Maine Department of Environmental Protection
9/15/2011

BASIS STATEMENT
Amendments to Chapter 375, Section 10 Control of Noise

History

- By letter dated December 17, 2010, the Board of Environmental Protection (Board) was petitioned to initiate rulemaking for specific sound standards related to wind power developments. The petition contained more than 150 signatures of Maine registered voters. The petitioners' proposal was to add to Section 10 a new subsection I, entitled Sound Level Limits and Measurements for Wind Turbine Projects.
- The petitioners' basis for requesting rule amendments was that noise generated by wind turbine projects is unique and significantly different than noise generated from common and industrial developments and that the Department had no experience with grid-scale wind energy projects at the time the noise standards were last amended. The petitioners proposed a lower nighttime sound level limit of no more than 5 dBA above the pre-existing background level, not to exceed 35 dBA. The petitioners proposed requiring that a number of uncertainty factors be included in the predictive modeling required of applicants as well as more restrictive definitions of, and penalties for, short duration repetitive sounds (SDRS) and tonal sounds. In addition, the petitioners proposed standards for conducting post-construction compliance measurements and a procedure for complaint response.
- The Board posted the petitioners' proposed rule to a public hearing at its meeting on February 3, 2011, but did not set a date for the hearing at that time. The Board subsequently scheduled the hearing for May 19, 2011. That hearing was postponed. A public hearing on the proposed rules was held on July 7, 2011. Prior to the hearing and in comments submitted at the hearing, the petitioners proposed changes to the rule that they had originally petitioned the Board to adopt. At the hearing and during the subsequent comment period, the focus of the evidence presented was a revised version of the petitioners' proposed rule. The comment period ended July 18, 2011 at 5:00 p.m.
- After review of comments and the evidence received, the Department staff, in consultation with its noise consultant, presented recommended amendments to Chapter 375, section 10 to the Board at its meeting on August 8, 2011. Deliberations by the Board resulted in some changes to the staff recommendation. To allow for comments on the amended proposed rule, the Board posted the proposed rule for additional public comment. The second comment period ended August 29, 2011 at 5:00 p.m.
- The existing rule governing noise from wind energy developments is the general rule under the Site Law, Chapter 375, section 10, which was adopted in 1989 before significant wind energy development was proposed in Maine. This rule takes into account the increased knowledge concerning noise generated by wind energy developments since the rule was adopted. The department has utilized certain practices and protocols in assessing whether proposed wind energy developments will meet the requirements in

existing general rule. The codification of sound level limits specific to wind energy developments and the currently used practices and methodologies will help developers by providing consistency as they develop applications for permits and design projects, will assist the department and the public in the process of assessing the applications for these developments, and will protect the environment and existing uses of the areas surrounding such developments.

SUPPLEMENTAL BASIS STATEMENT AND RESPONSE TO COMMENTS

Chapter 375, Section 10, subsection I Sound Level Standards for Wind Energy Developments

September 15, 2011

A list of commenters and index of comments received are attached to this document as Attachments A and B, respectively.

Response to Comments

The response to comments is organized by section of the proposed rule as modified on August 8, 2011 in response to comments. The section designations differ from those in the petitioners' proposal. This response to comments references: the existing Chapter 10 rules (1989 rule) in several instances; the petitioners' proposal (7/18/2011 version); the version of the rule that the Board posted for additional public comment (8/8/2011 draft); and finally the rule as proposed for provisional adoption.

I(1) Applicability

This section of the rule specifies which provisions of existing Chapter 375, Section 10 do not apply to wind energy developments.

I(2) Sound Level Limits for Routine Operation of Wind Energy Developments

The August 8th draft proposed, and the rule establishes, a single limit for all wind energy developments regardless of the location of the proposed project of 55 dBA daytime (7 am to 7 pm) and 42 dBA nighttime (7 pm to 7 am) for any protected location; and 75 dBA any time of day at any property line of the development or any contiguous property owned and controlled by the developer, whichever is farther from the development's regulated sound sources. Issues raised by commenters that are associated with aspects of the sound level limit are discussed below.

Comment #1. Single limit regardless of project location. While some commented that wind energy developments should not be regulated differently than other sources of sound, there were no specific objections to eliminating the separate limits in the existing 1989 rule for three types of locations: locations predominantly commercial, transportation or industrial; locations

not predominantly commercial, transportation or industrial, and locations with low ambient sound levels ("quiet locations"). The new rule essentially requires all wind energy developments to meet a modified version of the "quiet location" limit of the 1989 rule.

Rationale: Most wind developments are located in rural communities which would meet "quiet location" conditions. With the exception of Mars Hill, the developers of the DEP and LURC jurisdiction projects approved to date have assumed quiet location conditions when designing their projects. The Department believes that it is appropriate to set a single limit for wind power developments which have been, and will likely continue to be, located in rural areas of the state due to their scale both in terms of land area needs and size of turbines. No change to the August 8th draft rule.

Comment #2. Numeric limit or background plus. The petitioners proposed a nighttime limit of: (a) 35 dBA and 55 dBC at protected locations, or (b) pre-operational nighttime background LA90 plus 10 dBA and pre-operational background LCeq plus 20 dBC. The vast majority of members of the public commenting on the proposed rule support the sound level limits proposed by the petitioners for both health and quality of life reasons. (AR-173, 174, 175, 176, 177, 178, 179, 181, 182, 183, 184, 185, 186, 187, 188, 190, 191, 192, 194, 195, 196, 197, 198, 205, 209, 211, 213, 214, 215, 216, 217, 218, 220, 221, 222, 224, 225, 226, 227, 228, 229, 233, 236, 237, 238, 242, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 258, 260, 261, 262, 263, 264, 267, 268, 276, 279, 281, 282, 283, 286, 293, 295, 296).

