

Vermonters
for a
Clean Environment

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Vermont Public Service Board
112 State Street
Montpelier, Vermont 05620

December 31, 2013

RE: Docket #8167 Sound Standard Investigation

Dear Public Service Board Members Volz, Burke and Cheney,

Vermonters for a Clean Environment (VCE) appreciates the opportunity to offer comments for the Board's Sound Standard Investigation on behalf of our members.

When VCE was formed in 1999, our primary focus was a proposed natural gas power plant and pipeline project. Noise from the power plants and pipelines was among the many major concerns raised by the public. In 2000, Omya proposed a large quarry that involved noise issues from quarry operations including blasting, crushing, and trucking. Noise was and remains an issue at Omya's mineral processing plant in Florence, where neighbors have complained for years about noise from the plant's operations disrupting sleep and making people sick. VCE has worked on a variety of issues where noise is a factor for regulators to address. Much of our work involves the intersection of residential and industrial areas, and our goal has been to reduce or avoid conflict and assist businesses and neighbors in developing collaborative processes for solving problems.

We start with the premise that it is not only possible, it is essential, for Vermont's industries/corporations/businesses to be good neighbors. Even a heavy industry like Omya can reduce its negative impacts on neighbors and change the community dynamic from hostility to communication and cooperation. We do not accept the premise put forward by some that all energy requires sacrifice and it is acceptable and necessary to cause harm to neighbors' health and investments, without redress, in order to achieve our state's energy goals.

Overall goal for the investigation

A successful outcome for the Board's sound standard investigation will include improved transparency and communication among parties and the public, faster response times, respect for neighbors, and adoption of standards that protect public health and quality of life.

The Board must grapple with its evolving role as the final arbiter of issues that affect the public, as defined by both “public good” and the good of neighbors. Recent Board decisions place economic “public good” above the interests of neighbors who are bearing the negative effects, without compensation. These problems are increasing with the rapid development of energy, including wind, biomass, solar, natural gas pipelines and possibly power plants. Transmission lines with substations also create noise issues for neighbors.

The PSB’s role has shifted dramatically, from dealing with centralized electricity generation to distributed generation with greater land use impacts. The Board’s decisions are fostering a power imbalance, resulting in ongoing conflict and hostility between the Board’s permitted activities and neighbors whose only avenue for getting their grievances addressed is through nuisance lawsuits filed in Superior Court.

Act 250 has been largely successful in eliminating nuisance lawsuits between industrial and commercial operations and neighbors. An example of Act 250’s relative success can be seen in Rutland County, which has a lot of quarries that can cause noise and other problems for neighbors. However, slate quarries were exempted from Act 250 in the 1990s, and that has led to nuisance lawsuits filed in Superior Court by neighbors as the only venue in which to get their grievances addressed. Nuisance lawsuits in Superior Court by neighbors of quarries regulated by Act 250 do not occur.

Similarly, the Board’s recent decisions on these new types of energy projects are resulting in the use of Superior Court, both by developers and neighbors. Ironically, developers have successfully argued to the Vermont legislature that they need “one stop shopping” for more efficient permitting of renewable energy projects in particular. Yet it is those same renewable energy developers who have taken their neighbors to Superior Court to take property rights, without compensation, instead of utilizing the Condemnation process available to them via the PSB. As the PSB’s CPG conditions and monitoring protocols are failing to protect public health and neighbors’ peaceful enjoyment of their properties from noise pollution, neighbors’ only venue in which to get their grievances addressed is via nuisance lawsuits filed in Superior Court. We are aware of more than one nuisance lawsuit being developed for filing in Vermont Superior Courts over wind turbines. To VCE, these developing lawsuits are evidence that the Board has failed to find the right balance between developers’ interests and the interests of neighbors.

The relative success of Act 250 in reducing neighbor issues is due to a number of reasons. Act 250 employs a coordinator on the regional level, so there is a person for all parties to talk to. The district commission process for reviewing projects works best, in our experience, when the lawyers are kept out of the room. Neighbors can have a venue for participating without hiring expensive attorneys and experts, and projects often change and are improved during the more informal review process at the district commission level. The district commission process can, without lawyers,

be more of a conversation between parties than the contested case scenario utilized by the next level, Environmental Court, which is a much more legalistic, expensive and daunting prospect for neighbors.

