



Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection

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June 30, 2011

Falmouth Board of Selectmen
c/o the Honorable Mary Pat Flynn, Chairman
Falmouth Town Hall
55 Town Hall Square
Falmouth, MA 02540

Falmouth Board of Health
David Carignan, Health Agent
Falmouth Town Hall
55 Town Hall Square
Falmouth, MA 02540

RE: Harris Miller Miller & Hanson, Inc (HMMH) Wind Turbine Study Addendum, April 1, 2011

Dear Chairman Flynn and Agent Carignan:

In response to requests from the Falmouth Board of Selectmen, this letter will provide a response and additional guidance from the Massachusetts Department of Environmental Protection (MassDEP) regarding the April 1, 2011, HMMH Addendum to HMMH's September 2010 report concerning sound observation data gathered to evaluate the sound impacts from Falmouth Turbine Wind 1. The April 1, 2011 Addendum included additional information that MassDEP has carefully reviewed in preparing this letter. As you know, MassDEP previously provided guidance related to its recommended approach for sound evaluation in a January 24, 2011 letter (included herewith as Attachment 1) and met with HMMH on March 4, 2011 to discuss sound observations related to Wind 1 (meeting minutes included herewith as Attachment 2). This letter is based on MassDEP's evaluation of the original September 2010 HMMH report, the April 1, 2011 Addendum, the discussions with HMMH on March 4, 2011, and MassDEP's attendance at the Falmouth Board of Selectmen's meeting on June 6, 2011.

At the outset, MassDEP would like to acknowledge the work performed to date by HMMH on behalf of the Town and to commend the Board of Selectmen for their attention to this important issue. Evaluation of sound impacts from Wind Turbines is a complicated issue that was not considered by

MassDEP when it developed its sound evaluation/noise compliance guidance in the early 1970s and as revised in 1990. Accordingly, we appreciate the Town of Falmouth's and HMMH's efforts to work with MassDEP as we update our sound evaluation/noise compliance guidance to specifically address Wind Turbines.

In our January 24, 2011 letter, MassDEP provided guidance indicating that when we evaluate sound source compliance with the limit of 10dBA above background provided in MassDEP's Noise Policy for purposes of making nuisance determinations, the evaluation normally involves a comparison of the quiet period L90 background to the Lmax associated with the sound source in question for the same period. It is important to note that in most cases, MassDEP relies on attended sound observation studies so that sound observations/decibel readings can be attributed to particular sound sources and so the Lmax used for comparison to L90 background is from the sound source in question and not some other sound source. A limitation of attended studies is that they are short-term and provide only small amounts of data for impact evaluation and compliance decision-making. Long-term unattended studies, like the one performed by HMMH, can provide substantially more data so impact evaluations can include different sound source operating conditions and more times of day, but can leave questions unanswered regarding Lmax data observations and data capture related to the specific sound source in question.

During the March 4, 2011 meeting MassDEP and HMMH discussed how the data obtained through Falmouth's long-term unattended study could be used to make a determination of compliance with the MassDEP Noise policy. The study conducted by HMMH on behalf of Falmouth generated a significant volume of data that was not easily analyzed and the results presented in the September 2010 report were not in a format that would allow MassDEP to make a compliance determination. In the March 4, 2011 meeting we were informed of the specifics of how the study was designed (with input from the residents) and what the limits of the data were. At that time, we asked for the data to be reconfigured to compare L90 background to L90 with the wind turbine operating under various wind speeds under the assumption that if the wind turbine sound is a constant, such a comparison would provide us a means to compare background with and without the turbine to isolate the turbine sound profile.

The reconfigured data from HMMH's long-term unattended study indicates that Wind Turbine 1's broad band L90 one-hour sound impact compared to the L90 one-hour background at the same wind speed is no greater than 7.7 dBA. The study also appears to show that the wind turbine does not appear to be causing or contributing to any pure tone condition. There was one pure tone observed in the data but it was present with both the turbine on and off and is likely attributable to another source.

Despite the results of the reconfigured data, the September 2010 study shows a substantial number of Lmax sound observations that exceed 10dBA over background, both when the turbine is operating and not operating. While these observations cannot be attributed to turbine operation, MassDEP continues to have concern that these unattributed sound observations need to be further evaluated before a compliance determination can be made relative to broad band sound impacts from turbine operation. Therefore, MassDEP recommends that the Town conduct limited additional short term attended monitoring to augment the HMMH study.