With respect to the background plus approach, petitioners argued that most rural areas are quiet areas – noise levels of 20 to 25 dBA are common for rural areas that are inhabited (James AR-04 p. 5). The State Planning Office identifies 20 dBA as common for rural nighttime (AR-01, Exh. h). Petitioners cited information that if the sound level is increased by 10 dB, it is perceived as a doubling in loudness and almost always causes an adverse community response (Kamperman and James AR-01, Exh. e, p. 14 citing New York State Energy Research and Development Authority; James, PH Tr. p. 67). They also cited the expectation of persons living in quiet areas, many of whom may have moved to the location for its remote character. Other commenters supported a background plus approach (Rand, AR-85) citing US EPA case studies (1974) and more recent work by Pedersen indicating that people respond to the change above background. One sporting camp owner (AR-191) expressed concern that significant increases in sound above background may hurt business. The petitioners also argued that the nature of the sound produced by industrial scale wind turbines is fundamentally different, due to its comparatively constant presence and rhythmic nature, than natural or manmade sounds which may exceed background levels. They cited regulations in other states (Massachusetts, AR-14, Oregon AR-17) and countries (New Zealand) that use background plus (AR-03, p. 18).

Opponents of a background plus standard argued that a background plus standard is difficult to implement and would significantly impede wind energy development in Maine. The pre-construction ambient sound level in remote areas can be very low; in and around the proposed Highland Wind Project, the lowest monitored LA90 was 15 dB, and the lowest LC90 was 25 dB (Kaliski, AR-65, p. 10).

Response: The background plus limits proposed by the petitioners would base the standard on an increase in sound of 10 dB over the quietest of the quiet times (LA90). By definition LA90 is the sound level that is exceeded 90% of the time even in the absence of a proposed development. Given the Department's experience with wind energy developments to date, a limit of 10 dB above LA90 would likely be impossible to meet for a grid-scale wind energy development. Additionally, given the variability of natural background sound levels at the same location on a daily, weekly or seasonal basis, establishing background for a given proposed development would be a complex undertaking and would create an overly complex standard that would be difficult to implement and enforce. The Department notes that a background plus standard may be more appropriate in other types of terrain with fewer obstructions than occur in rural Maine which has variable terrain and is heavily wooded. Comment by the Executive Director of the Community Renewable Energy Association in Oregon (AR-235) states that the Oregon standard is structured as a background plus standard, which in most instances is an effective standard of 36 dBA for locations that are either not on land owned by the project or for which a waiver has not been obtained. Other Oregon locations have an effective standard of 50 dBA. Given its experience and after reviewing the evidence presented, the Department continues to believe that a numeric sound level limit is most appropriate. The rule establishes a numeric limit; no change to the August 8th draft rule.

Comment #3. Low frequency sound. The petitioners proposed a standard which includes a sound level limit using the C-weighed (dBC) scale which gives nearly equal weight to low, middle and high frequency sound in addition to an A-weighted (dBA) sound level limit. They argue that wind turbines contain a significant amount of low frequency noise (AR-01, Exh. e.). They cite, among others, the work of Moller and Pedersen (AR-42) showing that the spectrum of wind turbine noise decreases in frequency with increasing turbine size and that as turbines have become larger, the low frequency sound becomes a larger proportion of the sound generated by the turbines. Low frequency sound also travels greater distances than higher frequency sound waves due to air absorption. The petitioners (Nessenbaum, PH. Tr. p.52) and other commenters (Rand AR-85) cite the work of Dr. Alex Salt regarding the potential effects of even lower frequencies of sound (infrasound) on the inner ear. Rand and Ambrose (AR-85, AR-89) cite personal experiences of adverse health effects due to what they believe was very low

frequency sound. Petitioners argue that a dBC sound level limit would protect against low frequency sound and the issues that will likely arise as turbines increase in size.

Opponents of a sound level limit based upon dBC argue that low frequency sound is ubiquitous in nature and it would be difficult to attribute sound to the wind development. The level proposed by the petitioners would likely be exceeded every day even without a wind energy development. They noted that the work of Dr. Salt is based on animal studies (McCunney, PH, Tr. p. 166). O'Neil (AR-64) states that compliance with a 45 dBA limit is sufficient to guarantee that low frequency sound will not be an issue.

Response: There is no dispute that the A weighting is less sensitive to very high and very low frequencies (Exponent AR-48). The Department notes that the science regarding health effects of low frequency sound at the levels likely to be generated by a wind energy development is not settled and the reports of adverse health impacts on persons residing or spending time in the vicinity of these projects due to low frequency sound is anecdotal. The Department believes that the overall dBA limits established in the rule are protective of public health and welfare and are appropriate given the state of the science. The Department notes that other states do not have specific dBC sound level limits. While some states limit certain lower frequency octave bands, these octave band limits do not appear to be germane to wind power. No change to the August 8th draft rule.

Comment #4. Sound Level Limit. For protected locations, the rule requires a daytime limit of 55 dBA (unchanged from the 1989 rule) and a nighttime limit of 42 dBA.

Only one person commenting supported the proposed limit of 42 dBA as a place to start (AR-290).

The majority of individuals commenting on the draft rule are opposed to a sound level limit of 42 dBA arguing that it is not protective of public health and the quality of life in rural areas of the state. As stated in Comment #2, they support the petitioner's proposed sound level limits.

At the public hearing on July 7th, the Board heard testimony from persons living in the vicinity of the Mars Hill, Vinalhaven and Freedom wind energy developments regarding adverse impacts to their health and welfare, and quality of life. Ms. Lindgren testified that much of her experience with compromised sleep and other adverse impacts occurred when the sound level was below 45 dBA (PH Tr. p. 242). Additionally, those providing written comment argued that a decrease from 45 dBA to 42 dBA is not enough to make a meaningful difference, especially if offset by eliminating the 3 dBA uncertainty factor for the predictive model. An individual

commented that persons living in the vicinity of the Rollins Wind Project in Lincoln and Lee have experienced noise issues during recent testing of these turbines (AR-268). They believe that the Department should be cautious and not overly rely on the results of compliance monitoring at the Stetson II project.

