding of the ASTM E966-04 OILR procedures at the time. It has, though its investigation in the instant matter, become much more familiar with ASTM-compliant and industry standard OILR practices and procedures. The Department would now likely conclude that Vermont Wind’s failure to conduct windows open OILR testing due to cold temperatures was neither reasonable under the terms of the revised sound monitoring plan nor as a practical matter. The Department’s understanding now – which it did not have in early 2013 – is that the proper set up and calibration of outdoor “pink noise” sound source(s) and microphones requires the bulk of time and labor as part of the OILR testing process. The recording of interior levels, which requires “slowly sweeping the microphone mounted on a boom randomly throughout the volume of the room, maintaining at least 3 ft. from any surfaces” can be performed in ten minutes or less. Wintertime Sound Report at 4. Furthermore, the dormitories used as the SM3 monitoring site were vacant at the time of the OILR testing, as the King George School has closed at the end of the previous academic year. See Brouha to Hudson Letter, Mar. 1, 2013 at 3; Brouha to Hudson Letter, Apr. 1, 2013 at 2. Additionally, Hessler could have performed OILR measurements at the monitoring locations with windows open during any of the following three quarterly monitoring sessions, yet it chose not to perform any follow up testing.

acoustic consultants Cavanaugh Tocci Associates, Inc. (“Cavanaugh Tocci”), stating that the consultants had reviewed the NPC Report and found that Mr. Blomberg’s measurements and evaluation was “substantially in conformance with ASTM Standard Guide 966.” Letter from Brion Koning, on behalf of Cavanaugh Tocci, to Paul Brouha, Mar. 25, 2014 at 2.

The Department retained an independent sound expert, Jim Barnes of Acentech, to review the NPC Report and make recommendations for further steps. Mr. Barnes found that independent OILR testing at the Brouha residence was appropriate. See Letter from Aaron Kisicki, on behalf of DPS, to Susan Hudson, Clerk of PSB, *re Docket 7156 – Sheffield Wind Project – Brouha Complaint Status Update*, Jun. 6, 2014. Acentech representatives, including Mr. Barnes, performed OILR measurements on July 1, 2014 at the same bedroom used in the NPC Report. Mr. Blomberg from NPC and a representative from Cavanaugh Tocci witnessed Acentech’s measurement procedures. Representatives of Vermont Wind and/or Hessler were not present at the monitoring, despite voicing a desire to attend. Mr. Brouha would not allow Vermont Wind and/or Hessler representatives on his property. The results of Acentech’s OILR testing at the Brouha residence and analysis are reflected in the report dated September 25, 2015 and attached hereto as Attachment A (“Acentech Report”).

COMMENTS

The Acentech Report makes three salient findings: First, the NPC Report methodology used to gather and present attenuation data was flawed in several respects, despite arriving at an acceptable OILR value. Second, sound levels at the Brouha residence may be within 3 dBA of the Project CPG noise limit under certain attenuation conditions when compared to quarterly sound test data collected by Hessler in 2012, warranting additional monitoring under the

Monitoring Plan. Third, the Acentech Report illustrates the difficulty of enforcing the CPG noise conditions given the relative flexibility to choose key testing variables afforded by the current drafting of the CPG conditions, applicable Board orders, and the Vermont Wind Monitoring Plan. As a result, the Department acknowledges the potential for indoor sound levels approaching the CPG Condition 8 limit at the Brouha residence, and recommends that the Board initiate an investigation in response to Mr. Brouha's Relief Request. The Department is, however, unable to enforce the Project noise conditions as currently written with sufficient certainty to make objective determinations of CPG compliance.

NPC Test Results

The Department adopts the Acentech Report's findings related to the adequacy of the NPC Report's methodology. NPC took several unique steps when preparing the Brouha test room that appear to undermine the spirit of the CPG noise conditions, and fundamentally changed the nature of the attenuation test itself. NPC removed major furnishings from the test room, including a bed and an area rug, which changed the acoustic and sound absorption properties of the room. The Department interprets the CPG conditions to assume indoor testing conditions that reflect normal use of a residential room, not to necessarily create increased sensitivity at the test location. Removal of major furnishings would be consistent with testing for outdoor-indoor transmission loss; not OILR data sought for determining sound attenuation and CPG compliance. See Acentech Report, *re Vermont Wind/Sheffield Wind/Brouha Noise Complaint (PSB Docket 7156)*, Sept. 25, 2015 at 3-4.

ASTM E966-04 also makes clear that the repeatability standard deviation (i.e. the variation expected to occur when a test is repeated under nominally-identical conditions) of the

OILR test procedure is 2 to 4 dB. *Id.* at 4. The NPC Report made no mention of this variability in its report. The Acentech Report arrived at OILR values independent from this accepted 2 to 4 dB variability, but the Board should be mindful of the variation.

Acentech OILR Results

The Acentech Report identifies four general determining variables that arose when arriving at OILR values, and those values' application to the Hessler quarterly monitoring data and CPG Condition 8. First, OILR values change depending on the state of the test room's windows. The Monitoring Plan called for Hessler to conduct OILR measurements at each receptor location under both windows closed and windows opened (weather permitting) conditions. Hessler performed OILR measurements at only two of the four receptor sites, including SM3, under windows closed conditions. Acentech took measurements at the Brouha residence test room under windows fully closed, windows partially open, and windows fully open conditions. *Id.* at 5.

Second, OILR values varied depending on where the sound sample was taken within the room. The Acentech Report illustrates this variable by outlining both the OILR values derived from a measurement taken at the center of the test room, as well as the average of measurements taken at numerous locations within the test room. Generally, higher OILR values were seen using the averaging method under windows fully and partially open conditions. The room average method yielded OILR values 2 dBA higher than center of the room measurements under windows fully open conditions and 3 dBA higher with windows partially open. *Id.* Both approaches are consistent with ASTM E966-04 field measurement procedures, and are reflected in the Acentech Report's findings.