MassDEP is in the process of updating its guidance for conducting sound surveys to specifically address sound emissions from wind turbines. The current MassDEP Noise Sampling Guidance was developed to be generally applicable to industrial noise sources that typically exhibit fairly steady emission signatures with relatively little frequency and octave variation. Current guidance recommends collecting attended sound observations every 6 seconds over a 17 minute period for a L90 quiet background to Lmax sound impact evaluation. In most cases, these industrial noise sources have the greatest impact during very low wind conditions and the amount of sound they generate does not change as wind conditions vary.

MassDEP is considering the following factors as it updates its noise survey data collection guidance for wind turbines:

- 1) Because wind speed varies greatly over time and wind turbine sound emissions vary with wind speed, characterizing turbine sound emissions at particular wind speeds may mean gathering data over shorter periods to control for variation in wind speed; and
- 2) Because the turbine blade oscillation sound cycle can be constant, provisions will need to be made to ensure there is data capture of peak sound within the cycle. A regularly repeating sound cycle with data gathered at regular intervals can synchronize and result in no observations of the cycle at the sound emission peak.

Accordingly, a short term attended study to augment the information from the HMMH study should be designed to be consistent with current MassDEP Guidance as modified for concerns of variable wind speed by collecting both background sound levels (L90) as well as turbine operational sound levels (Lmax). Specifically, the short term attended study should include the following:

- To evaluate the impact of wind speed on turbine sound emission levels, MassDEP recommends three sampling runs be conducted for each of three different turbine operating conditions (wind speeds). This will establish an Lmax for each respective wind turbine operating condition.
 - The three different operating conditions (wind speeds) MassDEP recommends be evaluated are: 1) at or near the cut-in wind speed where background will be the lowest; 2) at the wind speed where manufacturer data indicates there will be the greatest sound power level from the turbine; and, 3) at the maximum wind speed where the turbine will be operating.
- Likewise, three sampling runs should be conducted in conditions similar to the three different turbine operating conditions so that L90 background can be established for each operating condition.
- Each sampling run should be 5 minutes in duration and samples collected every 5 seconds (60 sound measurements).

- Sampling should be limited to "A" weighted sound levels with the decimeter set to "slow" response. To ensure data capture of the highest sound level emitted by the turbine as the blade rotates past the tower, each 5 minute study for turbine operation should be initiated as near as possible to wind turbine sound cycle emission peak.

Once the data is collected, the L90 background for each of the three sampling runs that were collected when the turbine was not operating would be defined as the average of the 6th lowest reading from each run. Lmax for each of the three runs collected when the turbine was operating at the three different operating conditions being evaluated should be averaged to result in an Lmax value that can be compared to the L90 background for each operating condition.

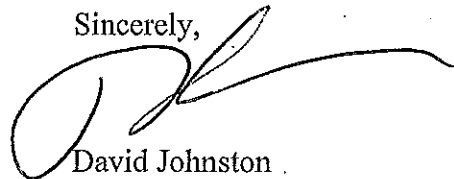
Consistent with current guidance, any peak sound levels that can be attributed to another sound source (e.g. local traffic, resident generated sounds) should be discarded from the data set before determining Lmax.

As noted above, MassDEP continues work to update our Noise Policy and Sampling Guidance in light of the challenge in evaluating wind turbine noise. The sound evaluation data from the Falmouth Wind Turbine study and discussions with residents and officials from the Town of Falmouth have been very informative. However, we believe that the additional data collection and analysis described above will allow the Department to reach a more definitive conclusion about the turbine's compliance with the Noise Policy than has been possible thus far. MassDEP also believes it should be feasible to complete this additional assessment, as well as MassDEP's review, in a relatively short period of time, and the Department is committed to working closely with the Town of Falmouth and HMMH as part of their ongoing evaluation of sound emissions from Falmouth Wind Turbine 1.

Finally, as was indicated by MassDEP at the June 6 Board of Selectmen meeting, MassDEP, along with the Massachusetts Department of Public Health, has also recently begun to convene an expert scientific panel on potential health impacts associated with exposure to wind turbines, including issues related to noise from turbines. MassDEP hopes that the results of this expert panel review will also help inform our ongoing evaluation of the Noise Policy, and that it will be of assistance to the Board of Selectmen and the Health Department as they continue to review these issues.

Please contact Laurel Carlson, Acting Deputy Director for the Bureau of Waste Prevention at (508) 946-2764 if you wish to meet to discuss in greater detail the specific elements MassDEP would recommend for collection of sound emission observations associated with wind turbine operation.

Sincerely,



David Johnston
Acting Regional Director

J/LC/lm

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