Petitioners point to the WHO Night Noise Guidelines for Europe (AR-01, Exh. r) as support for their proposed limits. The WHO found that the threshold for self-reported sleep disturbance was 42 dBA (L night, outside) (Executive Summary, p. XIII). WHO recommends an average night noise level over a year of 40 dBA (Executive Summary, p. XVII). The WHO night noise guideline applies to an 8 hour period, generally 11 pm to 7 am. Petitioners also point to the study conducted by Dr. Nissenbaum (AR-05) which they argue demonstrates a correlation between annoyance and sleep disturbance with distance from the Mars Hill wind energy development.

Petitioners further argue that the rule needs to reflect the precautionary principle – when the science is uncertain, err on the side of caution. In their view, a 35 dBA sound level limit does that (AR-265). They argue that there is no evidence that levels above 40 dBA are safe; and they argue that the rule should not establish a standard at the point of harm. The petitioners cite a transcript from a Vermont proceeding where Dr. McCunney testified that if it were his home, he would want the noise level kept below 35 decibels, maybe 40 (AR-01, Exh. e, p. 103). They argue that a 35 dBA limit has not prevented reasonable development elsewhere, citing wind energy development in Denmark and Germany. If the industry wants to exceed the 35 dBA limit, they argue that the project should have willing neighbors who agree to accept a higher sound level limit.

Others commented that a 42 dBA nighttime limit in a rural area that has a pre-development background level of 20-30 dBA will result in a major noise impact under conditions when the wind turbines will be most clearly audible (RSE, AR-291).

Persons commenting for the wind energy industry argue that a reduction in the sound level limit from 45 dBA to 42 dBA would add significant costs to wind energy projects and is not justified by the evidence. They argue that the lowest threshold for changes in sleep or awakenings is 35-42 dBA inside the bedroom (Guldberg AR-47, p.4). They note that the rule requires compliance with the sound level limit at the property line of the protected location, or for large lots, as much as 500 feet from the sleeping area, providing an additional buffer. The wind industry also commented that the Pedersen study and its conclusions regarding the sound levels which cause annoyance was based upon modeled sound levels, not actual measured levels, and the modeling was not as conservative as that currently required by DEP. Consequently, the sound levels that cause annoyance are likely higher than the 42 dBA

Pedersen reported (Kaliski, AR-141, p. 1-2). Further, supporters of community wind power projects state that a decrease in the sound level from 45 to 42 dBA would add significant costs to nearly all wind energy projects in Maine and will have a chilling effect on investment in projects in Maine (AR-294), and suggested that the rule might set a separate standard for small projects of 100 kw to 7.5 MW.

In response to the WHO recommendation of 40 dBA average annual nighttime level, Scott Bodwell (AR-46) determined the sound levels for each hour of operation of Stetson II for the first 12 months of operation for the purpose of comparing the performance of Stetson II with the WHO annual night noise guideline of 40 dBA over 8 hours. He found that the sound level at compliance Location B would be equivalent to 38.7 dBA and at Location D, 39.7 dBA, less than the WHO nighttime guideline of 40 dBA. The hourly sound level was less than or equal to 40 dBA 69% of the time at Location B and 62.8% of the time at Location D (AR-46, p. 9-14, PH Tr. p. 230-233.)

Dr. Dora Mills, former director of Maine Center for Disease Control commented that there is no credible scientific evidence that levels less 45 dBA cause health problems (AR-86, p. 5).

Response: The Site Law requires that an applicant make adequate provision for fitting the development harmoniously into the existing natural environment and that a development may not adversely affect existing uses in the area. The Site Law requires a developer to make adequate provision for the control of noise. The law does not have as a criterion that a proposed project may have no impact.

With respect to the public testimony regarding specific wind energy projects in Maine, the record shows the following. The license for Mars Hill requires an hourly average sound level limit of 50 dBA; compliance testing indicates sound levels of 45 to 50 dBA with one instance of 51 dBA. The Fox Island project on Vinalhaven, which did not use the current Department recommended modeling assumptions, has a documented incidence of non-compliance with a sound level of 47 dBA hourly average at the compliance point under protocol conditions. The Beaver Ridge project in Freedom was not licensed by the Department and was constructed prior to the requirement for certification of compliance with the Department's noise standards. The Department has no quantitative information on the sound levels at nearby residences.

While the Department cannot base changes in the sound level limit upon testimony regarding projects that are either out of compliance or have different sound level limits than proposed, such testimony does inform the discussion regarding levels that are clearly demonstrated to be causing a problem at wind energy sites in Maine. The available data demonstrates that persons

living near existing wind energy developments with actual sound level measurements near the 45 dBA limit as at Vinalhaven are experiencing adverse effects. Additionally, the WHO found that the threshold for self-reported sleep disturbance was 42 dBA (L night, outside) (Executive Summary, page XIII.) A decrease in the sound level limit from 45 to 42 dBA hourly average nighttime limit should be a perceptible difference in sound level and as protective as the WHO annual night noise guideline. The Department notes that the 42 dBA sound limit is an enforceable standard which must be met regardless of pre-development modeling predictions. No change to the August 8th draft rule.

Comment #5. Sound level limit for other than protected locations. The rule continues the provision that sets a sound limit of 75 dBA at any time of day at any property line of the wind energy development or contiguous property owned or controlled by the developer, whichever is farther. This provision allows for sound at 75 dBA at locations which are not protected locations, which includes undeveloped lots. A few commenters argued (AR-249, 258, 267) that this provision may limit the development rights of the owners of undeveloped lots since the sound levels permitted on such lots could be at levels that are undisputedly annoying and potentially a health concern. One commenter noted that owners of undeveloped lots are dependent upon nearby developed lots (which are protected locations) to ensure that excessive levels of sound from wind energy developments do not exist on their lots (Boulter, PH Tr. 339-345). In rural areas of the state, many undeveloped lots may not be so protected and some commented that excessive noise will be permitted by the rule jeopardizing the right of the owner to develop the lot. A sound level of 75 dBA is considered to be loud; comparable to a playground at recess or a vacuum cleaner at ear level (Kaliski, AR-65, Figure 1, page 4.)

