BEFORE THE
STATE OF NEW YORK
BOARD ON ELECTRIC GENERATION
SITING AND THE ENVIRONMENT

In the Matter of

Eight Point Wind LLC

Case 16-F-00062

January 22, 2018

Prepared Testimony of:

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Q. Will you please state your name, employer, and business address?
A. My name is Miguel Moreno-Caballero and I am employed by the New York State Department of Public Service (DPS or the Department), located at Three Empire State Plaza, Albany, New York, 12223.
Q. Mr. Moreno what is your position at the Department?
A. I am a Utility Engineering Specialist 3 (Acoustics) in the Environmental Certification and Compliance section of the Office of Electric, Gas and Water (Staff).
Q. Please summarize your educational background and professional experience.
A. I attended the Pontifical Xaverian University in Bogota, Colombia and received a Bachelor of Science degree in Civil Engineering in 1986. Thereafter, I continued my education at Universidad del Norte in Barranquilla, Colombia and graduated with a Master in Business Administration in 1992. I have accumulated more

than 20 years of experience in the field of acoustics and noise control. I owned and operated my own business in Colombia, South America for about 13 years, where I worked as an acoustical consultant and acoustical contractor. I designed and built noise abatement solutions for emergency generators, industrial machinery, HVAC equipment, and interior acoustical designs for indoor spaces. I obtained extensive experience in noise control including noise surveys and computer simulations of aircraft noise for two international airports.

After my arrival to the United States, I was employed as a Senior Acoustical Consultant by an acoustical consultant firm in Washington D.C., from October 2005 until May 2008. There, I analyzed sound surveys and performed computer noise modeling for roadways and highways and designed mitigation measures such as barriers and selected building envelope specifications for environmental noise control. I also designed noise control solutions for mechanical

equipment and interior acoustics for indoor spaces for a variety of projects. From May 2008 to June 2009, I was employed by an acoustical consultant company in Manhattan and worked for several acoustical and noise control projects including data centers and corporate projects. I joined the Department in November 2013. My duties include reviewing Public Service Law (PSL) Article VII and Article 10 pre-applications, applications, environmental noise assessments, noise surveys and mitigation measures. I also review sound collection protocols and witness sound measurements to ensure compliance with Certificate Conditions. I am a full-member of the Institute of Noise Control Engineering and an Associate member of the Acoustical Society of America.

Q. Mr. Moreno, which projects have you reviewed under PSL Article 10 and Article VII regulations?

A. Under Article VII regulations, I have reviewed the applications for the following certified

cases: New York Power Authority, Case 13-T-0515; DMP New York, Inc., Williams Field Services Company LLC, Cases 13-T-0538 and 13-T-0350; PSEG Power New York, Inc. Case 15-F-0040; and Consolidated Edison Company of New York, Inc., Case 13-T-0586. Although currently pending or uncertified, I also reviewed environmental noise assessments for the following Article VII projects: West Point Partners LLC, Case 13-T-0292; Poseidon Transmission, LLC, Case 13-T-0391; In the Matter of Alternating Current Transmission Upgrades – Comparative Proceeding, Case 13-E-0488; Vermont Green Line Devco, LLCI, Case 16-T-0260; and Niagara Mohawk Power Corporation, Case 15-T-0305. I am currently working on numerous PSL Article 10 proceedings (and some potentially affiliated Article VII filings) regarding wind generating facilities at various stages including the following projects: Cassadaga Wind, LLC, Case 14-F-0490 already certified by the New York State Board on Generation siting and the Environment (Siting

Board); Lighthouse Wind, LLC, Case 14-F-0485; Baron Winds, LLC, Case 15-F-0122; Galloo Island, Case 15-F-0327; Bull Run Energy, LLC, Case 15-F-0377; Eight Point Wind, LLC, Case 16-F-0062; Atlantic Wind, LLC -Deer River-, Case 15-F-0267; Canisteo Wind Energy, LLC, Case 16-F-0205; Case 16-F-0267;; Number Three Wind LLC, Case 16-F-0328;; Heritage Wind LLC, Case 16-F-0546; Bluestone Wind, LLC, Case 16-F-0559; Alle-Catt Wind Energy, LLC, 17-F-0282 and Atlantic Wind, LLC, -Mad River-,Case 16-F-0713. I am also assigned on multiple PSL Article 10 proceedings (and some potentially affiliated Article VII filings) regarding solar generating facilities at various stages including the following projects: Mohawk Solar, LLC, Case 17-F-0182; Hecate Energy Albany 1, LLC and Hecate Energy Albany 2, LLC, Case 17-F-0617; and Hecate Energy Greene County 1, LLC, Hecate Energy Greene 2, LLC, and Hecate Energy Greene County 3, LLC, Case 17-F-0619.

Q. Are you sponsoring or relying upon any other

exhibits?

A. Yes. I am sponsoring Exhibit__(MMC-1); through Exhibit__(MMC-13).

Q. Please briefly described those exhibits.

A. Exhibit__(MMC-1) contains the document entitled “Guidelines for Community Noise,” World Health Organization, 1999 (WHO 1999) which I will refer to as “WHO-1999”,

Exhibit__(MMC-2) contains a link to download the document entitled “Guidelines and Recommendations” which I will refer to as WHO-2009.

Exhibit (MMC-3) contains and executive summary of the most recent guidelines from the World Health Organization (WHO) regional office for Europe entitled “Environmental Noise Guidelines for the European Region” published in October 2018 which I will refer to as “WHO-2018-ES“.

Exhibit (MMC-4) contains the most recent guidelines from the World Health Organization (WHO) regional office for Europe entitled “Environmental Noise Guidelines for the European

Region" published in October 2018 which I will refer to as as "WHO-2018".

Exhibit_(MMC-5), contains a study entitled "Massachusetts Study on Wind Turbine Acoustics. Prepared for: Massachusetts Clean Energy Center and Department of Environmental Protection. Submitted by RSG Inc. Report 2.18.2016," which I will refer to as MA-STUDY-2016 in my testimony.

Exhibit (MMC-6) contains my notes on Figure 26, Page 69 of the MA-STUDY-2016.

Exhibit (MMC-7) contains the proposed certificate Conditions on noise and vibration that I am recommending for this Project.

Exhibit__(MMC-8) contains a Sound Testing Compliance Protocol that I have developed and am proposing for this project which I will refer to as DPS-Protocol.

Exhibit__(MMC-9) contains Table 2 of a reference called "Percentiles of Normal Hearing-Threshold Distribution Under Free-Field Listening Conditions in Numerical Form". Kenji Kurakata, Tazu Mizunami, and Kuzama Matsushita. Acoust.

Sci. & Tech. 26, 5 (2005), which I will refer to as KURAKATA-2005

Exhibit__(MMC-10) contains a drawing showing the turbines proposed for this project and the locations of non-participating residences differentiated to indicate the short-term noise levels reported in the Application.

Exhibit (MMC-11) contains an alternative to the certificate conditions that I am presenting for consideration including both a red-line and a clean version.

Exhibit (MMC-12) contains a red line comparison between certificate conditions proposed by the Applicant and my proposed Certificate Conditions.

Exhibit (MMC-13) contains my preliminary comments and edits on the protocols presented in the Application.