Third, the use of rolling one-hour Leq averages versus contiguous one-hour block Leq averages when applying the OILR values to the Hessler quarterly monitoring data had a significant impact on the overall arrived-at noise levels. Neither Board orders nor the Monitoring Plan specify which approach to use in determining CPG compliance. The Hessler sound data is expressed in ten-minute increments, and the Department found that using rolling one-hour averages (e.g., 8:00-9:00, 8:10-9:10, 8:20-9:20, etc.) was preferable to using contiguous one-hour averages (e.g., 8:00-9:00, 9:00-10:00, 10:00-11:00, etc.) when determining CPG compliance. Rolling averages provide greater granularity of detail of the Project's one-hour sound averages, creating a sound record more closely matched to actual Project sound output over time when compared to contiguous averages. The Acentech Report's findings and analysis are based exclusively on the use of rolling averages.

Fourth, the Department's sound expert found that NPC did not adjust its test results to reflect a representative wind turbine sound spectrum. *Id.* at 4. The Acentech Report notes that Hessler, like NPC, did not use a wind turbine sound spectrum when arriving at an OILR dBA value. Acentech did make such an adjustment as part of its OILR analysis. In this instance, Acentech's adjustment for a wind turbine sound spectrum may not have resulted in different OILR values in a windows fully open setting (depending on the measurement and analysis assumptions used) when compared to NPC's results, but such adjustment has the potential for significant impact on OILR values arrived at under different testing conditions. Acentech's OILR values determined under windows fully closed conditions varied from 25 dBA to 32 dBA depending on whether adjustment for wind turbine sound spectrum was made or not, respectively. *Id.* at 6.

Acentech's results, when adjusted to a representative wind turbine sound spectrum, found OILR values ranging from 1 dBA to 3 dBA with windows fully open, depending on whether a center of the room measurement or room average measurement was used, respectively. NPC's 1 dBA OILR value is within this range, but on the lowest end. Windows partially open conditions yielded OILR values from 6 dBA to 9 dBA. An OILR value of 25 dBA was found under windows closed conditions, regardless of the measurement method used. *Id.* at 5. Again, these values do not take the ASTM-recognized 2 to 4 dBA repeatability standard deviation discussed above into account.

Acentech then applied the OILR values to the 2012 Hessler quarterly monitoring data to determine whether any exceedances may have occurred under a number of window conditions and OILR measurement methods. The Acentech Report also compared the OILR values to a hypothetical 45 dBA outdoor sound limit as a means of comparison to the Kingdom Community Wind and Georgia Mountain Community Wind facilities' sound limits. Significant variability in terms of possible exceedances was shown among the different window conditions and measurement methods. For instance, no exceedances were discovered under windows closed conditions. On the other hand, exceedances were found either 10.7% or 14.3% of the monitoring time during the fall testing session under windows fully open conditions, depending on the measurement method used. By way of comparison, exceedances may have occurred, at most, 0.8% of the time during winter testing using a 45 dBA outside limit, and did not occur at all during the spring and summer test sessions. See *Id.* at Table 3.

Department Recommendation

The Department recommends that the Board open an investigation in response to Mr. Brouha's Relief Request. A reasonable possibility that the Project sound level is within 3 dBA of the CPG noise limit at the Brouha residence appears to exist based on OILR values established by the Department's expert. The CPG, companion Board orders, and the Monitoring Plan, however, do not provide enough guidance to adequately address the major variables discussed above, effectively rendering the CPG indoor sound limit unenforceable at this time. The Department therefore recommends that the Board provide guidance on the proper assumptions and best practices to be used during sound monitoring pursuant to the Project CPG and Monitoring Plan prior to investigating whether additional monitoring at the Brouha residence is appropriate.

As a preliminary matter, the crux of the Department's recommendations relative to Condition 8 rests upon the absence of measured OILR values obtained under windows closed *and* open conditions at each monitoring site as contemplated by Vermont Wind's approved Monitoring Plan. The Monitoring Plan complaint protocol requires the application of "Interior Sound Pressure Level determined at the nearest Monitoring Location" to establish proxy indoor sound levels at the complainant location when making general threshold determinations as to whether additional monitoring is appropriate in response to a noise complaint. Monitoring Plan at 7. The Department would almost certainly not be tasked now with performing OILR testing at the Brouha residence in an effort to determine whether additional monitoring is warranted had Hessler conducted the windows-open testing at the established monitoring sites outlined in the Monitoring Plan. Hessler did not, however, conduct the OILR testing under windows open conditions.

The Vermont Wind/Hessler's interior sound pressure level used in its complaint monitoring calculation made in response to an initial noise complaint lodged by Mr. Brouha in December 2011 appears to reflect closed windows conditions only. See Brouha to Hudson Letter, Mar. 5, 2013 at 1. The Department was not a party to the correspondence between Mr. Brouha and Vermont Wind in response to the December 2011 complaint, but it understands that Vermont Wind concluded additional monitoring at the Brouha residence pursuant to the Monitoring Plan was not warranted because Hessler's analysis found that the "maximum peak interior Leq sound level at [the Brouha residence] that is potentially due to the Sheffield Wind Project is 18 dBA." *Id.* at 1-2; see also Letter from Andrew Raubvogel, on behalf of Vermont Wind, to Susan Hudson, Clerk of PSB *re: Docket No. 7156 – Sheffield Wind Project (the "Project")*, Mar. 13, 2013 at 2. The Department assumes that Hessler applied the 33 dBA OILR value and attendant 9, 12, or 20 dBA SM3 indoor nominal project sound level arrived at in the Hessler's Wintertime Sound Report to the complaint monitoring equation found in the Monitoring Plan, resulting in the Brouha residence 18 dBA calculation.³ See Wintertime Sound Report at 32, 36; Monitoring Plan at 7.

