

1 July 2021

Mr. Jonathan A. Evans, Chair  
NH SEC Subcommittee  
21 South Fruit Street, Suite 10  
Concord, NH 03301-2429

Dear Mr. Evans:

Re: SEC 2021-02.

The purpose of this letter is to make three fundamental points. First, there is no basis in the record, nor in the governing document, nor in the logic of how humans perceive sound, that AVERAGE sound has any meaning whatsoever. The second is that turbine noise perceived by AWE neighbors is completely determined by the weather, the wind and the temperature. Third, there is a potential solution to the AWE turbine noise problem, and it hinges on the intelligent use of the weather, and weather forecasts.

## **1. AVERAGING TURBINE NOISE::::::::::**

### **6 Apples plus 6 Oranges do not add up to 12 Lemons. You cannot average anything that you can NOT add up.**

Averaging data can only be justified if the below-average data somehow compensate for whatever problems the above-average data cause. In the present case, the proponents of averaging (no matter the averaging interval) have to demonstrate that whatever problems the above-average noises cause, are compensated, or ameliorated, or corrected somehow by the below-average noises.

**AWE HAS NEVER MADE SUCH A CLAIM!**

**NOR STATED A BASIS FOR SUCH A CLAIM!**

**35 Db NOISE CANNOT UNDO THE DAMAGE CAUSED BY 45% Db NOISE!**

Of the reasons for NOT averaging sound values, the most cogent is the very language of RSA 162-H. The RSA uses the phrase “*not-to-exceed*”. It does NOT say you may exceed it occasionally, or just a few hours each week. What it does say is that noise louder than 40Db has noticeable impacts on the neighbors to the AWE facility. Measurable and serious impacts. At decibel levels below the specified “*not-to-exceed*” level, the sounds may pose an “acceptable” risk to the neighbors, no matter their duration, or the time-of-night. It accepts that the AWE turbines may make noise without limit below that level, but not the reverse. The AWE turbines may NOT make noise above that limit, ever! If *not-to-exceed* doesn't limit the number of minutes the turbines are allowed to spray 40Db or less noise to their neighbors, it must also mean that NO noises over 40Db are allowable. That there was a lower level specified for night obviously suggests that the lower ambient nighttime levels have been set for rest and sleep. The ability to have uninterrupted sleep time at night is the key. Does anyone really believe that occasional loud noise interruptions are conducive to a good nights sleep, as long as they don't average too loud? That idea doesn't pass the laugh test. Yet that is the essence of the AWE claim. They don't put it that way directly, but they do allege that “just a little” noise will not be sufficient to interrupt sleep, while a full hour of such noise will do the trick.

The *not-to-exceed* levels were not selected to allow a “little bit more annoying” noise, they were an admission that over 40Db noise is sufficiently serious as to require that they not be emitted at all. Imagine if averaging were OK, that noises above the *not-to-exceed* level were OK in small doses, but

in larger doses, they require being offset by some quiet breaks, a recovery period so to speak. Maybe AWE should have been given credits for their quiet periods (on other days?) to use when noisy. Or they could have added all their excess noises together until they reached their limit for the day, then shut down until tomorrow. There are all kinds of ways to play the game. Hourly averaging is but one. Military riflemen wear ear protectors for a reason, even though their AVERAGE noise dose is tiny, less than a few Db. But nobody suggests their average dose is fine. Nor should the SEC allow such manipulation of data to carry the day either. Silence does NOT make up for noise, period! I know of no amount of silence that corrects hearing loss from loud noises.

The bottom line is that *not-to-exceed* has a meaning which is the antithesis of averaging, no matter the averaging interval. RSA 162-H could have been written to reflect that the neighbors had to suffer some amount each night, but above which there would be a problem, “noise fatigue” maybe. In that case, 162-H would have set a *not-to-exceed* “noise dose” which AWE could inflict without harming their neighbors. But 162-H was NOT written that way. Instead it was written on the theory that noise above a *not-to-exceed* level is harmful. It did not assume that the neighbors were able to recover, during the short silences between thumps, from the problems loud AWE noises inflicted. They specify a *not-to-exceed* level. Averaging assumes that the AWE noise problems come equally from both the peaks and the valleys in their noise charts. But everyone knows (and 162-H memorializes) that louder noises are fundamentally different from softer noises. 45 Db noise is 10 times louder than 35 Db noise.

Imagine if AWE could run the turbines flat out for 50 minutes each hour, then turn them off for enough silence to lower their average for the hour, then go flat out for 50 minutes in the next hour, etc. According to AWE, that would not violate the 162-H rules, but imagine the neighbors sleep routines. *Not-to-exceed* has a meaning, and it was MEANT to keep the turbine noises below the level which causes harm to their neighbors, not a means to produce as much energy as possible! Ask why the *not-to-exceed* level is much more restrictive at night, why? If under 40Db is good, and over 40Db is bad, the average of good and bad is not OK.