Q. Mr. Moreno, what is your role under PSL Article 10 regulation review?

A. Under Article 10, my duties include the review of preliminary scoping statements, stipulations

and applications as they relate to the noise assessments and avoidance or minimization of environmental noise impacts from major electric generation facilities. My role regarding wind generating projects consists of the review of sections of the Application related to noise impact assessments from construction and operation of the facilities which includes pre-construction ambient noise surveys, analysis of existing or potential future prominent tones, noise modeling parameters, assumptions and results, amplitude modulation, low-frequency noise, infrasound, potential for hearing damage, indoor and outdoor speech interference, interference with the use of outdoor public facilities and public areas, community complaint potential or annoyance, and the potential for interference with technological, industrial or medical activities that are sensitive to vibration or infrasound. In addition, my role also includes the review of applicable noise standards and guidelines, local regulations on

noise, design goals for the facilities, noise abatement measures, complaint and resolution plans for noise from construction and operation of the facility, and proposed post-construction noise evaluations and compliance for conformance with certificate conditions.

Q. Why is the noise expected to be generated from the Eight Point Wind LLC Project (Project) an important issue for the Siting Board to consider in this proceeding?

A. Public Service Law §164 and the implementing regulations, 16 NYCRR 1001.19, require an applicant for a Certificate of Environmental Compatibility and Public Need (Certificate), to provide certain information concerning the noise and vibration impacts of the construction and operation of a facility. In addition, the various noise levels expected from a major electric generating facility, including a wind generating facility like this Project, are important factors in determining the nature of the probable environmental impacts of the

construction and operation of the proposed facility and whether it avoids or minimizes environmental impacts to the maximum extent practicable.

Q. Can you please describe the different labels such as $L_{eq,}$ and the L_{90}, often used to describe noise levels?

A. Noise levels frequently fluctuate over a wide range and over time, so different sound descriptors have been developed to describe sound pressure levels over a period of time. The “Leq” is the equivalent-continuous sound pressure level of a noise source. It is the single sound pressure level that, if constant over a specified time period, would contain the same sound energy as the actual monitored sound that varies in level over the measurement period. Guidelines for noise are sometimes expressed in terms of maximum noise levels specifying the period of time over which the measurements are taken. For example, 45 dBA $L_{eq\ (8\ hours)}$ means that the noise levels evaluated

during 8 hours have an energy average equivalent to a constant level of 45 dBA.

Q. What is a percentile level?

A. The Ln is the percentile level, where n is any number between 0 and 100. The number designated by n corresponds to the percentage of the measurement time period by which the stated sound level has been exceeded. (See, James P. Cowan, Handbook of Environmental Acoustics, J. Wiley [1994], p. 41). For instance, the L90 is the sound level that is exceeded 90 percent of the time, usually regarded as the “residual level” or the background noise without the source in question or discrete sound events (Cowan, p. 41).

Q. What does the designation “dBA” mean?

A. “dB” is a designation for “decibel” which is equivalent to a tenth of a “Bell” (a unit named after Alexander Graham Bell). A Bell is too large to describe the acoustic environment and for that reason was broken into tenths or “decibels.” (Cowan, p. 41). The “A” letter after

the “dB” designation denotes one of the most common weighting networks in acoustics and noise control. The human ear does not sense all frequencies in the same manner, and the human ear does not hear sounds at different frequencies the same way a typical microphone in a sound level meter does. (Cowan p. 36). For that reason, the “A-weighted” scale was developed and is comprised of a series of corrections applied to the sound levels measured by a sound level meter at all frequencies of the human audible spectra to resemble human hearing. (Cowan p. 31). Although the normal hearing range in humans goes from 20 Hertz up to 20,000 Hertz, humans are more sensitive to sound with frequencies between 200 Hertz and 10,000 Hertz (Cowan p. 36) and for that reason the greatest corrections are applied to the low frequencies. (e.g. minus 57 dB at 16 Hertz). In addition, we hear the sound levels between 500 Hertz and 4,000 Hertz similar to the way it is perceived by a sound level meter microphone and for that

reason the corrections are lower ranging from minus 3.2 dB at 500 Hertz up to 1.0 dB at 4,000 Hertz. After all corrections are applied to each frequency sound level, the individual contributions to the dBA level are added up and the result is noted as "overall," "broadband," "dBA" or "dBA-weighted" noise level.

Q. Does the proposed Project avoid or minimize the adverse environmental noise impacts to the maximum extent practicable?

A. No. While the Project as proposed does provide for some mitigation and avoidance of impacts, I believe that potential adverse environmental noise impacts from operation of the facility have not been avoided or minimized to the maximum extent practicable.

Q. Please explain your general impressions of the Content of the Application for this project and a summary of your findings.

A. I find that the design of the Project as originally proposed will most likely comply with the most relevant thresholds and criteria at

most receptors, but not all. I also note that the computer noise modeling did not use Noise Reduction Operations (NROs) to demonstrate conformance with design goals at most receptors which I think is not only a good approach during the design phase but should be maintained during the Siting process. However, this does not mean that I agree with all the content of the Application. In fact, I disagree with some of the assumptions in the Application such as interpreting computer sound results with the ISO 9613-2 Standard as the maximum hourly levels of the project, the introduction of corrections to the CONCAWE calculations to match the results with the ISO 9613-2, the evaluation of sound levels at 1.5 meters exclusively which may be appropriate only for one-story residences but not for residences with two or more stories, among others. In addition, the World Health Organization released new guidelines in October of 2018, after the Application was filed, with specific recommendations to address wind turbine

noise and with potential implications that I consider important to be considered by the Siting Board.

Q. What are the most important findings from your review of WHO-2018 as related to this project?

A. One of the most important findings is that WHO-2018 withdrew the outdoor short-term recommendation of not exceeding 45 dBA-Leq-8-hour during the nighttime that it had recommended in 1999. WHO-1999 was the basis for recommending the Siting Board that this short-term limit be applied to Cassadaga Wind LLC in Case 14-F-0490. In addition, WHO-2018 (p. 9) recommends a lower outdoor-to-indoor noise reduction provided by the residential buildings than the one that was assumed in 1999 for transportation noise sources, as well as maintaining the indoor noise levels as recommended in 1999. Furthermore, the new recommendation from WHO-2018 is protective not only of the nighttime period but of the daytime and evening time periods as well and more

importantly it may require a lower long-term nighttime noise limit than as recommended in 2009 which was also the basis for recommending the Siting Board adopting a long-term goal for Cassadaga Wind. After analyzing the recommendations of WHO-1999, WHO-2009, and the WHO-2018 independently, I recommend that the short term 45 dBA-Leq-8-h is not the most protective among all the three guidelines and that a shorter limit, on the order of 42-dBA should be adopted so that all three WHO guidelines and recommendations are met and that the potential adverse effects from the facility are minimized.

Further I have identified a few turbines that should be either re-located or eliminated from consideration so that the adverse effects are reduced on the most impacted receptors.

In addition, I do not find the post-construction compliance monitoring protocol presented in the Application as appropriate to demonstrate that the adverse effects from the facility were in

fact avoided or minimized to the most extent practicable and for that reason I am recommending a different protocol for consideration. Details of my findings are presented in this testimony.

Q. What are your general impressions of the Certificate Conditions proposed by the Applicant.

A. The Proposed Certificate Conditions presented by Eight Point Wind are similar to those applied by the Siting Board in Case 14-F-0490, Cassadaga Wind. I will be explaining the changes that I consider important and some recommendations for simplification of the Certificate Conditions, and post-construction noise testing.

Q. Please explain the first recommendation about the Certificate Conditions proposed by the Applicant for Eight Point Wind?