Response: While the circumstances raised by the commenters may exist, the frequency of occurrence is unknown. Experience with the projects licensed to date indicates that if "quiet location" limits are imposed (as is the case in the new rule) it is unlikely that 75 dBA will be exceeded at the property boundary of a wind energy development (or boundary of contiguous property controlled by the developer.) Department permitted wind facilities in Maine have demonstrated by modeled sound levels to be less than 60 dBA beyond the immediate vicinity of the wind turbines (1.5 to 3 MW). No change to the August 8th draft rule.

Comment #6. Municipal ordinances. Some persons commented on the importance of allowing municipalities to have different sound level limits than those proposed in the rule (AR-234, 294).

Response: The Applicability section of the existing Chapter 375, Section 10(B), will continue to apply to wind energy developments. Under this section of the regulation, if a municipality has a noise ordinance which addresses all the types of noise generated by the development and which

contains sound level limits that are not higher than the limits contained in this regulation by more than 5 dBA, that local ordinance is applied by the Department. Thus, in some cases under this proposed rule, a municipality's nighttime noise limit of 47 dBA could be applicable. The Site Law provides that a municipality is not prohibited from adopting noise regulations stricter than those adopted by the Board (38 M.R.S.A. §484(3)(C)). In such a case a municipality's limit lower than 42 dBA could also be applicable. While that option does not exist for persons residing in LURC jurisdiction, the Department believes a limit of 42 dBA will be protective of public health. No change to the August 8th draft rule.

I(3) Tonal Sounds

Comment #7. Tonal sound is defined in the existing rule at Chapter 375, Section10(H)(24). Tonal sounds are sounds of a single frequency, such as a whistling sound that could be created by a turbine. Manufacturer's testing does not indicate, and experience has not shown, a problem with tonal sound at existing projects in Maine. The proposed rule differs from existing Chapter 375, section 10 in that the penalty of 5 dBA for tonal sounds would be added to each 10 minute interval in which a tonal sound occurs, with the decibel levels for the 10 minute intervals then averaged to determine compliance. This is in contrast to the existing rule, which assesses the penalty to one or more specific one third octave band(s) and then averages over an hour.

The petitioners proposed that if there were substantial uncertainty as to whether tonal sounds or SDRS would occur during routine operations, the penalty should be applied during the permitting process subject to removal if post-construction compliance testing showed the absence of tonal sounds or SDRS.

One industry commenter (Kaliski, AR-272) requested clarification that the "10 minute one-third octave band sound pressure level" is an equivalent average sound level.

Response: The Department does not support application of the penalty for tonal sound if there is uncertainty regarding the likely occurrence of tonal sounds subject to removal if tonal sounds are found not to exist. The Department believes that the modeling requirements include reasonable input assumptions and that adding additional penalties as a precaution against tonal sound could result in unnecessary limitations on the proposed project which cannot be easily rectified after construction of the project. With respect to the requested clarification, the Department agrees with the comment and a clarifying change has been made.

I(4) Short Duration Repetitive Sounds ("SDRS")

Comment #8. The SDRS events which are of concern in this rule are those discernable changes in sound which are pronounced, rhythmic in nature and attributable to the rotation of the blades on the wind turbine. They have been described by some commenters as the repetition of a word, or sneakers in a dryer. The proposed rule defines an SDRS event, in part, as one which causes an increase in the sound level of 5 dBA or greater (valley-peak-valley) with discernable quiet times preceding and following the 5 dBA change. The proposed rule applies a penalty of 5 dBA to each 10 minute interval (Leq – 10 min) when 5 or more SDRS events occur within the 10 min. measurement interval. In contrast, the 1989 rule defines SDRS as an increase of 6 dBA or greater, and the penalty is only applied to each individual SDRS event (valley-peak-valley) with the sound levels of each individual peak averaged over an hour to determine compliance.

The petitioners agree with the proposed change in application of the penalty to each ten minute interval, but argue that the change in peak to valley which defines an SDRS event should be 3dBA and that the penalty should apply if more than 2 sequences occur in an hour, or any one sequence lasts 5 minutes or more. Petitioners argue that SDRS is an aspect of wind turbine sound that distinguishes it from other industrial sounds and which causes it to be most annoying and a cause of sleep disturbance. They argue that a peak to valley difference of 3 dBA above background is sufficient to cause sleep disturbance (James, AR-04).

The wind industry objects to defining an SDRS event as a change of 5 dBA as opposed to a change of 6 dBA as specified in the 1989 rule (AR-272, 289). These commenters argue that the proposed standard is excessive and would impose a penalty on everyday ordinary sounds that are naturally occurring (Kaliski, AR-272). Kaliski presented information on sound collected at a rural home with no wind turbine noise and argued that a change of 6 dBA peak to valley should be used to filter out the majority of naturally-occurring SDRS events. Kaliski also argued that the penalty should be applied only if SDRS events occur during more than 10% of the 10 minute intervals. Kaliski also proposed to clarify that the SDRS events be clearly discernible as an event resulting from the wind energy development. Others commented on the expense of obtaining and analyzing SDRS data and questioned the need for, and utility of, such data (AR- 115, AR-289, AR-292).

Response: The Department agrees that SDRS occurs naturally and the intent of the rule is to penalize only those events which are the result of the wind energy development. The Department has inserted qualifying language to that effect. However, Mr. Kaliski's example of the prevalence of SDRS that would be attributable to the development under the proposed rule

is not supported by the record. SDRS events of 5 dBA caused by a wind turbine, with a distinct quiet time preceding and following each event, can be distinguished from naturally occurring SDRS. Data from the three operational projects (Vinalhaven, Stetson I and Stetson II) has shown that the number of SDRS events of 5 dBA or more attributable to a wind turbine is much fewer than Mr. Kaliski suggests.