The contested case scenario is not necessarily the best way to address land use issues. Alternative dispute resolution programs have been created at major universities^{1,2}, businesses³ and by lawyers⁴ in an effort to improve the process through which we engage in development. In the area of renewable energy development, the Department of Energy has funded programs to encourage developers, especially wind developers, to utilize community-based stakeholder processes as it has become increasingly clear that the commonly-used contested case process is resulting in conflict. At a workshop VCE attended in 2011 at Harvard Law School⁵, representatives of the Consensus Building Institute⁶ and Raab Associates⁷ told an audience of 100 wind developers, regulators and community members that the reason DOE funded the 3-day program was to facilitate more successful wind energy development. In other words, the DOE recognized that the current model being utilized by developers and state regulators is hampering, not advancing, the goal of developing wind energy in New England.

VCE has been working on the wind issue since April 2009, or more than 4 ½ years. The very first words we spoke in public on the subject were to a wind developer who was proposing the Vermont Community Wind Farm (VCWF). At a public forum in Tinmouth on April 6, 2009, we asked him to please do it differently and work with the communities in a collaborative stakeholder process that would include joint fact finding, mutual gains negotiations, and other tools typically used in alternative dispute resolution. We were joined in this request to the VCWF developer by a representative of Omya, an industry that previously had poor community relations, and through a community-based stakeholder process made major changes to its operations and how it deals with its neighbors. VCWF declined VCE's and Omya's offer to meet with them and discuss a different approach. As the Board will recall, that project failed.

In November, 2009, we met with representatives of Green Mountain Power (GMP) in a 3½ hour meeting. We asked them to please approach their Lowell wind project differently, and work with the communities (not just Lowell, the host town) through a community-based stakeholder process. When it became obvious that GMP had no interest in doing anything other than the usual hiring of experts of their choice on the

¹ <http://www.darden.virginia.edu/web/Media/Darden-News-Articles/2012/Stakeholder-Theory->

² <http://www.pon.harvard.edu/>

³ http://www.alcoa.com/sustainability/en/info_page/community_stakeholder.asp

⁴ <http://www.indisputably.org/?p=5057>

⁵ <http://vermontersforacleanenvironment.wordpress.com/2011/04/19/the-problem-with-wind-siting-policy-technology-impacts-or-negotiation/>

⁶ <http://www.cbuilding.org/>

⁷ <http://www.raabassociates.org/>

numerous issues associated with the project, we narrowed our request to the noise issue. We asked GMP to at least work with the communities through a collaborative process to choose noise experts who the neighbors would trust, and develop a monitoring plan in cooperation with neighbors, so that mechanisms were in place to address problems post-construction. GMP followed up by asking us to send them names of noise experts we suggested they consider, and we provided them with a list of half a dozen names. That was the end of the discussion.

During construction, GMP sought out neighbors for the sole purpose of mediating the problems GMP was encountering with people utilizing the Nelson's private property next to the wind project site. GMP requested that a group engage in mediation. VCE staff participated in those meetings, with the goal of developing better protocols around the noise issues. GMP steadfastly ignored all efforts to discuss a more collaborative process for addressing post-construction noise issues which we had good reason to expect would occur.

VCE has also asked the developers of the Grandpa's Knob Wind Farm, the Seneca Mountain Wind project and the Derby Line wind project to please engage in a collaborative, community-based stakeholder process for the development of their proposals, prior to coming to the PSB for the contested case. In every instance, our efforts have been rejected. Two of those projects have failed.

Similar to the wind development problems, in 2000 we attended a workshop sponsored by the Federal Energy Regulatory Commission (FERC) in Albany, NY which was intended to address the problems being experienced with the build-out of natural gas pipelines. FERC convened the all-day workshop to facilitate the construction of gas pipelines because the regulators were observing that the process being used was resulting in opposition and projects were not getting built.

This Board's investigation into sound standards is an opportunity for the PSB to incorporate the efforts of FERC and DOE to encourage energy developers to collaborate with communities impacted by their proposals, rather than relying solely on expensive litigation and public relations campaigns. Coming up with a better process for understanding and addressing noise problems associated with energy projects can later be expanded to other issues, serving as a template for how to change the negative dynamic and outcomes we are now experiencing.