A. I note an insertion of a provision in Certificate Condition 65 (d) specifying that “[r]evised sound modeling shall not incorporate more than 3 dBA of the available NROs.” As I

will discuss in my testimony, NROs should not be used in a compliance filing to demonstrate conformance with relevant criteria and conditions that the Siting Board may impose on Eight Point Wind, but rather as a contingency mitigation option to be used after construction. For that reason, this provision should be replaced by one specifying that NROs shall not be used for demonstrating conformance with the Order in compliance filings.

Q. Do you disagree with any other proposed Certificate Conditions?

A. Yes. Certificate Condition 77 states: ”The Certificate Holder shall evaluate in a Compliance Filing which of the four alternate turbine locations, if any, are necessary to be employed in the following order of preference, Alternate Turbine 1, Alternate Turbine 4, Alternate Turbine 2, and Alternate Turbine 3. If an alternate turbine location is deemed necessary, the Certificate Holder will select Alternate Turbine locations 1 and/or 4, then

2…." This condition should be modified consistent with my recommendations that the Applicant 1) eliminates Turbine #10 and use ALT1 instead, which will reduce the impacts on receptors 327 and 329; 2) eliminates Turbine #5 and use ALT2, which will reduce the impacts on receptors 692 and 325; 3) eliminates ALT3 from consideration, as its use would burden receptors 456 and 454; and 4) eliminates Turbine #20 and use adjacent turbine ALT4, which will reduce the impacts on receptors 771 and 522. All these recommendations are proposed to decrease the noise levels on the most impacted receptors, with short-term sound levels predicted between 43 and 44 dBA which are depicted in red and orange colors in the Figure included in Exh MMC-10. I will be explaining further in my testimony why the sound levels at these receptors should be reduced.

Q. Do you have any other comments on the proposed certificate conditions?

A. Yes, all the changes that I am proposing on the

certificate conditions proposed by the Applicant can be seen in exhibit MMC-12 but I will be discussing most of them at the end of my testimony. However, I would like to start with a discussion regarding the short-term noise limits included in Certificate Condition 74 (a) proposed by the Applicant in light of the most recent recommendations by the World Health Organization. The most recent guideline, WHO-2018, states: “[t]he current environmental noise guidelines for the European Region supersede the [WHO Guidelines for Community Noise] (CNG) from 1999 (p. 28). Nevertheless, the [Guideline Development Group] GDG recommends that all CNG indoor guideline values and any values not covered by the current guidelines (such as industrial noise and shopping areas) should remain valid.”

What this means is that the 45 dBA-Leq-8-h outdoor from WHO-1999 was replaced with a new recommendation that is potentially more protective than the previous WHO-1999 guideline

for the nighttime and that the WHO-1999 indoor recommendation of 30 dBA-Leq-8-h nighttime was retained. I note that in 1999 the 45 dBA-Leq-8-h outdoor recommendation was based on the addition of an assumed 15-dBA outdoor-to-indoor noise reduction to the 30-dBA-Leq-8-h nighttime indoor recommendation (30+15=40). The outdoor-to-indoor noise reduction is provided by the exterior building components (e.g. exterior walls, windows and roofs).

Q. Why is that a concern?

A. The concern is whether residences could provide a 15-dBA noise reduction against wind turbine noise so that they can be exposed to a maximum outdoor noise level of 45-dBA-Leq-8-h and still comply with a 30-dBA-Leq-8-h indoor recommendation from WHO-1999. While good quality construction may provide more than 15-dBA reduction with the windows closed, it may not be able to provide such reduction with the windows open or partially open. The rule-of-thumb is that a light-weight residence may

provide about 10 dBA outdoor-to-indoor reduction with the windows open.

Q. What are the implications for this case?

A. According to the WHO-2018 (p.9) and other references, the outdoor-to indoor noise reductions against wind turbine noise with the windows open are between 10 dBA and 12 dBA, not 15 dBA. If a residence provides only a 10 dBA to 12 dBA noise reduction with the windows open, it should not be exposed to more than 40 dBA to 42 dBA outdoor during the nighttime so that the indoor recommendation of 30 dBA-8-h can be met.

Q. What is your conclusion?

A. WHO-2018 shows that an outdoor limit of 45 dBA during the nighttime may not be sufficiently protective if residents have open windows, a condition that may occur during the summer and as a result outdoor limits should be between 40 dBA to 42 dBA Leq-8-hour and not 45 dBA-Leq-8-h so that the indoor recommendations from WHO-1999 of 30 dBA-Leq-8-h can be met. As I will explain later in my testimony the short-term limit

should also be lower than 45 dBA-Leq for other reasons.

Q. What are the findings of your review of the short-term outdoor impacts on noise sensitive receptors for Eight Point Wind?

A. The Application included computer noise modeling by using the ISO-9613-2 propagation model with no meteorological correction by using the maximum broadband (overall) sound power levels from the turbines under consideration as stipulated for the project. Other assumptions included the use of a ground factor G of 0.5 and a correction of 2 dBA added to the results and a height of evaluation of 1.5 meters for sound sensitive receptors that represents the height of the human ears above the ground. The interpretation of the results in the Application is that they correspond to the maximum 1-hour sound levels from the Facility (1-hour and 8-hour) at sensitive sound receptors that could occur in a year.

Q. Do you agree with that interpretation?

A. No, I do not. I think that the actual maximum short-term sound levels could be greater than those calculated with those assumptions.
Q. Do you have any evidence supporting that?
A. Yes, in my review of studies concerning accuracy of the ISO-9613-2 model I found one where the use of the ISO-9613-2 sound propagation model with similar assumptions and input values to the ones that were used in the Application, resulted in about a 3-dBA underprediction of the Leq-1-hour noise descriptor for one out of six 1-hour samples and one out of the two highest sound pressure levels that were modeled and measured.
Q. What is the study you refer to and which is the section that shows the underprediction?
A. The study is entitled “Massachusetts Study on Wind Turbine Acoustics” (Ex. MMC-5) which was prepared for the Massachusetts Clean Energy Center and Department of Environmental Protection. The findings relevant to this case are shown on Figure 26, page 68, and is included as Ex. MMC-5. The figure has three graphs and

the one at the bottom shows a correlation between sound pressure levels estimated at a receptor located 330 meters (1,083 feet) downwind from the turbines as obtained with the ISO-9613-2 sound propagation model and a ground factor of G 0.5 plus a 2-dBA correction added to the results. The figure correlates the estimates to the sound pressure levels that were measured after monitoring the 1-hour Leq-dBA noise descriptor for six hours at that receptor. This can easily be observed in Ex. MMC-6 where I have included my notes on top of the relevant graph. As it can be seen from the graph in one out of the six hours, the sound pressure levels using computer noise modeling were 3 dBA lower than as measured after monitoring (43 dBA as opposed to 46 dBA). The 3-dBA underestimate occurred for one of the two highest sound pressure levels. This also shows that although the addition of 2 dBA to the ISO 9613-2 results improves the accuracy of the estimates, it is not sufficient for one out of two samples at the

maximum sound power levels. In this case a correction of 5 dBA, not 2 dBA, is needed to estimate the actual maximum 1-hour sound levels.

Q. You mentioned earlier in your testimony that the Massachusetts Study (MA-Study) used the same or similar input values to the ones used for Eight Point Wind. What are the differences and how are those differences relevant to this case?