The Department continues to believe that a valley-peak-valley change of only 3 dBA for SDRS is too small. Again, based upon information from Vinalhaven, Stetson I and Stetson II, changes in the range of 2 to 4 dBA are very common. If a change of 3 dBA were the standard, most existing projects would not meet the standard. On the other hand, a change of 6 dBA is too high a threshold and would eliminate many of the events which would be clearly audible and likely prominent to persons living in the vicinity of wind turbines. A valley-peak-valley change of 5 dBA is the point at which most persons perceive a noticeable change in sound.

With respect to compliance, the Department continues to believe that the penalty should be applied to each 10 minute interval with greater than 5 SDRS events. These 10 minute intervals are then averaged as provided for in subsection I(5) of the rule to determine compliance. If the penalty is only applied to each peak with all peaks then averaged over an entire hour as is current practice, any penalty for SDRS is essentially lost in the averaging. Some clarifying language has been added; otherwise, no change to the August 8th draft rule.

I(5) Compliance with Sound Level Limits

Comment #9. Methodology. The 1989 rule sets an hourly sound level limit. The petitioners originally proposed determining compliance based upon (6) contiguous 10-minute intervals or (9) 10-minute intervals in a 12 hour period. The August 8th draft of the proposed rule would determine compliance based upon the arithmetic average of the sound level of (12) 10-minute measurement intervals. In practice, it is very difficult to obtain the proper measurement conditions for an hourly sample. Obtaining the proper sampling conditions over 10 minute intervals has been found to be reasonable based upon currently operating facilities.

One commenter (RSE, AR-291) suggested changes to the language to ensure that the selected time intervals accurately reflect conditions. This commenter also stated his view that the State should move toward real-time compliance monitoring (RSE, AR-62 p.7).

Another commenter argued that compliance methodologies should be established on a site-specific basis (AR-289).

Response: With respect to the comments concerning selection of 10 minute intervals, subsections I(8)(d),(e),and (f) specify conditions for collecting data, require prior notification of the Department of the intent to collect compliance data, and submission of all compliance measurement data to the Department. This procedure should ensure that the Department receives the information needed to assess compliance of the facility. The word "contiguous" has been inserted to clarify the requirement; otherwise, no change to the August 8th draft of the rule.

With respect to the recommendation of real-time compliance monitoring as opposed to "single event" type compliance demonstrations, the Department notes that technology continues to evolve and real-time monitoring may be practicable at some point in the future, at which time the rule could be amended. At this time, no change to the August 8th draft rule.

With respect to the request to establish site-specific compliance monitoring protocols, site specific characteristics are integral to the application of the rule. No change to the August 8th draft rule.

Comment #10. Finding of compliance. Petitioners proposed that there be notice to interested persons if the Department determines that a project is found to be in compliance with the sound level limits of its license and that any such determination be subject to review.

Response: In the case of a compliance or non-compliance determination made in conjunction with a complaint, the complainant is notified. However, general compliance determinations are in the nature of enforcement matters which are not subject to judicial appeal. Some permit conditions which require review and approval of specific plans or studies may require a condition compliance submittal by a permit holder and a determination on such submittal may be appealable. As with other permitting regulations, this rule does not require notification to interested persons of compliance determinations; however, most Department records are public documents available for public review. No change to the August 8th draft rule.

I(6) Variance from Sound Level Limits

Comment #11. The 1989 rule allows the Department to grant a variance from any of the sound level limits contained in the rule upon a showing that the sound level limits cannot be practicably met with available technologies and a finding that the proposed development would not have an unreasonable impact on protected locations. It also provides for a variance for national defense and public safety. The August 8th draft rule eliminates the variance based on available technology, but retains the variance for national defense or public safety. One

commenter expressed concern that the change in the variance provision severely limits its utility, and argues that the variance provision would have no practical effect (AR-294).

Response: The one instance where a variance to the standard was granted (Mars Hill) allowing a nighttime limit of 50 dBA has led to a situation where there are ongoing complaints from persons living in protected locations. The Department believes that the new rule establishes a limit that is protective of public health. If the standard cannot be met at a protected location, the developer has the option of obtaining an easement, reducing the number of turbines or reconfiguring the array. No change to the August 8th draft rule.

I(7) Submissions

I(7)(a) of the August 8th draft rule, Pre-development ambient sound measurements.

Comment #12. The petitioners proposed the collection of long-term background sound measurement data (see section I(2)(b) of their 7/18/11 proposal) to determine the quietest 10 minute period at each location of interest. This information would serve as the basis for the background plus standard and a determination of the extent to which the project as developed increased sound above pre-development ambient levels. The August 8th draft of the proposed rule required that pre-development ambient sound measurements be taken in accordance with the procedures required for demonstration of compliance.

The industry objected to the requirement (Kaliski AR-272) arguing that extensive pre-development ambient sound level information is not required to meet a regulatory standard. They commented that if any pre-development ambient data is required, the specifications for obtaining the data should be relaxed. Others commented (RSE, AR-291, p.3) that pre-development ambient sound measurements should not be required because the ambient conditions are "infinitely variable and complex and will not likely be the same as the conditions that occur during compliance testing."

Response: If pre-development ambient data is collected, it must be collected in accordance with the procedures, and be representative of the conditions and locations used to verify compliance after the development is operational; otherwise meaningful comparisons cannot be made. However, the Department agrees that pre-development ambient data is not needed to determine compliance with the rule (the rule does not establish a background plus limit), and all projects are essentially required to meet a quiet location standard. The Department also agrees with the comments regarding the variability and complexity of ambient conditions and the difficulty of relying upon them as a baseline for determining compliance with the terms of a facility license. The requirement has been eliminated.