You might ask AWE whether they believe there is a significant difference in the effect on their neighbors of turbine noise in the 40-50 Db range, compared to turbine noise in the 30-40 Db range? And if so, WHAT is the difference?

Would you favor averaging the noise of a heavy truck passing maybe every minute? Its average noise level would be just a decibel or two. Or imagine averaging out the drummer in a band, his average sound level would be imperceptible. Or try installing a rifle range next to a church or library. The sharp, fractional second shot, interspersed with many seconds while reloading and aiming, wouldn't wake a church mouse.

It is not an oversight that the word AVERAGING is not in 162-H. This deliberate omission reflects the fact that the human ear does not (and cannot) average sound. Rain and snow data are totaled because they accumulate, sound does not! Rain and snow have accumulative effects. These data are “totaled” because their effect is cumulative, rain in one minute is generally irrelevant, but totaled over an hour, these rain totals can be very significant. Snow accumulates, sound does not accumulate. Totaling sound over some arbitrary interval, then dividing it into an average over the arbitrary interval, makes sense only if the TOTALING had some significance. **LACKING A REASON FOR TALLING, AVERAGING IS MEANINGLESS.**

The reason for NOT averaging sound data is simply that:

## **Neither the human ear nor human brain averages sound**

### **2. NOISE Generation and Broadcast are meteorological issues:::::**

Noise is 99% a meteorological problem, and its required governmental oversight, including the issue of its amelioration or elimination is a meteorological issue. The level of noise emitted by the turbines increases as the wind speed increases. The broadcast of this noise to its neighbors depends on the amount of noise which goes up and out into air, and the amount of noise which is trapped in the air below the height of the turbines, and sent out horizontally to its neighbors. The turbine noise can be trapped in a small volume of air when there is a “temperature inversion”, in which the air temperature is lowest near the ground. In a “temperature inversion”, the ground cools the lower air by radiating its heat to space. On a clear night, the cooling ground creates a pool of cold air near the ground, the depth of which gradually get thicker, from the ground up. On some nights the top of this cold pool of air stays below the turbines, on others it deepens so that the turbines themselves are immersed in this cold air. When this happens, the turbine sounds that would otherwise spread up and out over large areas, are trapped in the cold pool of air. The cooling of the air near the ground starts by sunset, and increases during the night with its maximum cooling usually late at night, before dawn. The optimum circumstances for an inversion are clear skies, dry air, and light surface winds. The optimum meteorological combination for the loudest noises sensed by its neighbors is a combination of strong winds on the turbines, and clear and calm weather down in the valleys with the neighbors. This combination will ALWAYS produce the maximum noise perceived by the neighbors! There will be variations introduced by the interesting topography of the Antrim Hills, and the effect of that topography on the wind direction.

### **When should sound be measured?**

Everyone, including AWE, agrees that the main determinant of the noise level emitted by the AWE turbines is the wind speed! And everyone also knows that the main determinant of the how far and wide that noise is broadcast to its neighbors is the depth and strength of a “temperature inversion”. Therefore, noise measurements intended to determine whether AWE violates the 40Db standard should ONLY be taken on nights when the weather is optimum for the maximum generation and broadcast of noise to its neighbors. In such weather conditions, unless the measured noise levels exceed the standards, there is no value to any other noise measurements. But without these measurements for optimum noise (both its generation and its broadcast), there is NO basis for any discussion of the noise perceived by the neighbors! Which neighbors are subject to the noise is also dependent on the wind direction. The wind speed and direction, and the temperature structure at low levels will determine which neighbor(s) are affected, critical in the examination of complaints. And forecasts of the nights with likely “optimum weather” can be provided by many weather services.

### **Has AWE made such measurements????**

The Antrim Wind facility was built for \$65 million. It was sold 2-3 times after it was built, each time to a big corporation. We must assume each sale required “due diligence” on the part of the buyer. But did that due diligence include any noise measurements? That brings us to the obvious question, has AWE made sound measurements on nights when the meteorological factors are likely to produce the loudest noises for their neighbors?

There were many conflicts in the testimony about noise measurements during the SEC approval process, but the SEC settled these pre-construction conflicts without any actual measurements of noise. There is no record of any “due diligence” studies, or actual noise measurements, by AWE since. Whatever limitations this lack of pre-construction noise data had on the question of due diligence, all such questions became irrelevant after the turbines were installed. Post-construction noise measurements were, and are, possible, requiring only an interest in actually making them.

It seems reasonable, in view of the noise complaints, to assume that AWE, or its current owner, have made post-construction noise measurements to determine whether the turbine noise levels exceeded the agreed noise levels. Since the loudest noises heard by its neighbors will only come in definable, and forecastable, meteorological situations, AWE needed only to measure the turbine noise during these “noisiest weather” conditions. A few careful measurements at the right times, would settle this issue, for much less time and money than AWE has spent on legal fees to postpone their day of reckoning. If these noise measurements were taken under the meteorological conditions which would maximize the noise perceived by its neighbors, and they were less than 40Db, we would conclude that the noises would never be excessive..