A. There are two differences. The first is that the receptor in the MA-Study was evaluated at 330 meters (1,083 feet) from the turbine but the setbacks for Eight Point Wind are 1,400 feet. Despite the differences, the findings are still applicable to this case. In fact, I would expect that the discrepancies would grow for receptors at distances greater than 1,083 feet and not decrease as research has found that the underpredictions with the ISO-9613-2 model are higher for more distant receptors. The second difference is that the MA-Study evaluated sound receptors at 1 meter above the ground while the Application evaluated receptors at 1.5 meters

above the ground. Such difference may not be relevant. While a height of evaluation of 1.5 meters may be appropriate for one-story residences, it will not be appropriate for residences with two or more stories. This is because two-story residences should be evaluated about 4 meters above the ground to estimate levels at the second floor. For two-story houses the predicted sound levels may be higher (about 1.5 dBA for the closest receptors). At this time there is no information in the Application about whether the most impacted receptors are one or two-story residences, but this is something that should be considered for the final design and for postconstruction compliance sound tests.

Q. What do you recommend?

A. I recommend that all non-participating receptors with sound levels exceeding 40 dBA-Leq-1-h as forecasted with the ISO 9613-2 model, be investigated to confirm that in fact they correspond to single-story houses. Otherwise,

the preconstruction and postconstruction sound impacts should be evaluated at 4 meters as recommended by the reference cited in WHO-2009 (Section 1 of Annex I of the European Directive 2002/49/EC of June 25, 2002).

A. How could a 3-dBA underprediction in the Leq-1-hour noise levels affect the accuracy of the prediction of the Leq-8-h noise descriptor?

Q. It depends on how many times an underprediction of 3-dB occurs in an eight-hour period. If, in the best case, this occurs only once, the underprediction of the Leq-8-h could be only half of a decibel, but if the worst case occurs during the eight-hours, the underprediction of the Leq-8-h could be 3 dBA. If it occurs half of the time, it will result in an underprediction of approximately 2 dBA.

Q. If the actual sound levels after construction could be higher than predicted in the Application how is this relevant?

A. Sound pressure levels in the initial design are estimated to be as high as 44 dBA-Leq-1-hour at

four non-participant receptors and greater than 42 dBA-Leq-1-hour at nine non-participating receptors without the use of NROs in computer modeling. In the worst case, if a 3-dBA underprediction occurs for eight consecutive hours, the maximum noise levels could exceed the regulatory limit proposed by the Applicant and as explained before, that would not comply with an indoor recommendation of 30 dBA if the windows are open.

Q. You mentioned earlier in your testimony that the 3-dBA underprediction occurred for one out of the two highest sound levels for a receptor located downwind from the turbines. Is it possible that a receptor could be located downwind from the closest turbine for eight consecutive hours during any time of the day in a year, when the turbines are generating the highest sound power levels?

A. Yes, it is possible.

Q. Can such exceedance be mitigated after the Project becomes operational?

A. Yes, a 3 dBA underprediction can be mitigated by applying NROs on the closest turbine(s).
Q. If it can be mitigated by applying NROs what is the concern?
A. The concern is that the mitigation that may be needed could be higher. For instance, if sound limits are 42 dBA or lower as previously stated in my testimony and if an underprediction of 3 dBA occurs, the total noise reduction at the most impacted receptors could be as high as 5 dBA. (44 dBA maximum impact plus 3 dBA underprediction minus 42 dBA proposed regulatory limit equal to 5 dBA). In addition, if the non-participating receptor is a two-story house, the sound levels at the second floor could be about 1.5 dBA greater than as estimated (45.5 dBA rather than 44 dBA). In that case the noise reduction at the receptor could be as high as 6.5 dBA.
Q. Is that feasible?
A. For some turbine models it may be feasible but not for all. Documentation about NROs for the

turbines considered for the project are not provided in the Application. For those wind turbine models for which it is not feasible, the only mitigation option would be a shutdown for the periods when the sound limits are exceeded. Both NROs and shutdowns reduce the energy production making the Project less efficient.

Q. What is your recommendation?

A. My recommendation is that NROs should not be used for computer noise modeling to demonstrate conformance with relevant criteria and that minimization measures should be provided during design for the most impacted receptors.

Q. What is your conclusion about the analysis of short-term impacts and Certificate Conditions.

A. Short-term regulatory limits should be lower than those set for Cassadaga Wind and may need to be as low as 42-dBA-8-h-nighttime to comply with the indoor recommendations of WHO-1999. NROs should not be used for computer noise modeling to demonstrate conformance with

relevant criteria but rather be left as contingent mitigation options as underpredictions and discrepancies between computer noise modeling and post-construction actual sound levels are likely to occur.

Q. What are your recommendations for participating receptors.

A. I also recommend reducing the regulatory limit for non-participating receptors, from 55 dBA as ordered for Cassadaga Wind to 52 dBA-Leq-8-h) on the basis that the difference between the short-term limits and the long-term limits may be as low as 2 dBA and not 5 dBA as assumed for Cassadaga. This is based on an identified threshold of 50 Lnight in WHO-2009 for zero risk of cardiovascular disease. Participating receptors should be aware that indoor noise levels with the windows open, or partially open, may be higher than as recommended by WHO-1999 and may need to close their windows to reduce the potential for annoyance or sleep disruptions. Currently the Application shows

that the maximum Leq-1-h sound levels at participating receptors are predicted to be 48 dBA, five dBA below the 52 dBA Leq-8-h regulatory limit that I am recommending.

Q. Do you have any concerns with long-term sound levels as proposed by the Applicant?

A. In Cassadaga Wind, the Siting Board imposed Certificated Condition 80(b), which includes a sound limit of 40 dBA L(night-outside), annual equivalent continuous average nighttime sound level from the Facility outside any existing permanent or seasonal non-participating residence, and a limit of 50 dBA L(night-outside), annual equivalent continuous average nighttime sound level from the Facility outside any existing participating residence. Although the clause is included in the Certificate Conditions proposed by Eight Point Wind this is not included in the protocol for post-construction noise evaluations.

Q. Do you agree with excluding testing of the Lnight-outside regulatory limit from the scope

of the compliance testing protocol?

A. No, I do not. I consider that the 40 dBA L(night-outside) for non-participating receptors which is based on the recommendations of WHO-2009 is potentially more protective than the 45 dBA (dBA) Leq (8-hour) WHO-1999 recommendation and therefore should be evaluated at the most critical locations after the Project is built. Alternatively, the Project should be designed for a lower short-term limit as previously stated.

Q. Is the WHO-2009 still applicable?

A. Yes. As stated in the most recent guideline (WHO-2018) “the current guidelines complement the [WHO Night Noise Guidelines] (NNG) from 2009.”

Q. Has the Application included computer noise modeling and calculations showing that the design complies with the 40 dBA-Lnight recommendation of WHO-2009 for non-participating receptors?

A. Yes. The Application shows that the maximum

impact will be 40-dBA at non-participating receptors. Also, that a maximum level of 45-dBA Lnight will not be exceeded at non-participating receptors.

Q. Do you have any issues regarding how the Lnight levels were calculated and if so, could you please describe what those issues are?

A. Yes. The calculations of the Lnight include corrections on an hourly basis so that the results with the ISO 9613-2/CONCAWE method never exceed the Leq-1-hour calculated with the ISO 9613-2 at the particular wind speed that occurs during each hour.