I(7)(d) of the August 8th draft rule, Predictive model. [new subsection I(7)(c)]
This subsection establishes the variables which must be included in the predictive model. In order to obtain a license, the applicant must demonstrate via predictive modeling that the sound level limits will be met. The input to the predictive model is therefore critical. The model should not substantially overestimate the sound levels that will result from the proposed development (which could unnecessarily limit the project's design and/or require the procurement of additional land or easements) or substantially underestimate sound levels (with the consequence of unacceptable sound levels at protected locations and the resultant need to limit the operation of turbines that have been constructed.)

In general, petitioners proposed that the model should be designed to represent the "predictable worst case" noise impacts on protected locations: maximum rated output of turbines, nighttime stable atmospheric conditions (high wind speeds aloft and low surface wind speeds) with high wind shear above the boundary layer, "all other conditions that affect the in-flow airstream that can exceed the design limits for normal operation of the turbines," with sound propagation rate based on point or line source, or some combination thereof depending upon the arrangement of turbines. Petitioners also proposed that the predictive model address coherence (combining of sounds from multiple turbines with similar spectral and temporal content) and turbulence due to the wake of other nearby turbines.

Many of the provisions in the new rule codify current Department practice which most developers have agreed, on a case by case basis, to implement. Comments on various modeling provisions are discussed below.

Comment #13. Predictable worst case. The August 8th draft of the rule incorporated many of the petitioners' proposals. It proposed the use of maximum rated output of the sound sources during nighttime stable atmospheric conditions with high wind shear above the boundary layer and "all other conditions that affect the in-flow airstream that can exceed the design limits for normal operation of the turbines." The wind industry commenters argue that the provision regarding conditions that exceed design limits is not logical since turbines are not designed to run outside operational limits.

Response: SDRS is most frequently associated with conditions of high wind shear. Other factors which may contribute to it are less frequent, more difficult to predict and not well understood. The Department agrees with the comment; the language has been modified to require consideration of conditions that may affect in-flow airstream turbulence.

Comment #14. Coherence. The petitioners argued that the predictive model should include the effect of combining multiple turbines. Commenter RSE (Resources Systems Engineering) stated that the overlap of sounds from simultaneous modeling of multiple turbines is already accounted for by proper application of ISO 9613-2 (AR-62, p. 4).

Response: Acoustic coherence associated with distributed wind turbines is a transient phenomenon. The overall impact is addressed in modeling and compliance requirements (sound level, SDRS, and tonal limits) for a given interval and location. No change to the August 8th draft rule.

Comment #15. Point vs. line source. The August 8th draft of the proposed rule calls for sound from the proposed development to be modeled as a point source with a decay rate of 6 dB for each turbine in the array. This requirement reflects current Department practice. Petitioners proposed use of point or line source with decay rates of 6dB and 3dB respectively depending upon the arrangement of the wind turbines.

Response: Modeling each turbine as a point source has been found to be more accurate for audible frequencies (20-20,000 Hz). The Moller-Pedersen (June 2011 JASA V29 N6) (AR-42) study concludes that, while line source attenuation decaying at a rate of 3 dBA per doubling of distance has been observed by some at frequencies less than 20 Hz, "more knowledge is needed about atmospheric conditions and the occurrence of various phenomena." Testing results for wind turbine projects in Maine (at 45 dBA) do not support use of line source modeling. The provision specifying point source has been relocated from subsection I(7)(c)(1) [old I(7)(d)(1)] to subsection I(7)(c)(2); otherwise, no change to the August 8th draft rule.

Comment #16. Attenuation factors. The petitioners proposed that modeling exclude attenuation factors except for atmospheric absorption; they argued that factors currently included in the model such as ground absorption should be set to 0. Wind industry commenters disagreed, arguing that eliminating such factors from modeling would have the effect of greatly overestimating the sound from the proposed facility and consequently making it impossible to site facilities in most areas of the state (Kaliski, AR-65).

Response: Attenuation due to geometric spreading, atmospheric absorption, ground absorption/reflection, and three-dimensional terrain are reasonable model input assumptions and consistent with well accepted methodologies. No change to the August 8th draft of the rule.

I(7)(d)(2) of the August 8th draft rule, Attenuation due to geometric spreading.
[new subsection I(7)(c)(2)]
Comment #17. Kaliski (AR-141) requested clarification that modeling should be as a point source at hub height.
Response: The Department agrees. The clarification has been made.

I(7)(d)(9) of the August 8th draft rule, Uncertainty. [new subsection I(7)(c)(9)]
Comment #18. In accordance with current Department practice, a 3 dBA uncertainty factor is added to address model uncertainty. The August 8th draft rule provides for the addition of an uncertainty factor of 0 to 3 dBA to the modeled sound level due to uncertainties in the model at the discretion of the Department.

The petitioners (AR-265) and many members of the public who commented on the August 8th draft rule argue that the 3 dBA uncertainty factor should be required; otherwise the reduction in the sound level from the current 45 dBA limit to 42 dBA will essentially be undone. They also argue that the make and size of turbines are changing rapidly adding to, not decreasing, the level of uncertainty associated with predictive modeling.

The wind industry objects to the additional uncertainty factor of up to 3 dBA and cites the fact that the rule does not provide any guidance on the conditions which would trigger the use of an uncertainty factor greater than 0 (AR-270,271, 272, 289). These commenters also comment that as a result of the use of multiple conservative assumptions, wind energy developments predicted to produce sound levels of 45 dBA at the compliance point are actually producing 3-5 dB less than predicted, with the current practice of the inclusion of the additional uncertainty factor of 3 dBA. At Stetson I actual sound levels are 2-3 decibels less than predicted (AR-46). At Stetson II, the model (with the additional 3 dBA for uncertainty) predicts a maximum hourly sound level of 45 dBA; actual measurements show a range of 10 min Leq of 40-42 dBA, which is 3 to 5 dBA below model predictions (AR-46). They argue that Stetson II has served to calibrate the model and demonstrates that a 3 dBA uncertainty factor for the model is no longer necessary.

Petitioners respond that the industry is relying too heavily on the Stetson example given the limited number of projects actually operational, and they argue that the Department should use caution in generalizing from that case. Turbines continue to change in size and design requiring a conservative approach.