The noise problems the PSB is now grappling with are related to business ethics, and the need to improve the ways these new types of energy sources are engaging in development of their business interests in our communities. The wind industry is distinguishing itself as one of the least transparent and least ethical businesses currently operating in Vermont. Virtually all of the operational and cost information associated with wind projects is closely held and not shared with the public, while companies make unsubstantiated claims about public benefits. Technologies exist for GMP, GMCW and First Wind to display real time operational data on their websites, just as their operations control centers see it. Yet, the wind companies refuse

neighbors' and even the PSD's requests for operational data that would help inform the noise discussion. The Board has allowed the wind companies to keep their information confidential, compounding the lack of public trust in both the wind industry and the Board. We know that the wind developers will not willingly come to the table to collaborate with community members on the development and operation of their projects. Therefore, through this investigation, the Board has an opportunity to require that businesses seeking to operate energy projects in Vermont must be willing to cooperate with their neighbors.

Another measure of a successful outcome of this investigation will be restoration of the public's trust in the Board's decision-making. This will require holding developers accountable for the harm they are causing, and can inspire energy developers to operate in a more ethical manner.

Mitigation after the fact is a poor substitute for well designed projects. However, this docket will not be successful unless it results in addressing the problems being experienced at existing projects. We support a robust investigation to learn from Vermont's real world laboratory that the PSB has permitted.

Format that the investigation should follow

We recommend that the Board identify the specific types of noise generators to be addressed, and develop approaches most appropriate for the technologies.

As Les Blomberg of Noise Pollution Clearinghouse testified in the Lowell wind docket, "There are three general mitigation techniques available to reduce noise: quiet the source, mitigate noise in the path to the receiver, or insulate the receiver." Some noise sources can be surrounded by insulation, berms can be built, or receivers like homes can be insulated. Other noise sources are, by their nature, out in the open and produce types of noise that cannot be mitigated by enclosing the noise source or insulating receivers or blocking noise with landscaping or berms.

As a first step, we recommend that the Board sort out the different noise sources it is seeing in its dockets, noting which ones are appropriate to address through typical mitigation techniques, and those which cannot benefit from those methods. Standards for operations that can utilize typical mitigation techniques should be developed separate from noise sources that are out in the open.

In particular, this investigation must specifically investigate wind turbine noise. We followed the Energy Generation Siting Commission's work closely, and have also been involved in legislative discussions. We note that there has been an overall unwillingness to grapple with the specifics of wind energy technologies in those venues, especially the noise problems. By keeping the discussion general, it ignores the uniquely problematic noise issues that arise from big wind turbines. A general discussion about noise issues from energy sources could devolve into generic standards that might work for noise sources suitable for typical mitigation

techniques, while continuing to ignore the special problems that are caused by wind turbines.

Vermont now has three operating big wind turbine projects in Sheffield, Lowell, and on Georgia Mountain. According to data from Regional Planning Commissions, these are the numbers of structures surrounding each mountain within two miles in the host and neighboring towns:

Sheffield	137
Lowell	104
<u>Georgia Mtn</u>	<u>290</u>
Total	531

In addition to the host communities, residents of Sutton, Barton, Eden, Irasburg, Albany, Craftsbury, Milton, and Fairfax are impacted by these projects. **Attachment A** shows the location and number of structures within two miles of each operating wind project.

Ideally, health surveys of residents who live in these areas would have been conducted prior to construction. However, the Health Department declined requests by doctors and others to conduct pre-construction health surveys. Post-construction health surveys should be done as part of the Board's investigation, preferably at least 2.5 miles from 2.5MW turbines and 3 miles from 3MW turbines. The Health Department is best suited to conduct in-person health surveys, either with existing staff or in conjunction with town health officers or trained individuals following approved protocols. The first goal of the investigation is to identify the extent of the problems.

In an attempt to understand the extent of the noise complaints, VCE set up a complaint reporting form⁸ and publicized it through letters to the editor and paid advertisements. In addition, local residents printed forms and took them to neighbors who do not use the internet, and put them in local stores. Through our regular communications with the Public Service Department's Consumer Complaints Division, we know that VCE has received more complaints than the PSD. The PSD's protocols require neighbors to report complaints directly to the wind developers, and we do not have access to those numbers. We also do not know how many people are experiencing noise or health problems due to the wind turbines who are not complaining. The only way to find out is to go door to door and survey the residents. Because health issues are involved, confidentiality issues make it difficult for entities other than the Health Department to conduct these types of surveys.

Noise impact surveys have been done around wind projects, for instance, in Australia⁹ and Canada¹⁰. Templates are available so there is no need to start from scratch. The PSD's investigation can build on work being done elsewhere. These problems are the same everywhere there are big wind turbines.