The 18 dBA calculation does not reflect a reasonable range of estimated indoor sound levels at the Brouha residence, regardless of the indoor SM3 dBA level Hessler applied. The calculation does not reveal the estimated interior level at the Brouha residence with windows fully, or even partially, open. The Department's sound expert's measurements and analysis show

³ The complaint monitoring equation presented in the Monitoring Plan requires the input of "Interior Sound Pressure Level determined at the Nearest Monitoring Location, dBA" in order to determine the "Estimated Interior Sound Pressure Level at the Complainant Location, dBA" Monitoring Plan at 7. The Wintertime Sound Report, however, provides four different indoor sound levels at the SM3 location ranging from 9 to 20 dBA reflecting both maximum and "more typical peak" levels expressed as L90 and Leq measurements. Wintertime Sound Report at 32. The record available to the Department does not make it clear which dBA level was used in the complaint monitoring equation.

that OILR values and resultant indoor sound levels change significantly depending on the condition of the windows. Likewise, the Department's expert found that the OILR value at the Brouha residence with windows closed changed from 32 dBA – very similar to Hessler's 33 dBA SM3 OILR value – to 25 dBA once the sound data was normalized to a turbine sound spectrum. This adjustment, if applied, would have a significant impact on the calculation of the estimated sound levels pursuant to the complaint monitoring equation.

In sum, any Department investigation into a Project noise complaint without access to windows-open OILR measurements at the Project monitoring sites would necessarily require it, at a minimum, to conduct OILR measurements from scratch in response to a complaint at each unique location. The testing protocol this arrangement would require is a complicated and resource-intensive endeavor, as evidenced by the time taken to provide these comments and report here. The Department doubts that it is feasible to replicate the efforts it has taken here to measure and analyze OILR values at individual residences in the absence of Vermont Wind/Hessler establishing accurate OILR values under a variety of window conditions at the four established monitoring locations surrounding the Project and further guidance from the Board.

The Department has also found through its investigation into this matter that neither the CPG noise conditions, nor the companion Board orders, and/or Vermont Wind's approved Monitoring Plan provide sufficient guidance for gathering OILR values to enable clear determinations of CPG compliance. As discussed above, four major variables have been left unresolved by the Board approved guidance documents in this proceeding: the appropriate assumptions related to window conditions within a test room, the type of sound measurement method used (single measurement location versus the average of multiple locations), the use of

contiguous versus rolling one-hour averages when applying OILR values to outside sound data, and normalization of sound data to a representative turbine sound spectrum. The implementation choices related to each variable have a significant impact with respect to the final OILR values arrived at, and to overall calculation of CPG compliance. As a result, the Department is unable to arrive at a clear conclusion related to the proper calculation of OILR values and/or CPG compliance at this time.

The Department notes that developing guidance related to the proper window conditions to be used in any indoor sound standard compliance analysis poses unique concerns related to seasonal assumptions. For instance, applying windows fully open OILR values to summer monitoring data would likely be appropriate, as well as using windows fully closed values against winter monitoring data. The reasonable window condition assumptions in the spring and fall months are less clear, yet have a significant impact on the potential rate of sound limit exceedance in this instance.⁴ Further clarification and guidance on the appropriate seasonal window condition assumptions are necessary to render CPG Condition 8 enforceable.

⁴ Determination of the appropriate window condition assumptions for the spring and fall months is further complicated by the relatively cool average temperatures experienced near the Project site – with average high temperatures below 60 degrees F from October through April – as well as the comfort preferences of residents near the Project. See <http://ab.weather.com/outlook/recreation/outdoors/wxclimatology/monthly/graph/05866>; <http://www.intellicast.com/Local/History.aspx?unit=F&month=12&location=USVT9677>.

CONCLUSION

The Department's investigation into Mr. Brouha's Relief Request and the NPC Report has found that NPC's finding of a 1 dBA OILR value at the Brouha residence test room is within the range the Department's sound expert established. It also found that sound levels at the Brouha residence may have come within 3 dBA of the 30 dBA(Leq)(1) indoor noise limit during Hessler's 2012 quarterly monitoring period under certain circumstances, justifying additional monitoring at the residence. However, the Department is unable to arrive at a clear conclusion related to the appropriate OILR values at the test room to be applied to the Hessler sound data. Likewise, the proper calculation to determine whether exceedances of CPG Condition 8 may have occurred cannot be made without further clarification and/or direction from the Board. The Department is unable to enforce the CPG sound standards at this time.

The Department therefore recommends that Board take two distinct, but interrelated, actions in response to Mr. Brouha's Relief Request. First, in an effort to resolve the underlying barriers to effective enforcement of the Project noise limits identified above, the Department suggests that the Board accept additional comments from Vermont Wind and Mr. Brouha in response to this filing. The Board may, in its discretion, consider holding a status conference to discuss with the parties whether reexamination of the Project noise limits is appropriate at this time. Second, the Department recommends that the Board initiate an investigation into whether additional sound monitoring is appropriate at the Brouha residence after the Board has made the necessary determinations related to the above-identified monitoring variables to allow for consistent enforcement of the Project CPG noise limits.

Dated at Montpelier, Vermont this 14th day of October, 2015

Respectfully submitted,

VERMONT DEPARTMENT OF PUBLIC SERVICE



Aaron Kisicki
Special Counsel

cc: Paul Brouha
Geoff Hand, Esq., Dunkiel Saunders Eliot Raubvogel & Hand, PLLC

ATTACHMENT A



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25 September 2015

Vermont Public Service Department
112 State Street
Montpelier, VT 05620-2601

Attention: Aaron Kisicki
Special Counsel

*** (via email: Aaron.Kisicki@vermont.gov) ***

Subject: Acoustical Consulting Services
Vermont Wind/Sheffield Wind/Brouha Noise Complaint (PSB Docket 7156)
Acentech Project No. 624219

References: Your 4/17/2014 email with attached documents -

- "7156 - 2014.02.28 - Brouha Blomberg Complaint.pdf"
- "7156 - 2014.03.28 - Brouha Cavanaugh Tocci Comments.pdf"
- "7156 - 2007.08.08 CPG.pdf"
- "7156 - 2007.08.08 Final Order.pdf"
- "7156 - 2007.10.01 Reconsideration Order.pdf"
- "Revised Sheffield Sound Monitoring Plan May 2010.pdf"
- "7156 - 2012.02.27 - Operational Sound Level Compliance Test, Wintertime Conditions.pdf"
- "7156 - 2012.06.08 - Operational Sound Level Compliance Test - Spring.pdf"
- "7156 - 2012.08.27 - Operational Sound Level Compliance Test - Summer.pdf"
- "7156 - 2012.12.17 - Sound Report Autumn Conditions.pdf"
- "7156 - 2013.05.01 - Order re Mot for Relief.pdf"
- "7156 - 2014.03.12 - FW Resp to Brouha 2014.2.28 Filing.pdf"