Q. Please explain.

A. The Application adopted two methods for prediction of future operational noise levels from the Project called the ISO-9613-2 and the CONCAWE. The ISO-9613-2 method uses the ISO 9613-2 propagation standard with no meteorological corrections to estimate the short-term sound levels and the CONCAWE method uses the ISO 9613-2 propagation standard in

conjunction with the CONCAWE meteorological correction. As stipulated, both use the ISO-9613-2 propagation standard but without the ISO meteorological correction (Cmet). Instead, the CONCAWE approach adds a meteorological correction that is used in the original CONCAWE propagation standard to the hourly calculation of ISO-9613-2 components for estimates of long-term sound impacts.

Q. Are the ISO-9613-2 input values and assumptions the same for both methods.

A. No, they are not. The formulas are the same, but the input values and assumptions used in the studies are different. The ISO 9613-2, for estimates of maximum short-term noise levels, is calculated with a ground factor G 0.5 but uses a ground factor of G 1 when used in conjunction with the CONCAWE meteorological correction for long-term estimates. In simple terms, a G factor of 1 represents a better ground effect that results in lower noise levels at receptors. Then the CONCAWE meteorological correction is

calculated which can be either positive or negative, in other words, it can be added or subtracted to the ISO 9613-2 calculation components in an hourly basis. Further calculations of about 8,760 hours in a year are conducted to arrive to an estimate of the long-term energy-based average sound level Lnight at a particular receptor. The CONCAWE meteorological corrections can be either positive or negative because there are atmospheric conditions that are favorable and others that are unfavorable for propagation of noise. In other words, it may increase or decrease the sound levels at a particular receptor.

Q. What is the issue with the estimates of long-term sound levels?

A. The problem is that for every hour that the sum of the ISO-9613-2 with G=1 and the CONCAWE meteorological correction exceeds the sound levels estimated with the ISO-9613-2 standard with G=0.5 and maximum sound power levels, a

correction is applied to match the ISO-9613-2 results. In other words, this is done so that the level never exceeds the ISO-9613-2 short-term estimates.

Q. Is this approach reasonable?

A. In my opinion it is not. I have not found any peer reviewed publication or standard that calls for this. The correction also seems to be based on the Applications' assumption that predictions of the 1-hour-Leq sound levels with the ISO 9613-2 and no meteorological correction (Cmet)correspond to the maximum sound levels that can actually be measured, but as I explained before the MA-Study contains evidence showing that this is not the case. For one out of six 1-hour-Leq samples (and one of the two highest) the measurements exceeded the predictions by three decibels. Therefore, regardless of the assumptions and input values used in the CONCAWE calculations, corrections should not be applied to reduce the predictions with the CONCAWE to match the ISO-9612-2 G=0.5

calculations because, as the evidence supports, the actual measured sound levels can be up to 3 dBA higher than the estimates achieved by using computer noise modeling.

Q. You mentioned earlier in your testimony that you disagree with applying corrections to the CONCAWE method to match the ISO-9613-2 results. What is your opinion about the calculation with CONCAWE meteorological corrections presented in the Application and do you propose an alternative?

A. The review of calculations of long-term estimates is complicated. In fact, the supporting data is contained in two spreadsheets than contains about 390,000 data cells each. However, the raw data without any corrections, shows 1-h-Leq sound levels 1 to 2 dBA above the ones predicted with the ISO-9613-2. In other words, about 45 dBA to 46 dBA Leq-1-h, not 43 to 44 dBA for the most impacted receptors. I think the unadjusted data results are closer to maximum 1-hour Leq levels that it may occur.

Based on the information submitted by the Applicant, the differences between the short-term and the long-term calculations with corrections for sensitive receptors is between 2 and 11 dBA. I consider is practical to analyze whether the differences make sense. One of the most practical approaches is to make an estimate of the Lnight based on the difference between the maximum 1-hour sound power level generated by a turbine in a year and the yearly energy-average of all sound power levels generated by the same wind turbine in a year based on the statistics of wind direction for a site and the turbine selected for a project. Basically, this acknowledges that the main factor for the generation of noise is the wind magnitude at the hub height and ignores other variables that may affect the sound levels at a receptor such as wind direction and cloud coverage during the nighttime. For this project I see that the difference between the maximum sound power levels and the equivalent nighttime sound power

levels during the nighttime time is about 3 dBA. Essentially, if the facility does not want to exceed the 40 dBA Lnight WHO-2009 recommendation, the turbines should not produce more than 43 dBA short-term sound levels at receptors at the maximum sound power levels. Therefore, I consider that using a difference of 3 dBA is more appropriate than a higher difference. In this case, if the facility doesn't want to exceed the long-term recommendation of WHO-2009 equivalent to 40 dBA Lnight, it should not exceed a short-term level of 43 dBA. This again shows the need for considering short-term sound limits lower than the 45 dBA-Leq-8-hour recommended by WHO in 1999.

Q. If for some reason a Lnight of 40 dBA is exceeded at a particular receptor, is it possible to provide mitigation?

A. Yes, but as I explained before, there is a concern about accuracies because of the correction applied to the CONCAWE results to

match with the ISO 9613-2 results (between 1 and 2 dBA according to the Application) and also there is no certainty about whether the receptors are single or two-story residences. This again shows that the NROs should not be used in the design but rather being considered as a contingent mitigation option.

Q. Are there any other concerns?

A. Yes, the NROs are more effective if they are needed to reduce exceedances to a short-term noise limit rather than a long-term limit. In fact, when a short-term limit is exceeded, the NRO will only be applied during the periods of times when the short-term sound levels are exceeded, most likely at the highest sound power levels of generation. But for long-term sound limits this works differently.

Q. Please explain.

A. Noise reduction operations are more effective at high wind speeds, but they could be zero at medium and low wind speeds. Therefore, the noise reduction achieved at the receptor is lower than

the noise reduction applied on the turbines. For instance, if a 2-dBA noise reduction is needed at a receptor a higher NRO would need to be applied on the closest turbines (about 3 dBA). There is no NRO sound information provided for the turbine selected for this project, but I estimate that the noise reductions needed at the turbines can be approximately 1-2 dBA higher than the noise reduction needed at a receptor. If the NRO is applied only to one turbine and not to other closer turbines the NRO may need to be even higher. This is another cause of concern specially because although the long-term limits that were imposed by the Siting Board in the Cassadaga Wind case are included in the Certificate Conditions proposed by the Applicant for Eight Point Wind, evaluation of the Lnight descriptor is not included in the protocol for post-construction evaluations. What this also means is that if the long-term sound levels are only modeled by computer, there will be no measurements to demonstrate whether the facility

exceed the long-term recommendation of 40 dBA Lnight from WHO-2009.

Q. Is there any other alternative?

A. Yes. One is to measure the Lnight as I have proposed in the DPS-Protocol to address such measurements. Alternatively, the long-term limits may be eliminated from post-construction compliance measurements provided a lower short-term limit is adopted and NROs are not used in computer noise modeling. Since NROs are only effective at high wind speeds and might not be applied to all relevant turbines, this short-term regulatory limit should be conservatively estimated.

Q. Do you have any recommendation for that short-term limit?

A. My best estimate at this time is that that limit should be 42 dBA Leq so that the long-term recommendation of WHO-2009 and the interior noise levels could also comply with the indoor recommendations of WHO-1999 when windows are open or partially opened.

Q. You mentioned at the beginning of your testimony that the new recommendation of WHO in WHO-2018 includes consideration of the daytime periods as well, not only about the nighttime period. Please explain.