⁸ windreporting.org

⁹ <http://waubrafoundation.org.au/library/community-noise-impact-surveys/>

¹⁰ http://www.windvigilance.com/windvoice_home

Complaints received by VCE show similar patterns around all three big wind projects. Based on the complaint reports we have received, it is clear that the closest residences are the most seriously impacted. All three Vermont big wind projects have neighbors living 3300 to 4500 feet from the turbines, and they are complaining regularly. The most complaints are coming from people within about one mile of each project. All three Vermont big wind projects are also generating noise complaints from neighbors living about 2 ½ miles to the southeast. For both Sheffield and Georgia Mountain, that is the furthest distance we have logged complaints. Lowell is a different story. Complaints about the noise from the Vestas v112 3MW turbines lining the Lowell Mountains are coming from people living beyond 2 ½ miles, and from all directions.

At a hastily-called meeting in May, more than 60 people showed up to discuss the Lowell wind project's impacts on their lives. Nearly half of them were from Lowell, and they were complaining loudly and angrily about the noise. We asked them if they had filed complaints, and they said "no, why bother," and besides "we are so angry already, it will just make us even angrier to have to call GMP and complain." This meeting showed that there are people living in the area surrounding the Lowell wind turbines who are not filing complaints with GMP, the PSB, PSD or VCE. Until an in-person survey is done of the surrounding area, there is no way of knowing the extent of the problems.

We should add that we are also aware of Vermont neighbors of the Hoosac Wind (Florida and Monroe, MA) project who are complaining about noise from the turbines harming their health and disrupting their lives. They live in Readsboro, more than 1.5 miles from the 1.5MW turbines Iberdrola erected at the end of 2012. Those Vermont residents are in a regulatory gray area, where Vermont regulators have no interest in what is occurring, and as out-of-staters those Vermont residents have no standing in Massachusetts' proceedings where projects are reviewed on the local level. While there is a state noise standard that the project must meet, the interests of Vermonters have so far not been considered by Mass. regulators.

The Board's investigation would best serve the public and developers' interests by utilizing a collaborative stakeholder process that follows the process taught to wind developers, regulators, and community members at the DOE-funded program held in 2011. The process begins by identifying a third party neutral to facilitate the process, identify and engage key stakeholders, and convene meetings. Stakeholders choose experts through consensus, and the investigation can then proceed. Categorization of noise sources, surveying of neighbors, identification of the unique types of noise from various sources, and discussion of approaches to reduce or eliminate noise problems can flow in a process that builds relationships between businesses and their neighbors, rather than enriching attorneys and hired experts who focus only on promoting their clients' interests.

Utilizing the stakeholder process format, the Board's investigation can proceed to explore the issues identified by the stakeholders, and be developed to specifically

meet the needs of the companies and the people who their operations are impacting. A critical piece of this process is notably absent from the Board's current contested case process, and that is giving equal weight to neighbors and their interests. The Board should embrace the opportunity to develop a new process that will result in a level playing field with improved outcomes for all parties.

Intervention issues

The Board's normal process for addressing issues is to utilize attorneys, experts, and voluminous amounts of paperwork. The public has attempted to participate as fully as possible in the Board's wind energy dockets, often at great expense. The Board's record of utilizing the expertise provided by the public is evident, and discouraging to the public. In the cases of Sheffield, Georgia Mountain and Lowell wind, intervenors have said upon reading the Board's decisions, "It's as if we weren't even there." With well over \$1 million spent by the public to participate in the Board's wind dockets, the question of how the public will pay for its intervention in this sound standard docket first must overcome the question of "why bother?"

The Board must grapple with the problem they have created, where experience has shown that there is no point in raising money to hire lawyers and experts who in the end will be ignored. To illustrate this problem, a sampling of testimony provided by intervenors' experts (other than GMP) in the Lowell wind project is included as **Attachment B**. Much of the expertise that the public would request that the Board review on sound standards for wind projects has already been presented to the Board in the Lowell docket, and the Board has already decided to rely only on the testimony of experts provided by GMP and ignore the testimony of experts offered by towns and community groups and neighbors.

Should the Board choose to proceed with this sound standard investigation utilizing its normal process of lawyers, experts, and paper filings, public participation is likely to be minimal. Public participation in the Board's investigation using the contested case process would benefit from the Board using its legal authority to hire (perhaps by issuing an RFP) a special investigator, funded by the developers, who has the authority to hire experts answerable to the Board. In other words, if the Board's usual process is used, the Board should not expect the interested public, especially those dealing with existing wind projects, to spend any money except on travel and taking time from work to participate in meetings or hearings.