### **3. A Proposed Resolution::::::::::**

A way forward is obvious, once you accept the simple logic that all the NOISE at issue is generated and distributed to the neighbors by the WEATHER. This “weather noise” is created by the wind on the turbines, and the direction and extent of this noise traveling to the neighbors is also dependent on a “temperature inversion”, or no. This inversion is created, expanded and maintained by the clarity and humidity of the air, the low level wind direction and speed, and the temperature of the ground. The net is that the entire noise problem is a weather problem, exacerbated at times by the ground surface topography and reflectivity.

The solution to the “weather noise” problem is therefore also in the weather! So how do we use the weather in solving this “weather noise “ problem? The outline is simple, but requires a serious effort by AWE to do what they claimed they HAD done before their application to the SEC, that is model the weather effects on their proposed facility. Such a model would have determined the combination of weather elements that produced the maximum noise effects on their neighbors, and how often they would expect to be in violation of the required 40Db nighttime noise levels. During the hearings they always answered my question as to how they could be so certain that they would never be in violation, but their answer was always; we will shut down any offending turbines.

In the current post-construction era, when actual noise levels, and actual weather data are available, we have had many complaints, and some real DATA, which indicate serious violations of the 40 Db noises. AWE refused to recognize such violations, and the SEC hired a so-called expert consultant to investigate. The consultant, a Mr. Tocci, did not even throw a nod to the 162-H requirement that he must test under “similar conditions”. He completely ignored the weather, either at the time of the complaint, or when he tested!

AWE has characterized this hearing as an up-or-down choice, either AWE continues on its way, or closes down. Nothing could be further from the truth. Instead, AWE needs to adjust its operations to the reality that they chose to be in a populated area. This choice carries limitations that require some adjustments on their part. They neither have to shut down all operations, nor be allowed to blast excessive noise indiscriminately. They need to determine what weather situations send excessive noise

to their neighbors, and adjust their operations accordingly. Two major adjustments are required. First, they need to determine what specific weather events cause noise problems for their neighbors, including which neighbors, and which turbines, are the offenders. This is a study that the original SEC Committee should have required, but despite multiple requests during the hearings was never considered. Now it is required. The second is an acceptance by AWE that averaging is an oxymoron, and fractional second sound measurements are required. Quiet sounds do NOT ameliorate, or make up for, loud sounds, period.

Antrim Wind needs only to measure neighborhood sounds on nights with both strong winds on the turbines, and surrounding temperature inversions. Both are forecastable. If the noises on these nights are below the 40 Db level, we would have to conclude that they would never exceed 40 Db on ANY nights. Both of these required steps are straightforward, and should have been required prior to the original approval. There is no reason for the SEC to not require them now. Weather-sensitive nights are easily forecast a day in advance, and Antrim Wind has, or can easily get, the meteorological data.

#### 4. Sound Sense:::::::::::::

The first rule: Sound is a meteorological problem.

The second rule: You cannot AVERAGE anything unless you can add it up.

The third rule: 6 apples plus 6 oranges do NOT add up to 12 lemons.

The bottom line, adding harmless noises together with harmful noises does not make for a good night's sleep. 162-H was clear in choosing *not-to-exceed* rather than any suggestion of AVERAGING. It does NOT say "most of the time", "generally" or "except occasionally", it says *not-to-exceed*. Nowhere in 162-H does it suggest/allude/imply that that choice was to be equivalent to measuring a flood tide by its average over the 12-hour moon cycle. Noises above 40 Db are NOT just a little less of the same problem, the 40Db cutoff says that 45Db is a different breed from 35Db. The "belows" (40 Db) are not like a sleeping pill, but more like a "respite" from loud noise. That means that averaging sounds with little or no impact together with sounds of great impact is a logical violation. Many things DO NOT AVERAGE OUT.....loud noises is one example. *Not-To-Exceed* means not to exceed! And the word AVERAGE never appears in RSA 162-H. It is a "construct" from the imagination of AWE.

I have proposed an approach for the SEC to resolve this dispute, using meteorology to eliminate the loudest noises. Since AWE claims they never (maybe meaning seldom) violate the 40 Db requirement, they should have little trouble modifying their operations occasionally to comply completely with 162-H, using the weather. And the Antrim Selectmen will sleep soundly.

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Oral

The average annual temperature in Concord, NH is about 50 degrees.

At 50 degrees, there need be no heat warnings.

At 50 degrees there need be no frost warnings.

At 50 degrees we don't even need any TV weathermen, or girls, or a Weather Bureau.

And since our average snowfall is only a fraction of an inch per day, we don't need any snowplows.

You can't total things that aren't the same

You can't average things that can't be totaled