A. Yes, the new guidelines propose the Lden noise descriptor which considers the daytime, evening time, and nighttime noise levels.

Q. Do those guidelines address specifically the potential health impacts from wind turbine noise?

A. Yes. Recently, the WHO released the WHO-2018 guidelines for noise which include consideration of Wind Turbine Noise. The WHO-2018 guidelines found that adverse health effects (such as annoyance) are associated with a level equivalent to 45 dBA Lden. Therefore, the recommendation is that sound levels from wind turbines should be lower than 45 Lden in a year.

Q. What is the Lden?

A. The Lden is another noise descriptor equivalent to a yearly energy-based average with no

penalties applied to the daytime period, a 5-dBA penalty applied to the evening period, and a 10 dBA penalty applied to the nighttime period.

Q. How are the daytime, evening time and nighttime periods defined?

A. The definitions for all these periods of time in a day may be different for Europe, the United States, and other countries. For example, the “nighttime period” in Europe spans from 11 p.m. up to 7 a.m. the following morning, or from 10:00 p.m. to 6:00 am the following day (8-hour), while in United States “nighttime period” spans from 10 p.m. up to 7 a.m. (9-hour). In addition, the “daytime period” in Europe spans from 7 a.m. up to 7 p.m. or from 6:00 a.m. to 6:00 p.m. (12-hour) (WHO-2018, p. 9) while in United States “daytime” spans from 7 a.m. to 6 p.m. (11-hour). The “evening time” in Europe goes from 7 p.m. to 11:00 p.m. or from 6:00 a.m. to 10:00 p.m. (4-hour) while in the United States “evening time” spans from 6 p.m. up to 10:00 pm. Despite the differences in timing

definitions, the effects on the Lden noise descriptor may be minimal and may result in numbers that are quite similar with differences in the order of a few decimal points.

Q. If a sound source is constant during the day time, evening time, and nighttime (as defined in the United States), how many decibels should that noise source be in order not to exceed the 45-dBA Lden recommendation?

A. That sound source should have a constant average sound pressure level lower than 38.2 dBA Leq during the daytime (Lday), evening time (Leve), and nighttime (Lnight) in a year so that after all the penalties are applied it does not equal to or exceed the 45 dBA Lden WHO-2018 recommendation. In other words, the daytime, evening time, and nighttime average sound exposure in a year should be about 6.8 dBA lower than 45-dBA Lden WHO-2018 or equivalently 38.2 dBA.

Q. Are there any other corrections to be applied?

A. Possibly. For instance, it is technically

feasible to include the periods of time when the noise sources are not generating noise in the calculation of the Lden in a year. The effect of not including any noise from the noise sources (wind turbines in this case) during these periods depends on the percentage of the year the turbines are not generating and producing noise, but they may result in an extra allowance that could be approximately 1.1 dBA for a noise source that is not generating sound for approximately 15% of the time in a year. That being said, the sound should be lower than 39.3 dBA for the yearly average of the Ldaytime, Levening, and the Lnight (38.2+1.1=39.3). These levels, when combined with the percentage of time that noise source is not generating noise and after the 5- and 10-dBA penalties are applied to the evening time and the nighttime (respectively), will result in a Lden of 45 dBA.

Q. How does a noise level of 39.3 dBA Leq in a year equate to a maximum short-term threshold such as the Leq-11-hour(daytime), 4-hour(evening time),

9-hour(nighttime).

A. As explained for the Lnight descriptor the difference between the long-term and the maximum short-term levels depend on the statistical distribution of wind speed magnitudes at the site and the turbine model selected for the Project. Assuming that that difference is 3 dBA, a 39.3 dBA average in a year during the daytime would approximately equate to a short-term level of 42.3 dBA Leq during the daytime. For a noise source that is constant in time the average for the daytime and evening time periods should be the same. Therefore, in my opinion, the regulatory short-term limit for the daytime and evening time should also be about 42 dBA so that the 45 Lden recommendation is met.

Q. These are estimates for a noise source that is constant in time. Are they applicable to wind turbine noise that is not constant in time?

A. Yes, they are. The Netherlands has regulations that use the Lden and the Lnight noise descriptors. The limits have been set at 47-dBA

Lden and 41-dBA Lnight since 2011, a difference of 6 dBA between the two noise descriptors. See, Wind Farm Noise Measurements Assessment and Control Colin H. Hansen, Con J. Doolan and Kristy L. Hansen. (p.41) Wiley. 2017.

Q. What are the implications?

A. In order to comply with the WHO-2018 recommendation of 45 dBA Lden, a wind generating facility should not exceed a level of 39 dBA Leq in a year during the daytime, evening time and nighttime. A 39 dBA Lnight is 1 dB lower than the Lnight of 40 dBA recommended by WHO in 2009. This again would translate to a short-term limit of about 2 dBA to 4 dBA greater. In other words, a short-term level of 41 dBA to 43 dBA. I would recommend 42 dBA in this case, which is an average between those two levels.

Q. If the short-term limit regulatory limit is kept in 45 dBA in how many decibels the new WHO-2018 recommendation could be exceeded?

A. The Lden could be around 48-dBA, exceeding the new recommendation by about 3 dBA.

Q. Can that be mitigated and how?
A. Yes, by applying NROs to the closest turbines or eliminating some from the design. If NROs are applied, they need to be greater than the noise reduction needed at the receptor. I note however that the Application does not state whether NROs are available for the turbines considered for the Project and the maximum noise reduction that can be achieved. Also, there is no information attached that includes the sound power levels for NROs.
Q. What are the short-term sound results included in the Application?
A. The Application provided tables with short-term sound impacts using the Leq-1-h noise descriptor. There are no receptors with short-term levels exceeding 45-dBA-Leq-1-hour sound levels.
Q. How many receptors may exceed a short-term sound limit of 42 dBA-Leq-1-h?
A. There are 9 non-participating receptors with short-term levels exceeding a 42-dBA-Leq-1-hour

sound levels.

Q. Are there any issues related to low frequency sounds from the wind turbines in the Compliance Protocol proposed by the Applicant?

A. Yes. In case 14-F-0490 the Siting Board adopted Certificate Condition 80 (c)which requires the facility to "[c]omply with a maximum noise limit of 65 dB Leq at the full octave frequency bands of 16, 31.5, and 63 Hertz outside of any non-participant residence existing as of the issuance date of this Certificate in accordance with Annex D of ANSI standard S12.9-2005/Part 4 (Sounds with strong low-frequency content)." That condition, although proposed by the Applicant for Eight Point Wind is not included in the protocol for post-construction noise testing.

Q. What does Annex D of the ANSI Standard say?

A. Section D.2 of Annex D in ANSI S12.9-2005 Part 4, entitled “Sounds with strong low-frequency content,” states “[g]enerally, annoyance is minimal when octave-band sound pressure levels

are less than 65 dB at 16, 31.5 and 63-Hz mid-band frequencies."

Q. What is your recommendation for this case?

A. Post-construction monitoring of low frequency sounds is protective of annoyance to low frequency sounds and perceptible vibrations and for that reason should be adopted for Eight Point Wind as it was for Cassadaga Winds. This is reflected in Exhibit__(MMC-8), the DPS-Protocol.

Q. What is your opinion about Amplitude Modulation for this project.

A. The Certificate Conditions designated as 75(e) by Eight Point relates to the way complaints from Amplitude Modulation are handled.