We sincerely hope that the Board will be open to a process in which intervenors can participate in a meaningful way, without paying to participate. As an example of the unfairness of the Board's process, GMP has been accused of violating its sound standards for the Lowell wind project. To participate in the Show Cause hearing that the Board held in August, neighbors Don and Shirley Nelson have had to spend over \$200 in copying and mailing expenses, in addition to hours of their time. GMP can recover all its costs through rates. The public, especially those who are experiencing harm as a result of energy projects, should not have to further impoverish themselves in order to participate in the Board's proceedings.

Potential schedules

VCE will be attending the Board's prehearing conference on Jan. 8 and we will be prepared to offer suggestions for schedules based on how the Board responds to our suggestions for goals, format of investigation, and intervention issues.

We will point out that the Board has active complaints before it from each of the three big wind projects, each of which is moving slowly through the Board's process. This sound standard investigation presents an opportunity to use those complaints as case studies. During its review of the application for the Lowell wind project, the public witnessed the Board's responding to GMP's requests with great speed. The public has not seen anything close to a timely response to noise problems associated with the big wind turbines that have been brought to the Board for resolution:

- Many times in the last year and a half, Luann Therrien has filed complaints with the Board about the harm being caused to her family by First Wind's turbines in Sheffield. To date she has received no response from the Board.
- In the Georgia Mountain wind case, in September, neighbors Reggie Johnson and Shirley Phillips filed a noise complaint, including complaints about noisy fans that were not discussed during the permitting phase. To date, the Board's only response has been to advise GMCW to monitor for the fan noise. However, there has been no meaningful response from the Board to the Johnson/Phillips noise complaints.
- Also in the Georgia Mountain case, during the recent ice storm, neighbors Dan and Tina FitzGerald and Scott and Melodie McLane filed a complaint with the Board about the turbines operating during icing conditions in violation of the Board's approved Winter Monitoring Protocol. The complaint was filed on Dec. 23, and neighbors have received no acknowledgment of receipt of the complaint from the Board.
- In August, Donald and Shirley Nelson participated in the PSB's Show Cause hearing about GMP's violation of its CPG noise conditions. Shirley presented compelling testimony¹¹ about the impact of the wind turbine noise on her health and quality of life. Five months later, neither the Board nor GMP has taken any action to address the Nelsons' complaints.

Meanwhile, Shirley Nelson continues to monitor sound levels well above the permitted 45 dBA 1 hour Leq standard set by the Board. The Board has been dismissive of her monitoring, while allowing GMP to continue to operate the turbines without proof that they are within the Board's standards. Samples of the Nelson's Sound Monitoring results are included as ***Attachment C***.

The schedule for this sound standard investigation must include investigating and addressing the very real harm that is occurring to neighbors of the Board's permitted wind projects.

¹¹ http://vce.org/ShirleyNelsonPreFiled_7628_072613.pdf

Closing comments

VCE works with Vermonters on a variety of issues. The nature of our work involves us becoming expert on the issues in which we are involved. The wind issue in particular has caused us to become conversant in the jargon of acousticians and noise control experts. The more we learn, the more convinced we are that the Board's approach to regulating wind turbines in particular, and other noise sources in general, is not effective in protecting the public.

The current approach sanctioned by the Board, as advocated for by developers' experts, involves placing an unattended machine in an area for a period of two weeks. The expert does not live in the area, listen to the noise, or experience the impacts. Instead, the expert takes raw data that should be supported by audio files and weather data to interpret massive quantities of information. Processing the data allows the experts to discard data deemed to be contaminated by precipitation, barking dogs, crickets, airplanes, or other unwanted sources of noise. At no time does anyone talk to the neighbors who are living with the noise source, ask them what they are hearing, or inquire about possible health problems.

The Board's approach is, in a word, inhuman. From the time the unattended machines are set up until the results are before the Board, many weeks have transpired. Neighbor complaints go unanswered for weeks, months, and even years in the case of the Therriens. The human factor is completely discarded in favor of a machine controlled entirely by experts paid for by developers. Neighbors become unwilling participants in a protocol that by design will never bring the issues to the Board, unless the monitoring done by the developers' experts shows a violation of the standard.

Neighbors from all three wind project areas talk to each other. They compare notes, especially those who host the monitoring equipment. They have observed that during the two-week monitoring periods required by the Board, the noise levels are kept down. As soon as the monitoring equipment is removed, the noise levels are regularly above the PSB's 45 dBA Leq standard. Neighbors who follow the Board's protocols must complain to the wind company, and at best the neighbors are then offered an inside/outside test, regardless of whether the noise complaint is about interior noise.