Response: Provisions for the uncertainty of modeling built into the rule include: (a) assuming all turbines operating at maximum sound output, which is rarely the case; (b) the receiver is

assumed to be downwind of all turbines, which is not physically possible; (c) inclusion of the manufacturer's uncertainty factor for power output (generally 2 dB); and (4) the additional discretionary uncertainty factor for model uncertainty of 0 to 3 dBA. Compliance monitoring at Stetson I and Stetson II indicates sound levels of 3 to 5 dBA less than predicted, with the practice of adding the 3 dBA uncertainty factor. Department staff believes that the location selected to check for compliance at Stetson II was a worst case scenario and a good case from which to calibrate the predictive model used for the majority of the wind energy developments to date (excluding Mars Hill, Vinalhaven, and Freedom). However, while a number of wind energy developments have been licensed, there are only two completed projects (Stetson I and Stetson II) from which to verify the model. One person living in the vicinity of the Rollins Wind Project in Lee and Lincoln has stated that there have been complaints about the turbines being tested at that facility (AR-268).

Given the topographical variability of potential development sites and associated protected locations and the changing size and designs of wind turbines, the Department believes that it is important to continue to be conservative when modeling, but also believes some flexibility is appropriate. The Department, however, agrees with the commenters who request that the rule provide some guidance on when the additional uncertainty factor would be applied. The Department therefore has modified the provision regarding the discretionary 0-3 dBA factor to include factors such as inland or coastal location, specificity of data regarding meteorological operating conditions, and prior experience.

1(7)(i) of the August 7th draft rule, Complaint response protocol. [new subsection 1(7)(j)]
Comment #19. The 1989 rule does not require a complaint response protocol, although a complaint response protocol has been made a condition of some licenses. The petitioners proposed a very detailed protocol in response to difficulties encountered at some of the development sites, most notably Vinalhaven, that would require: 24 hour hotline, posting of contact information at the facility, standard set of information to be obtained from complainant for each complaint, specification of data the licensee must collect in response to a complaint, maintenance of a complaint log for 2 years with information made available to the interested public via the internet, notification of complainant and DEP of response to the complaint.

The August 8th draft of the rule included a requirement that the applicant submit a complaint protocol as part of the application, which would include at least four stated components: 24 hour contact, complaint log accessible to the Department, analysis of each complaint in accordance with the approved compliance measurement protocol for the project, and notification of findings to the Department and the complainant.

In their comments on the August 8th draft, petitioners argued that there have been difficulties obtaining compliance data and that the complaint response procedure must be more explicit (AR-265).

The wind industry commented that the proposed requirement that each complaint be analyzed in accordance with the compliance measurement protocol regardless of complaint content or conditions of occurrence is excessive and potentially not useful. Bodwell (AR-271) noted that the conditions under which the complaint occurred may not be the same conditions under which compliance testing is required. Rather than requiring a protocol-based compliance evaluation for every complaint, Bodwell suggested using the complaint response protocol established for the Oakfield Wind Project and provided alternative language.

Response: The Department agrees with the petitioners that there should be greater specificity for complaint response protocols, but also agrees with wind industry commenters a complaint should provide information that would aid in determining the conditions which give rise to the complaint. The rule has been revised to address the concerns of both the petitioners and the wind industry commenters.

I(8) Measurement Procedures

I(8) Introductory paragraph. Language regarding measurement of ambient sound has been deleted. See Comment # 12 eliminating requirement for submission of pre-development ambient sound measurements.

I(8)(b)(7) Audio recording devices.

Comment #20. Kaliski (AR-272) argues that the requirements for audio recording devices are overly burdensome; the requested wav file formats become large very quickly and monitoring sites would need to be visited every other day to download data.

Response: The Department agrees with the comment and the rule has been modified to relax the file format required. The revised language ensures adequate sound resolution and retains the concept of synchronous audio and acoustic data measurement. A corresponding change was also made to subsection I(8)(f)(10).

I(8)(c) Equipment calibration.

Comment #21. Kaliski (AR-272) argues that equipment should be calibrated in accordance with manufacturer's specifications and that annual calibration is not necessary.

Response: The Department disagrees. Annual calibration of equipment is the standard most commonly recommended by manufacturers. There is no credible evidence in support of

requiring calibration on less than an annual basis. The equipment is used under harsh conditions, outdoors and unattended, and the quality of the data obtained is critical. Minor changes have been made to the wording of the provision to improve clarity.

I(8)(d)(2 and 3) Compliance measurement location, configuration and environment
Comment #22. The wind industry (AR-272, 289) commented that measurement locations meeting the specified parameters in the August 8th draft rule are difficult to find especially in the forested areas of the state and especially if the locations must be available for continuous monitoring. They note that many landowners would not want to accommodate the presence of equipment on an on-going basis.
Response: As discussed below, the Department agrees that continuous monitoring is not practicable and that provision has been eliminated. If only periodic monitoring is required to assess compliance and respond to complaints, the monitoring locations as described should be easier to find; however, the Department has modified the rule to clarify that monitoring locations with the specified characteristics be used "to the greatest extent possible."

I(8)(d)(4) of the August 8th draft rule, Continuous monitoring. [deleted]
Comment #23. The petitioners proposed, and the August 8th draft of the rule included, a requirement for continuous monitoring 24 hours per day, 7 days per week during all periods when the wind energy development's turbines are generating electricity. The rationale was that continuous monitoring would allow the Department to check compliance at any time, and the sound level data would be available to check compliance during the time corresponding to a complaint.

The wind industry commented (AR-271,272,289) that continuous monitoring is excessive. They state that it would generate massive amounts of data which would be costly (ranging from $60,000 to $180,000 the first year) and would be difficult to both obtain and maintain. Kaliski (AR-272) also stated that continuous monitoring would require essentially the permanent installation of equipment on private land, access which he argued would be difficult to obtain. He also stated that no other state or country that he is aware of requires continuous monitoring. One wind industry commenter cited a project in LURC jurisdiction where there is no protected location within 2.5 miles of the project, making a requirement for continuous monitoring excessive (AR-270).