J. Barnes 4/22/2014 email to you

L. Blomberg 5/20/2014 email with photos of his OILR test setup to me

Your 11/4/2014 email with Vermont Wind data files

Dear Mr. Kisicki:

Introduction

At your request, we reviewed the above-referenced materials and performed field measurements and analysis that relate to a community noise complaint with the Vermont Wind Sheffield Wind Project. These materials include a filing to the Vermont Public Service Board (VPSB) by Les Blomberg of Noise Pollution Clearinghouse (NPC) on behalf of Paul Brouha, a resident near the wind facility, which alleges violations of the project's noise limits at the resident's home. The Brouha Blomberg Complaint filing presents two reports that L. Blomberg had prepared for P. Brouha:

- "Outside to Inside Attenuation at the Brouha Bedroom (2/25/2014)
- "Indoor Wind Turbine Noise Levels at the Brouha Residence and a Critique of Vermont Wind's Quarterly Noise Reports" (2/25/2014)

This filing was submitted by P. Brouha to the VPSB where they were received on 3/3/2014.

In addition, Brion Koning of Cavanaugh Tocci Associates (CTA) reviewed at least one of the above two NPC reports and prepared a peer-review report entitled "Environmental Sound Levels Evaluation - Brouha

Residence" (3/25/2014). This report was submitted by P. Brouha to the VPSB where it was received on 27 March 2014.

The Vermont Wind Sheffield Wind facility incorporates 16 Clipper Liberty 2.5 megawatt (MW) wind turbines and support equipment with a total project nameplate capacity of 40 MW. The facility began operation on 10/19/2011. P. Brouha lives in a farmhouse at 92 Queen Elizabeth Farm Lane in Sutton, VT.

This letter report describes the wind project and the permit conditions that address community noise; offers our comments and suggestions on the L. Blomberg/NPC and B. Koning/CTA submittals; outlines the sound test and analysis that we have performed; and summarizes our conclusions about project compliance inside the Brouha residence. As expected, the results of our study indicate that the wind project sound levels and compliance status estimated inside the second floor west bedroom of the Brouha residence necessarily depend on whether the bedroom windows are closed or open.

Project Noise Conditions

The Certificate for Public Good (CPG, 8/8/2007) and Final Order (8/8/2007) issued by VPSB impose noise conditions on the wind project that include:

- "8. UPC shall construct and operate the Project so that it emits no prominent discrete tones pursuant to the American National Standards Institute (ANSI) standards at the receptor locations, and indoor sound levels at any King George School structure and any surrounding residences do not exceed 30 dBA (Ldn)." VPSB Order (10/1/2007) modified the sound level requirement in CPG Condition 8 to 30 dBA (1-hr Leq).
- "9. In the event noise from operation of the Project exceeds the maximum allowable levels, UPC shall take all remedial steps necessary to bring the sound levels produced by the turbine(s) into compliance with allowable levels, including modification or cessation of turbine(s) operation."
- "10. UPC shall submit to the Board for review and approval a noise monitoring plan to be implemented during the first full year of operation. The Plan shall establish a monitoring program to confirm under a variety of seasonal and climactic conditions compliance with the maximum allowable sound levels described above."

Vermont Wind's noise consultant [David Hessler/Hessler Associates (HA)] developed a Noise Monitoring Plan (5/26/2010), which was approved for this project. The Plan summarized the project's noise conditions and indicated that continuous sound monitoring would be conducted outdoors at four community locations over a two-week period during each of the four seasons over the first year of operation.

The approved Revised Sheffield Sound Monitoring Plan states "that a site-specific sound test will be conducted in accordance with ASTM standard E966-04 to determine the actual amount of attenuation that occurs between exterior and interior sound levels at each of the 4 monitoring locations. The interior sound levels will then be calculated based upon exterior sound levels and the measured attenuation of the structures." A footnote states: "The outside-to-inside sound test will be performed under both windows open and windows closed conditions, weather permitting." The Plan also indicates that if a specific community location cannot be used for the monitoring program, then Vermont Wind should select a comparable alternate location.

2012 Vermont Wind Compliance Measurements and Reports

HA conducted the initial operation sound level compliance measurements for Vermont Wind over a two-week period in the latter half of January 2012. Measurements included continuous sound monitoring at four outdoor locations representative of residences exposed to turbine sound and at four other outdoor locations farther from the turbines and less exposed to turbine sound; the latter locations were selected as proxies for characterizing background ambient sound levels in the area during the compliance test period. HA also conducted sound measurements on 1/18/2012 at two of the four turbine sound

monitoring locations, including an unoccupied lounge at the King George School dormitories on Dareios Road (Vermont Wind Location SM3), in order to characterize the Outdoor-Indoor Level Reductions (OILR) of the structures.

The outdoor-indoor measurements were obtained by HA in general conformance to ASTM Standard Guide E966-04 with a loudspeaker installed outdoors and all windows closed; no data were provided for the windows open condition. HA calculated indoor turbine sound levels based the measured outdoor turbine sound levels, with adjustments for the contribution of background ambient sound (measured at an associated proxy location) and the OILR value (measured at structure or another assumed similar structure), and compared them to the project indoor sound limit of 30 dBA. The above-referenced report, "Operational Sound Level Compliance Test, Wintertime Conditions," presents the sound measurements and concludes that the results demonstrate compliance with the indoor sound limit at each of the four monitoring locations. The spring, summer, and autumn 2012 measurements and analyses (all with windows closed condition), which were also performed by HA and presented in the above-referenced reports, indicate similar results.