Q. Please explain the concept of amplitude modulation and the Application's analysis and conclusions related to amplitude modulation.

A. In simple terms, amplitude modulation is a repetitive sound that occurs with a frequency of about one second or less. This is commonly described as a repetitive "swish" or "thump"

associated with turbine operation. “Recent evidence suggests that at times this ‘swish’ can become more of a pronounced ‘thump,’ leading to complaints from wind farm neighbors” (UK-2016, p. 1).” The interval of measurement has to be a fraction of a second (one tenth), to allow the problem to be described and analyzed. Once the amplitude modulation is properly measured, the amplitude modulation depth can be estimated. In simple terms the amplitude modulation depth is the number of decibels the amplitude of sound fluctuates from peak to trough.

Q. Can amplitude modulation be predicted at this time, before the Project is built, and what is the recommendation of the UK-2016 document for decision makers such as the Siting Board?

A. One of the main findings of the UK document 2016 is that amplitude modulation cannot be predicted at this time “[t]he prevalence of unacceptable AM has not been evaluated as part of this study, and current state of the art is that the likely occurrence cannot be predicted at the planning

stage. That does not preclude future research to determine the likelihood of AM occurring coming forward, and the development of a risk based evaluation, or similar. Due to the lack of ability to predict AM occurring on a site, and the reported difficulties in applying Statutory Nuisance provisions to control AM on existing sites, it is likely that the default position for a decision maker would be to apply the condition on all sites unless evidence is presented to the contrary." (Id. at 4).

Q. If amplitude modulation cannot be predicted at this time, what can be done to identify the problem should it occur?

A. Since amplitude modulation cannot be predicted at the planning stages for the proposed Project, the important issue is to address how amplitude modulation will be evaluated and how the impacts will be mitigated if they occur.

Q. What are the options for mitigation of amplitude modulation?

A. The UK 2016 document states in section 4.5.29,

pages 71 and 72 “[w]ith current technologies, mitigation in most cases will likely be achieved through pitch control of the turbine blades, or in the worst case the switching off of one or more turbines during periods of unacceptable AM.”

Q. Do you have any recommendations for Compliance testing?

A. Yes, I do. In Case 14-F-0490 the Siting Board adopted Certificate Condition 72 requiring the Applicant to perform two compliance tests: one during “leave-on” conditions; and another one with “leaf-off” conditions. For Cassadaga Wind DPS Staff did not proposed a compliance protocol. Absent of any alternatives, the Siting Board adopted the protocol presented by the Applicant. The Applicant here has proposed addressing the complaints and testing the Facility with protocols that were filed with the Application. I have objections to the protocols which are presented in my testimony and in Exhibit__(MMC-13) with edits and comments on the

most relevant issues discussed herein. This does not address the parts that a compliance protocol should have but that in my opinion are missed. In general, I do not recommend the adoption of the Protocols as presented in the application as it will not properly evaluate whether the facility as designed and as built will in fact avoid, offset, or minimize, the adverse environmental noise or vibration impacts upon the local community for the duration of the certificate.

Q. Are you recommending a Protocol for postconstruction noise evaluations?

A. Yes. The protocol is included in Exhibit MMC-8.

Q. Are there any differences between the Certificate Conditions Staff is recommending for noise and vibrations and the Certificate Conditions proposed by the Applicant as related to Compliance Filings?

A. Yes. All the differences can be seen in a red-line comparison included in Exhibit__(MMC-12). In Certificate Condition 65(c)(i) I am including

edits to fix typos related to the standards used to report sound power levels from the turbines. In Certificate condition 65 (c)(ii) I am including minor edits. In certificate condition 65 (d) I am recommending insertions as follows: first, I am expanding the requirements for revised computer modeling to allow the Applicant flexibility in case they want to introduce changes in revised modelling provided these changes result in more conservative results. Second, as explained in my testimony, I also recommend that NROs not be used in the design, to demonstrate conformance with any limit imposed by the Siting Board as a compliance filing requirement. For that reason, I am proposing changes requiring the Applicant not to use NROs in the compliance filings. Third, I am introducing edits to require the Applicant to confirm that the sensitive receptors with sound results approaching any noise limits of the final Order are in fact single-story residences. If they are found to be two-story buildings or

more, the sound levels should be evaluated at 4 meters, not at 1.5 meters. Forth, I am recommending incorporating my recommendations for elimination of turbines and the use of some already identified alternative locations in replacement of the text proposed by the Applicant for Certificate Condition 77 (c). Fifth, in certificate Condition 65 (d) (i) I am recommending requiring the Applicant to evaluate the new recommendations from WHO-2018 consisting of noise levels lower than 45 dBA Lden. As an alternative to this, I am recommending lower short-term regulatory limits as shown in my alternate proposed Certificate Condition 74(a) in Exh MMC-11. Sixth: Although the recommended decision for Cassadaga refers to a 50 dBA (Lnight-outside) for boundary lines I agree in having Certificate Condition 65 (d) (iii) expressing this requirement by using a short-term limit for this compliance filing at boundary lines. That is because is practical to generate sound contour drawings with the ISO

model for boundary lines with the sound turbines at maximum power levels but not feasible to generate yearly noise contours with the CONCAWE meteorological correction.

Q. Are there any differences between the Certificate Conditions Staff is recommending for noise and vibrations and the Certificate Conditions proposed by the Applicant as related to Postconstruction Compliance Evaluations?

A. Yes. In Certificate Condition 66, and as explained in my testimony, I am recommending adopting the Sound Testing Compliance Protocol presented by DPS in Exh-8 and not the Protocol presented by the Applicant. Should the Siting Board order any changes to the certificate conditions recommended by DPS or the Applicant I am recommending in Certificate Condition 66, requiring the Applicant to reflect those changes exclusively in the Protocol which should be filed as indicated in my proposed Certificate Condition 66. For the reasons explained above, I am also recommending eliminating Certificate

Condition 66 (a) proposed by the Applicant. Since the protocol presented by Staff already contains all the elements included in Applicant's Certificate Condition 66(b), 66(c), and 66(d), I am recommending the elimination of those provisions.

Q. Please explain what is the next change that you recommend.

A. Certificate Condition 68 proposed by the Applicant reads "[i]f the results of the first or the second Sound Compliance test performed by the Certificate Holder or any tests performed by DPS, upon reasonable notice to the Certificate Holder and following the Protocol approved in the Compliance Filing for the tests to be performed by the Certificate Holder, and after a reasonable period has elapsed for discussions between DPS and the Certificate Holder's acoustical consultant has elapsed, (…) indicate that the Facility (…)"

I disagree with this condition. First, the Applicant and DPS Staff should not follow the

protocol presented by the Applicant as this protocol is insufficient. Second, I recommend that if the Siting Board decides to grant a Certificate to Eight Point any post-construction monitoring should be conducted by following the Sound Testing Compliance protocol presented by DPS and attached to this testimony as Exhibit__(MMC-8).

Q. Are there any differences between the Certificate Conditions Staff is recommending and the Certificate Conditions proposed by the Applicant as related to regulatory noise limits to the facility?