Response: While technically possible, the Department agrees that continuous monitoring would be costly in terms of time, equipment needs, and amount of data to be managed. It would be a significant cost to keep the data organized in any useful form so that it could be retrieved and meaningfully analyzed in response to a complaint. Continuous monitoring of sound levels is not

required of other industries or of wind energy developments in other jurisdictions. The Department has concluded that it is not practicable or necessary, and periodic compliance testing and testing in response to complaints is sufficient. The rule has been modified to eliminate the requirement for continuous monitoring.

I(8)(e)(1) Compliance data collection.

Comment #24. The August 8th draft rule has been modified to remove the requirement for continuous monitoring for the reasons stated above, and to correct a cross-reference. See Comment #23.

1(8)(e)(5)(c) Submission of Compliance Data.

Comment #25. The petitioners proposed continuous monitoring with the licensee required to submit monthly compliance reports during the first year of facility operation and annually thereafter. The petitioners further detailed the information which they believe the compliance reports should contain. The August 8th draft rule specified the submission of compliance data the first year of operation, once during each 5th year thereafter, in response to community complaint or any subsequent enforcement, and for validation of sound levels when requested by the Department.

Response: The Department believes that monthly compliance reports are not realistic. The occurrence of the proper conditions for determining compliance (as set forth in Section I(8)(c)(7-10) of the rule) are difficult to predict and are unlikely to occur on a monthly basis. The rule requires a compliance test under specific conditions designed to reflect worst case conditions once during the first year of operation and every 5 years thereafter. The Department retains the ability to request additional compliance tests in response to noise complaints and to validate sound levels. No change to the August 8th draft of the rule except for insertion of cross reference to subsection I(7)(j) which specifies submissions for the complaint response protocol.

I(8)(f)(9) Reporting of Compliance Measurement Data – SDRS.

Comment #26. Kaliski (AR-272) comments that measurements for SDRS should be at 125 millisecond (ms) intervals, not 50 ms or less.

Response: The Department disagrees. Data points at 50 ms intervals is needed to ensure sufficient resolution to detect SDRS. No change to the August 8th draft of the rule.

I(8)(f)(10) The rule has been modified to change the requirement for audio recording devices. See Comment # 20.

I(8)(g) Measurement of Ambient Sound.

Comment #27. The requirement for measurement of ambient sound has been deleted. See Comment # 12.

Other Comments

Comment # 28. Noise Easements.

The petitioners proposed that noise easements be permitted only if the applicant submits to the Department a written statement of the disclosures given to the resident or owner executing the noise easement that adequately discloses public health risks associated with the expected noise levels at that location. The wind industry opposed such a requirement, presenting evidence that there is no consensus regarding health impacts from sound levels associated with industrial scale wind turbines.

Response: There is no agreement in the medical or scientific community regarding the health effects that can be attributed to the sound level limits established in the new rule. Therefore, a requirement for such a disclosure of health impacts could lead to considerable dispute over the content and meaning of the disclosure. The provision was not included in the rule.

Comment #29. Noise Reduction Operation.

In some permits issued, the Department has allowed companies to operate turbines in noise reduction operation mode to ensure compliance with sound level limits. Several persons commenting argued that NRO should not be allowed. They argued that NRO itself generates sound that is annoying, NRO does not decrease sound levels in a predictable way, and it is difficult to enforce. (AR-227, 244, 246, 247, 253, 256, 258, 259, 260, 281). They argue that if the sound level limit cannot be met, the turbine should be shut down.

Response: NRO is a viable option for allowing a turbine to be placed in a particular location and allowing some generation of power while maintaining compliance with noise level limits. It can also be used to address noise complaints that may arise after construction of a wind energy development. NRO allows the project to adjust sound output under problematic conditions while continuing to generate some energy from the turbine. The commenters did not present any evidence regarding adverse impacts from NRO that would warrant elimination of this option, and the Department is not aware of any. The rule does not prohibit NRO.

Comment #30. Enforcement.
As part of the compliance assessment, petitioners proposed certain enforcement steps including issuance of a Notice of Violation, specification of time for response to the NOV and the ability of the Department to order cessation of operation under certain conditions.

Response: The rule is intended to specify the sound level criteria for licensing of wind energy developments. It is inappropriate to specify required enforcement steps in a rule since each case is different. Enforcement actions are discretionary with the Commissioner. The provision was not included in the rule.

Comment #31. Community impact assessments.
Ambrose (AR-89, 193) stated his view that developers should conduct community impact assessments to determine acceptable levels of sound from developments such as wind energy projects. He recommends very large setbacks for quiet areas on the order of 1 to 2 miles.

Response: The Department notes that the petitioners modified their petition eliminating their earlier request for a setback of one mile. Required setbacks on the order of 1 to 2 miles would have a severe impact on the development of wind energy that cannot be justified by the science. The Department believes that establishment of a numeric sound level limit is appropriate. The requested provision was not included in the rule.

Comment #32. General Support for Wind Energy Developments.
Several commenters expressed their general support for wind energy developments as a clean, alternative source of energy. (AR-74, 172, 230, 234, 240, 241, 243, 274, 277, 284, 285, 287, 288, 292, 294).

Response: In its enactment of the Wind Energy Act and its amendments to the Site Law and the Natural Resources Protection Act, the Legislature made policy decisions to encourage the development of wind energy as a component of Maine's energy sources. This rule guides the Department in its implementation of the Site Law statutory framework.

Comment #33. General Opposition to Wind Energy Developments.
A few commenters did not speak to specific provisions of the draft rule but expressed general opposition to industrial wind energy development in Maine for reasons such as the removal of mountain tops and impacts to wildlife. (AR-269, 278, 280).

Response: This rule addresses the noise impacts of wind energy development and helps specify the applicable criteria of the Site Law.