2012 NPC Measurements at Brouha Residence for OILR

Following submittal of the first sound compliance report ("...Wintertime Conditions") by Vermont Wind, NPC conducted sound measurements at the Brouha residence on 5/2/2012 to characterize the OILR value of the second-story bedroom façade that faces the turbines. It appears that NPC conducted and reported the measurements carefully and in accordance with many aspects of ASTM Standard Guide E966-04. NPC installed and operated a loudspeaker outside the P. Brouha residence and measured the sound both outside and inside a second-story bedroom with the room's windows open. For these measurements, NPC removed both beds and an area rug from the bedroom. Based on the outdoor sound data presented in the first Vermont Wind sound compliance report and on the results of the OILR sound test at the Brouha residence, which is about 5000 ft northeast of the King George School dormitories on Dareios Road, NPC calculated that the sound of the wind turbines would exceed the indoor project limit of 30 dBA at times in the Brouha bedroom.

Acentech Comments and Suggestions on NPC Measurements and Analysis

Based on our review of the NPC reports and related project documents, we developed the following comments and suggestions:

- We disagree with part of the OILR test procedure employed by NPC and question NPC's results of only 1 dBA sound attenuation from outdoor to indoor.
- We disagree with NPC removing furnishings from the bedroom, including beds and an area rug, in order to reduce sound absorption in the space. (Therefore, we must also disagree with related comments in CTA's letter about NPC's outdoor-indoor measurements). The OILR test procedure in the cited ASTM standard does not direct this modification. We judge that the spirit of the CPG noise conditions is to limit the project sound levels in indoor spaces as they are typically occupied. Removing the beds and rug changed the acoustical characteristics of the bedroom and likely led to measurements inside the bedroom that are not typical of occupied conditions. It is reasonable to expect that NPC would have also made sound measurements in a normally-furnished bedroom and at a typical head position on the bed. NPC removed the furnishings in an effort to obtain a different type of test result (OITL rather than OILR), which is not applicable to the project's permit conditions. The ASTM standard describes the difference between OILR and OITL values:

"This guide may be used to determine the outdoor-indoor level reduction (OILR), which is the difference in sound pressure between a specified outdoor sound field and the resulting sound pressure level in the room abutting the test facade or facade element.....With further measurements under restricted conditions, a basic property of

a facade or facade element, the outdoor-indoor transmission loss, OITL, may be determined.”

- NPC did not adjust the test results to account for the difference between the broadband test loudspeaker sound spectrum and a representative wind turbine sound spectrum at the Brouha residence when developing an overall A-weighted value (dBA) for OILR. (Note: HA also did not appear to adjust its test results to a representative wind turbine sound spectrum). Although this issue did not affect the overall findings of our study, we would still recommend that an overall OILR dBA value developed for a wind turbine project use a wind turbine sound spectrum. This issue is discussed further in a following section with our 2014 OILR test results.
- The results in the NPC Attenuation report show virtually no reduction (1 dBA) in the broadband sound of the loudspeaker between outdoors and indoors. This value is much lower than is normally expected, even for large open windows. (Note: Acentech measurements in July 2014 under similar test conditions did generally agree with this value; and depending on the measurement location within the room, yielded an OILR value of about 1 to 3 dBA with the windows fully open.)
- At our request, NPC provided additional photos and information that helped to clarify the field conditions during their 2012 OILR test.
- The ASTM E966 -04 “Standard Guide for Field Measurement of Airborne Sound Insulation of Building Facades and Facade Elements (2004)” states: “14.1 Precision — No body of experience in the use of this guide exists at present; however, it is estimated that the repeatability standard deviation of the test procedure is of the order of 2 to 4 dB, depending on frequency.” Therefore, OILR results may vary by up to 2 to 4 dB. The NPC report does not acknowledge or account for this degree of uncertainty in its measurements and conclusions.
- We agree with NPC that Vermont Wind did not strictly follow the approved Noise Monitoring Plan in several key areas – the OILR values at all four monitoring locations were not measured, no alternate locations were used, and also, the OILR for the windows open (partial or full) condition was not used in calculating the summer (and perhaps spring and fall) indoor sound levels for the project.
- We believe that the two year gap between the measurements and reports by HA and NPC in 2012 and the reports by NPC and CTA in 2014 are inconsequential to understanding the merit of P. Brouha's 2014 filings.
- Without clear measurements at the Brouha residence, it would be difficult for us to judge the accuracy of the NPC measurements and analysis, and compliance/noncompliance with the project sound limits at this community location.

2014 Acentech Measurements at Brouha Residence

In an effort to judge compliance/noncompliance at the P. Brouha residence, we suggested that Vermont Public Service Department (VPSD), Vermont Wind, and P. Brouha consultants agree on the estimated outdoor turbine sound levels for this location, including a background ambient sound adjustment; we understand that all parties currently do agree with the turbine project sound levels outside the Brouha residence. To estimate the indoor turbine sound levels, we also recommended that outdoor-indoor sound measurements be conducted at the P. Brouha residence with the second floor bedroom normally furnished and with its windows closed and opened.

Acentech performed a series of measurements at the Brouha residence on 7/1/2014 to determine the attenuation of exterior sound to the interior of the home's second floor west bedroom. Our measurements, which were guided by the Vermont Wind's Noise Monitoring Plan, and more specifically, by ASTM Standard

Guide E966-04, were aimed to characterize the OILR of the bedroom's structure. As stated in the Revised Sound Monitoring Plan, the outside-to-inside sound test was performed with the windows open and closed. To determine the actual attenuation of the structure within the context of VPSB's Certificate for Public Good and Final Order for this wind turbine project, which limits the indoor sound of the project to 30 dBA, we requested that the bedroom be in its normally furnished condition for our test. The procedural steps in our overall OILR test method were similar to the steps employed by HA and NPC in 2012. We chose to use the *Calibrated Source Method* and the *Nearby Average Method* in ASTM Standard Guide E966-04 for quantifying the outdoor sound level produced by the speaker and to collect both 1/3-octave band and full octave band data for our OILR test. This procedure is consistent with the OILR definition in Section 3.2.4 of the standard, which states: "outdoor-indoor level reduction, OILR—in a specified frequency band, the difference between the time-averaged exterior sound pressure and the space-time average sound pressure in a room of a building." For the *Calibrated Source Method*, we measured the speaker sound output under a free-field condition (speaker pointed away from the residence and other reflecting surfaces); and for the *Nearby Average Method*, we measured the sound field just outside the residence's bedroom façade with the speaker in its normal test position pointing toward the façade. As noted below, we employed the octave band data from the OILR test and octave band data for the Clipper C96 wind turbine to develop an overall A-weighted OILR value (dBA) for our analysis.