A. Yes. Based on my discussions in my testimony, I am recommending in Certificate Condition 74(b) the facility also be required to demonstrate compliance with the new WHO guidelines of 45-dBA Lden for any existing permanent or seasonal non-participating residence by post-construction noise testing after the facility is built. Alternatively, if the Siting Board decides not to impose a certificate condition of 45 dBA

Lden, 40 dBA L(night) or both, I recommend reducing the short-term regulatory noise limit from 45 dBA Leq (8-hour) to 42 dBA Leq (8-hour) for any existing participating receptors and from 55 (dBA) Leq (8-hour) to 52 (dBA) Leq (8-hour) for any existing non-participating receptors. This option is reflected in my alternate conditions included in Exh-11. In addition, I'm recommending that the noise descriptor for the 65-dB Leq low-frequency noise limit included in Certificate Condition 74(d) be clarified as 65 dB Leq-1-hour. This is consistent with the requirements for compliance filings for Cassadaga and also with the noise descriptor used in Certificate Condition 65 (d) (iv) proposed by the Applicant.

Q. Are there any differences between the Certificate Conditions Staff is recommending and the Certificate Conditions proposed by the Applicant as related to complaints from noise and vibration from the facility?

A. Yes. I am proposing an insertion in Certificate

Condition 75(c) to clarify that the notifications required in this clause relate to the Applicant. In addition, I recommend that complaints be reported monthly during the first three years of operation and quarterly after that rather than monthly during the first full year of commercial operations as adopted for Cassadaga. If no noise or vibration complaints are received, I also recommend requiring the Certificate Holder to submit a letter to the Secretary indicating that no complaints were received during the reporting period rather than excepting the Applicant of any filings if no noise or vibration complaints are received.

Q. Are there any differences between Certificate Conditions proposed by Staff and the Applicant as related to complaints from Amplitude Modulation (AM) from the Project?

A. Yes. Given the discrepancies that could occur between computer noise modeling and actual post-construction noise measurements I recommend that complaints related to Amplitude Modulation be

investigated if measured or modeled sound levels at the location(s) being evaluated exceed 40 dBA L1hr, rather than based on modeled levels exceeding 40 dBA L1hr exclusively as ordered for Cassadaga Wind. In addition, I recommend edits on the clause related to Amplitude Modulation as ordered for Cassadaga. The edits are consistent with the discussion in page 60 of the Cassadaga's Order that states "[t]he RD also adopted a restriction on the Facility's production of amplitude modulated sounds, such as complaints of swishing or thumping type sounds. Should such amplitude modulated sounds be found to exceed a noise level of 45 dBA for more than 5 percent of the evaluation period, the Certificate Holder would be required to implement minimization measures." Consequently the 10% has been changed to 5%. In addition, I consider that the time frame of evaluation of Amplitude Modulation should be clearly specified. I am proposing a time frame of evaluation of 8-hours which I consider is

appropriate. The text “amplitude modulation depth is 5 dB or lower for a minimum of 90% any hour” it is confusing. First, I think that the 90% was set as the complement of the 10% indicated in the same clause. Therefore the 90% should be 95%. Second, the text should be referring to the penalty for Amplitude Modulation which is set at the beginning of the same clause. For that reason, I am proposing edits so that the Application of the AM penalty makes sense and is consistent with the intent expressed in the discussion of the order and the first portion of this clause.

Q. Is there any other way to address potential issues with amplitude modulation sound?

A. Yes, by reducing the sound limits to which the AM penalty is applied. The UK-2016 document recommended amplitude modulation penalties between 3 and 5 dBA. The 3-dBA penalty is applied if an AM depth of 3 dBA occurs while a 5 dBA penalty is applied if an AM depth greater than 5 dBA occurs. If the short-term goals and

limits are reduced to 42 dBA or lower an amplitude modulation penalty may not be needed.

Q. Are there any advantages when doing this?

A. Yes. There is no need to measure amplitude modulation. This clause could be eliminated as I am proposing in my alternative to my proposed certificate condition 75(e) in Exhibit__(MMC-11). As I previously said, the short-term limit should be 42 dBA to meet the WHO recommendations of 1999, 2009, and 2018 and at that level, the AM penalty may not be longer necessary.

Q. Is there any other change recommended to the Certificate Conditions proposed by the Applicant?

A. Yes. Certificate Condition 75(f) is edited to reflect that any re-testing should follow the provisions included in DPS Sound Testing Compliance Protocol, including section 10 of the protocol. Given that the protocol is limited to testing a few residential positions within the first year of operation, these provisions should apply to any re-test required in response to

legitimate complaints from any sensitive receptors existing as of the date of the Order.

Q. What are your final recommendations about the proposed facility.

A. The design should keep the noise reduction operations as a contingency option to mitigate any discrepancies between predicted and actual sound levels. Should sound levels after construction exceed relevant criteria or any Certificate conditions imposed by the Siting Board at the non-participating or participating receptors, then NROs should be applied as necessary on relevant turbines to bring noise levels back into compliance.

Q. Are there any mitigation measures that could be implemented if a non-conformance operational situation is found?

A. Yes. NROs are the most practical mitigation measure that could be implemented after the Project is built provided they are sufficient to mitigate any actual exceedances.

Q. How are identified the Certificate Conditions

that you are recommending for this Project?

A. My recommended Certificate conditions set forth below are included in Exhibit__(MMC-7) and an alternative is included in Exhibit__(MMC-11).

Q. Are those conditions based on your testimony and the record in this case?

A. Yes.

Q. Does the proposed Facility avoid or minimize environmental impacts to the maximum possible extent?

A. No. I believe that the potential adverse environmental noise impacts from operation of the facility have not been avoided or minimized to the maximum extent practicable. I also believe that additional minimizations measures such as elimination or relocation of turbines need to be explored. As stated at the beginning of my testimony my recommendations to reduce the impacts on the most impacted receptors are that the Applicant 1) eliminates Turbine #10 and use ALT1, which will reduce the impacts on receptors 327 and 329; 2) eliminates Turbine #5

and use ALT2, which will reduce the impacts on receptors 692 and 325; 3) eliminates ALT3 from consideration, as its use would burden receptors 456 and 454; and 4) eliminates Turbine #20 and use adjacent turbine ALT4, which will reduce the impacts on receptors 771 and 522.

Q. What is your recommendation to the Siting Board regarding granting a Certificate to the Applicant in light of the environmental noise impacts?

A. My recommendation as related to adverse environmental noise and vibration effects is that the Project should be approved subject to the Certificate Conditions, the post-construction protocol, and the regulatory limits that I am recommending for this project so that the adverse environmental noise effects of the operation of the Facility are minimized or avoided to the maximum extent practicable using verifiable measures. The Applicant should present updated computer noise modeling results including the elimination and relocation of

turbines as I previously described to demonstrate that the adverse operational noise impacts have been minimized or avoided to the maximum extent practicable. The final computer model should determine whether additional turbines need to be relocated or eliminated in order to comply with relevant thresholds and criteria as recommended in this testimony. In addition, the Applicant's proposed certificate conditions and Postconstruction Compliance Protocol is not sufficient to demonstrate that the Facility will in fact avoid, offset or minimize the impacts upon the most sensitive receptors to the maximum extent practicable using verifiable measures. Further, I recommend adoption of DPS- Staff proposed certificate conditions on noise and protocol for demonstration of compliance after construction, if the project is finally approved. The Applicant should also present updated computer noise modeling results as a compliance filing if any change is introduced to the design such as

different turbine model or turbine locations, any changes on the list of receptors including any changes on participation status, to demonstrate that the adverse operational noise impacts have been minimized or avoided to the maximum extent practicable before a final design can be approved and construction can begin.

Q. Does this conclude your testimony at this time?

A. Yes.