Figure 1 is an aerial photograph that identifies the location of the Vermont Wind Sheffield Wind Project, the Brouha residence, and the King George School dormitories on Dareios Road. The latter location was used as Location SM3 for the project operational sound monitoring program by HA. Figure 2 shows photographs of the OILR test conditions at the Brouha residence. They display the elevated speaker on a bucket truck in the general path between the turbines and the second floor bedroom windows, the bedroom windows and exterior façade, and the bedroom interior. The bedroom was modestly furnished and included a bed for our test. Table 1 lists the type of acoustic instrumentation that we employed to generate high-level broadband sound (i.e., pink noise) across the outside façade of the bedroom and to measure sound outside and inside the bedroom.

Figure 3 presents the 1/3-octave band sound pressure levels that we measured outside the façade with the speaker on, and inside the bedroom (center of bedroom) with the speaker on and off and the windows in three different conditions: fully closed, partially open, and fully open. The data confirm that the speaker produced sufficiently high-level broadband sound for our OILR test.

Table 2 lists the measured octave band sound pressure levels for the same conditions as plotted in Figure 3, adjustment of the measured data for the contribution of ambient sound to the total sound measured at the center of the bedroom with the speaker on, adjustment to normalize the outside sound spectrum to a representative wind turbine spectrum (Clipper C96 wind turbine at 9290 ft), and calculation of the overall A-weighted OILR values for the Brouha bedroom structure. Octave band data were employed in this procedure since the Clipper wind turbine sound data were available in octave band format. The OILR values that we determined for distant wind turbine sound are:

- Windows fully closed – 25 dBA
- Windows partially open – 6 dBA
- Windows fully open – 1 dBA

We obtained similar OILR values with additional measurements at different locations in the bedroom. Average data measured around the bedroom yielded the following OILR values:

- Windows fully closed – 25 dBA
- Windows partially open – 9 dBA
- Windows fully open – 3 dBA

The OILR values of 1 to 3 dBA for fully open windows are consistent with NPC's test result for the same Brouha bedroom and the OILR value of 25 dBA for fully closed windows is similar to HA's test result for the King George School dorm façade.

An OILR value necessarily depends on the spectrum of a sound source (e.g., nearby highway traffic, distant wind turbine, or local lawnmower). This fact is noted in the introduction of ASTM Standard Guide E966-04:

"The sound transmission of a building facade or facade element as measured under field conditions is dependent not only on the physical characteristics of the facade, but also on the characteristics of the incident sound field used to make the measurement." If we did not normalize the our test results to a distant wind turbine sound spectrum, they would still yield OILR values of 1 to 3 dBA and 6 to 9 dBA for, respectively, windows fully open and windows partially open conditions, but they would yield an OILR value of 32 dBA, rather than the above 25 dBA for the windows fully closed condition.

Acentech Project Sound Estimates at Brouha Residence

We have developed project sound estimates at locations outside and inside the Brouha residence based on HA sound monitoring data, a distance adjustment from the HA monitoring location to the residence, and Acentech OILR test results at the residence. The following paragraphs describe our calculation methods.

Sound data collected by HA during the four operational sound surveys were provided to us in digital format for one-hour and ten-minute intervals. The project-only Leq sound levels at Location SM3 (King George School dormitories on Dareios Road (Location SM3) were derived from the measured total sound levels with adjustments for measured ambient background sound levels and exclusions for intervals with low hub height wind speeds (≤ 4 m/s) without significant turbine operation. We evaluated the derived one-hour Leq project-only sound levels for rolling 60-minute periods based on the ten-minute interval data.

The derived project-only sound levels at SM3 were adjusted by -2 dBA to yield estimated project-only sound levels outside the Brouha residence. This adjustment is consistent with the approved Noise Monitoring Plan and accounts for the greater distance from the wind turbine project to the Brouha residence than to SM3 (9290 ft vs. 7180 ft). HA and NPC have both agreed with this -2 dBA adjustment.

The OILR values for the Brouha second floor west bedroom structure that were determined by Acentech were applied to the estimated project-only sound levels outside the Brouha residence. The attenuation values for the structure ranged from 25 dBA with the windows fully closed to just 1 to 3 dBA with the windows fully open. We note that the ASTM Standard Guide E966 -04 presents an estimated standard deviation of 2 to 4 dB for a measured OILR value and that this tolerance is not included in our results.

Table 3 summarizes the percentages of monitoring time that the estimated project-only sound levels exceeded the applicable 30 dBA one-hour Leq indoor project standard at the Brouha residence during each of the four Vermont Wind operational sound monitoring surveys. The equivalent outside criteria for comparison with the project-only sound measured at Location SM3, which are listed in Table 3, are intended to meet 45 dBA outside the Brouha residence and 30 dBA inside 2nd floor west bedroom of the Brouha residence. The criteria include a 2 dBA adjustment for greater distance from the project to the residence than to SM3 and the OILR adjustments provided by the residence's façade. The table also presents results for the estimated project-only outdoor sound levels at the Brouha residence; these values are provided only for comparison purposes with other similar facilities in the state (Lowell and Georgia Mtn.) that have an outside standard of 45 dBA. Note that the table lists project-only criteria at SM3 that are equivalent to 45/30 dBA (outdoor/indoor) criteria at the Brouha residence.

The results indicate that estimated project-only sound outside the Brouha residence exceeded 45 dBA less than 1% of the time during the winter 2012 survey; 0% during the spring and summer 2012 surveys; and about 0.1% of the time during the fall 2012 survey. For the indoor locations in the second floor west bedroom of the Brouha residence (center of room and around the room), the estimated project-only sound did not exceed 30 dBA with the windows fully closed during any survey, but did exceed 30 dBA with the windows partially or fully open during most of the other surveys. During the summer, a time when windows are most likely to be open, the percentage of time exceeding 30 dBA ranged from 0% (windows partially open) to less than 1% (windows fully open). During the winter, when windows are more likely to be closed, the percentage of time exceeding 30 dBA ranged from less than 6 to 8% (windows partially open) to about 10 to 12% (windows fully open). And during the shoulder seasons of spring and fall, when windows are likely to be open at times, the percentage of time exceeding 30 dBA ranged from about 2 to 6% (windows partially open) and about 10 to 14% (windows fully open).

Results and Conclusions

We have reviewed information provided by Vermont Wind and NPC and conducted an OILR test at the Brouha residence. In addition, we have estimated the percentage of time that the project-only sound levels may have exceeded the permit level of 30 dBA indoor at the Brouha residence. We note that the project-only sound levels should be considered as estimates since they are based on total sound levels and ambient background sound levels that were measured at other locations than the Brouha residence and included adjustments outlined in the approved Noise Monitoring Plan without consideration of any measurement tolerances. The results indicate project-only sound levels that at a few times did exceed an outdoor criterion that only applies to two other wind facilities in Vermont; and with the bedroom windows open, at times did exceed the indoor criterion that applies to this facility. The results also indicate that project-only sound levels did not exceed the indoor criterion at any time with the bedroom windows fully closed.

Please contact me if you have any questions or comments about our study or this letter.

Sincerely yours,

ACENTECH INCORPORATED



James D. Barnes

Figures 1 - 3

Tables 1 - 3

xc: Geoff Commons (geoff.common@vermont.gov)

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Figure 1.
Aerial Photograph Showing Sheffield Wind Turbines, Brouha Residence, and King George School Dormitories on Dareios Road (Vermont Wind Monitor Location SM3).



0 4000 ft



Figure 2.
Photographs of Brouha Residence and Acentech OILR Sound Test Conditions (7/1/2014).



Loudspeaker and Residence



2nd Floor Bedroom – Partially Open Windows



2nd Floor Bedroom – Fully Closed Windows



Inside 2nd Floor Bedroom – Fully Open Windows

Figure 3.
One-Third Octave Band Sound Pressure Levels Measured during OILR Test for 2nd Floor West Bedroom Structure (Center of Bedroom) at Brouha Residence by Acentech (7/1/2014).

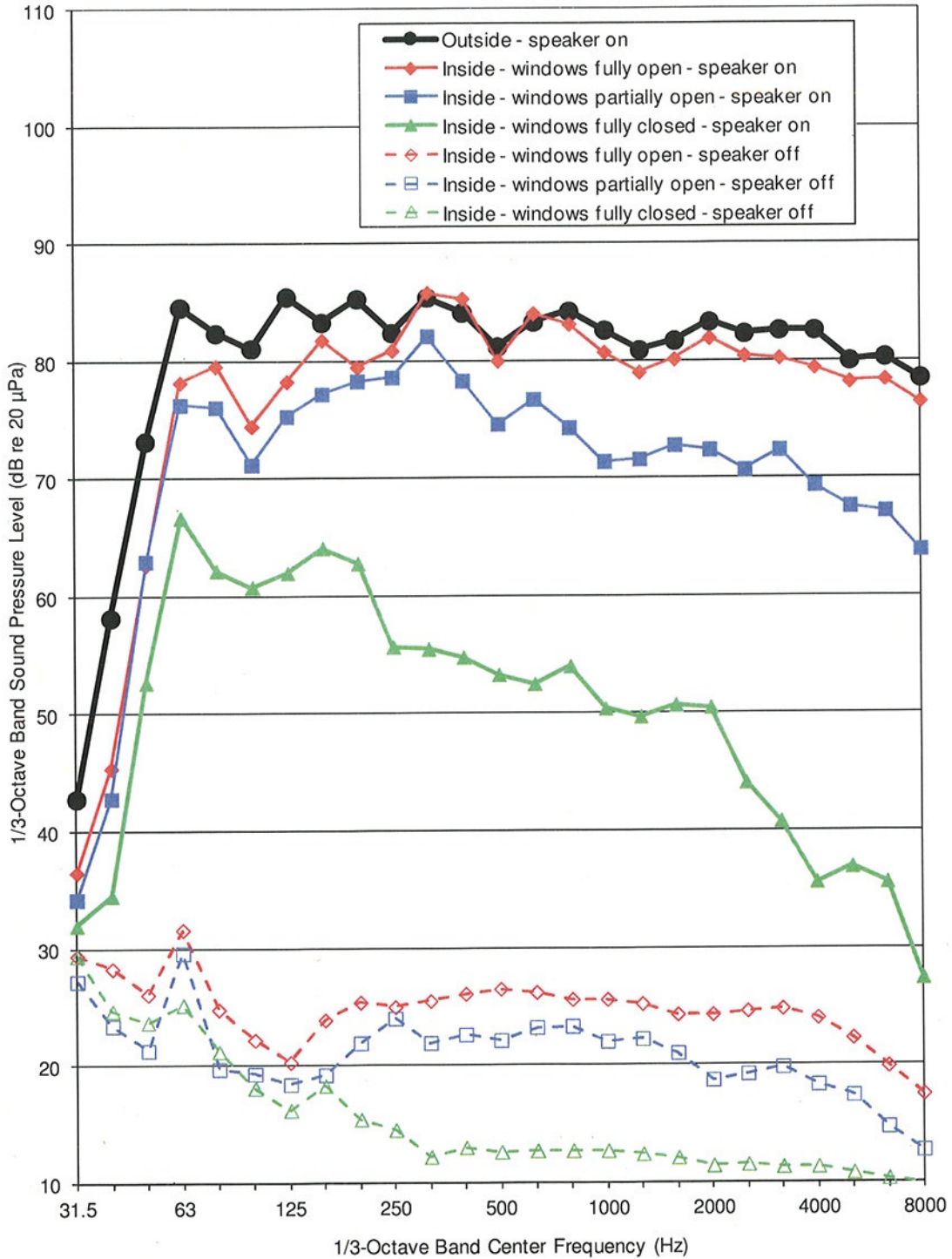


Table 1.
Type of Acoustic Instrumentation Used for OILR Sound Test at Brouha Residence (7/1/2014).

Instrument Type	Manufacturer	Model
Sound Generator	Minirator	MR1
Powered Speaker	Peavey	Impulse 1012P
Precision Sound Level Meter and Octave Band Analyzer	Rion	NA-28
Preamplifier	Rion	NH-23
1/2" Microphone	Rion	UC-59
Acoustic Calibrator	Norsonics	1251

Table 2.
OILR Values for 2nd Floor West Bedroom Structure (Center of Bedroom) at Brouha Residence Based on Speaker Measurements by Acentech (7/1/2014).

Description	Octave Band Center Frequency (Hz)									Overall dBA
	31.5	63	125	250	500	1000	2000	4000	8000	
Speaker ON (broadband pink noise plus ambient)										
Outside	60	87	89	89	88	88	87	87	84	
Inside at Center of 2nd Floor West Bedroom										
windows fully closed	39	68	68	64	59	57	54	43	37	
windows partially open	44	80	80	85	82	78	77	75	70	
windows fully open	47	82	84	88	89	86	86	84	82	
Ambient (Speaker OFF)										
Inside at Center of 2nd Floor West Bedroom										
windows fully closed	35	29	23	19	18	18	17	16	15	
windows partially open	33	31	24	27	28	28	25	24	18	
windows fully open	35	34	27	30	31	30	29	29	23	
Speaker ON only (broadband pink noise only, adjusted for background)										
Inside at Center of 2nd Floor West Bedroom										
windows fully closed	37	68	68	64	59	57	54	43	37	
windows partially open	44	80	80	85	82	77	77	75	70	
windows fully open	46	82	84	88	88	86	86	84	82	
OILR for 2nd Floor West Bedroom Building Structure (based on center of room data)										
windows fully closed	23	19	21	25	29	31	33	44	47	
windows partially open	16	7	8	5	6	10	10	12	14	
windows fully open	13	5	5	1	-1	1	2	3	2	

Apply Octave Band OILR Values Measured at Brouha Residence to Wind Turbine Sound Spectrum

(used single turbine at 9290 ft)

Turbine sound power level (Lw) (ref: Hessler Assoc. 2006 Cohocton, NY report for Clipper C96)	114.5	110.2	108.8	105.8	105.0	99.3	90.7	85.1	68.3	
Distance and atmospheric attenuation only (Cadna/A program with 10C and 70% relative humidity).	77	77	78	80	82	87	104	170	408	
Outside ---- one turbine sound spectrum at 9290 ft	37	33	31	26	23	12	-14	-85	-340	23
Estimate Inside Turbine Sound if have 45 dBA turbine sound level outside Brouha residence										
Outside ---- 45 dBA turbine sound spectrum	59	55	53	48	45	34	8	<0	<0	45
Inside at Center of 2nd Floor West Bedroom										
windows fully closed	37	36	32	23	16	3	<0	<0	<0	20
windows partially open	44	47	44	43	39	24	<0	<0	<0	39
windows fully open	46	50	48	47	46	32	7	<0	<0	44

OILR Normalized to Turbine Sound Spectrum for 2nd Floor West Bedroom Building Structure (based on center of room data)

windows fully closed	23	19	21	25	29	31	33	44	47	25
windows partially open	16	7	8	5	6	10	10	12	14	6
windows fully open	13	5	5	1	-1	1	2	3	2	1

Table 3.
Estimate of Time Exceeding Potential Project Sound Level Criteria at Brouha Residence
(Center of Bedroom) Based on HA 2012 Measurements at King George School Dormitories on
Dareios Road.
(Rolling-Hour Data Collected at Vermont Wind Monitor Location SM3)

Condition	Criteria* (dBA)	% of Time Exceeding Criteria for Total Monitoring Period			
		Winter (335 total hrs)	Spring (384 total hrs)	Summer (375 total hrs)	Fall (335 total hrs)
Outside Brouha Residence	47	0.8%	0.0%	0.0%	0.1%
Inside Brouha 2nd Floor West Bedroom (Center of Room OILR)					
Windows fully closed	57	0.0%	0.0%	0.0%	0.0%
Windows partially open	38	7.2%	5.7%	0.0%	5.9%
Windows fully open	33	11.7%	11.5%	0.8%	14.3%
Inside Brouha 2nd Floor West Bedroom (Average Room OILR)					
Windows fully closed	57	0.0%	0.0%	0.0%	0.0%
Windows partially open	41	5.3%	3.4%	0.0%	2.0%
Windows fully open	35	9.5%	10.1%	0.0%	10.7%

*Equivalent outside criteria for wind turbine project sound (without ambient sound) measured at Vermont Wind Monitoring Location SM3 to meet 45 dBA outside Brouha residence and 30 dBA inside 2nd floor west bedroom of Brouha residence. The criteria include -2 dBA adjustment to account for the greater distance from the Brouha residence than from SM3 to the wind turbine project (9290 ft vs. 7180 ft), plus the Outdoor-Indoor Level Reductions (OILR) associated with windows closed (-25 dBA), windows partially open (-6 dBA), and windows fully open (-1 dBA) conditions that Acentech measured in the center of the 2nd floor bedroom structure at the Brouha residence. Results are also presented for the average OILR values associated with windows closed (-25 dBA), windows partially open (-9 dBA), and windows fully open (-3 dBA) conditions that Acentech measured around the 2nd floor bedroom at the Brouha residence.

As stated above in this report, the results for "Outside Brouha Residence" are provided only for comparison purposes with other similar facilities in the state (Lowell and Georgia Mtn.) that have an outside limit of 45 dBA.

Criteria are 1-hr A-weighted Leq values. Analysis used rolling 60-minute periods based on the 10-minute interval data collected by HA.