The Board may not be aware of how intrusive their approved inside/outside test is for neighbors of wind projects. The test requires blasting the house with speakers aimed at the home from at the same angle as the wind turbine noise. As described to me by a noise control expert, the test also involves removing all soft material from the bedroom where the monitoring will be done, including bedding, the bed itself, curtains, pillows, and anything that might absorb sound and diminish the test results. The Board has approved a procedure that requires homeowners to let representatives of a company they do not trust into their homes and totally disrupt their possessions in their most private place, their bedrooms.

If neighbors following the Board's approved complaint procedure do not avail themselves of the inside/outside test, the process ends there. The complaint never gets to the Board. Only if the inside/outside test is conducted, and the test shows that dBA levels are higher than 30 dBA will the complaint come to the Board. We are not sure that the Board is aware of how intrusive the inside/outside test is, or whether the Board would have required it as part of the complaint protocol had they understood what the test entails.

VCE has learned that noise monitoring is very complicated, and the monitoring wind turbine noise is even more complicated than monitoring for other types of noise. The Board is relying primarily on the compliance with audible noise, on the dBA scale, to protect public health. Neighbors who have purchased their own sound monitoring equipment understand even better how important it is to be present and listen. Shirley Nelson's monitoring is relevant, because she tosses any data that is contaminated by ground level winds, precipitation, or other anomalies. She knows what she is hearing when she is monitoring, and can confirm that the data is showing wind turbine noise. GMP's expert can do that only by identifying spikes and attempting to correlate it to audio files and weather data.

In the Lowell wind project, the Board also did require monitoring for Low Frequency Noise (LFN) which is on the dBC scale. However, the reports submitted by RSG do not contain specific sections on the LFN and it is unclear what the data shows. As the Town and LMG experts testified in the Lowell case, Low Frequency Noise and Infrasound are increasingly being identified as the cause of the serious health problems people like the Therriens are experiencing, in addition to being awakened by audible noise.

The Board was persuaded by GMP's experts that infrasound is not an issue with wind turbines. However, "A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin"¹², in a report issued December 24, 2012, concluded:

The four investigating firms are of the opinion that enough evidence and hypotheses have been given herein to classify LFN and infrasound as a serious issue, possibly affecting the future of the industry. It should be addressed beyond the present practice of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies.

This finding is now under attack from the wind industry, which continues its global efforts to deny that there are any noise issues at all associated with their products. Wind proponents are going to great lengths to discredit neighbors, accusing them of being influenced by "anti-wind campaigners." "The nocebo effect" is the latest effort the wind industry has engaged in to allege that "it's all in people's heads."

¹² http://psc.wi.gov/apps35/ERF_view/viewdoc.aspx?docid=178263


Therefore, the climate in which the Board is undertaking this investigation is clouded by political and lobbying interests who have much to gain by discarding the lives of people who live in the vicinity of their projects. To a great extent, the Board has to date played along with the industry's interests, creating sacrificial properties and victims. The list of victims is growing, as the health effects are cumulative and increase over time, while wind turbines get noisier as they age.

While monitoring for wind turbine noise is complicated, after spending more than four years learning about the issue we have come to the conclusion that protecting people and the natural world from harm is not that complicated. Because the noise from wind turbines cannot be mitigated by typical methods used by noise control experts, the best and only solution is appropriate setbacks. Discussions about setbacks are a non-starter with the wind industry, because if protective setbacks are established in Vermont, there will be no places where wind turbines will be allowed. The industry is choosing larger and taller turbines with longer blades, which create more low frequency noise and infrasound that has been found to travel up to 10 miles in mountainous terrain.

Noise control experts who are attempting to use their decades of experience with typical power plants say they are unable to solve problems such as are being created by the GMP Lowell, First Wind Sheffield, and GMCW Georgia Mountain wind projects. After the fact, there is no solution except to turn the turbines off or take them down. The Lowell turbines are particularly problematic. They are too big, the blades are too long, the turbines are too close together, and they are too close to residences and farms in an area that was previously one of the quietest places on earth and is now blasted with noise day and night. Wildlife, both on the ground and in the air, have either vanished or changed their patterns so they are lower down, not up on the mountain which is their normal home. Wildlife communicate by infrasound and their communications are not possible when wind turbine noise invades their homes.

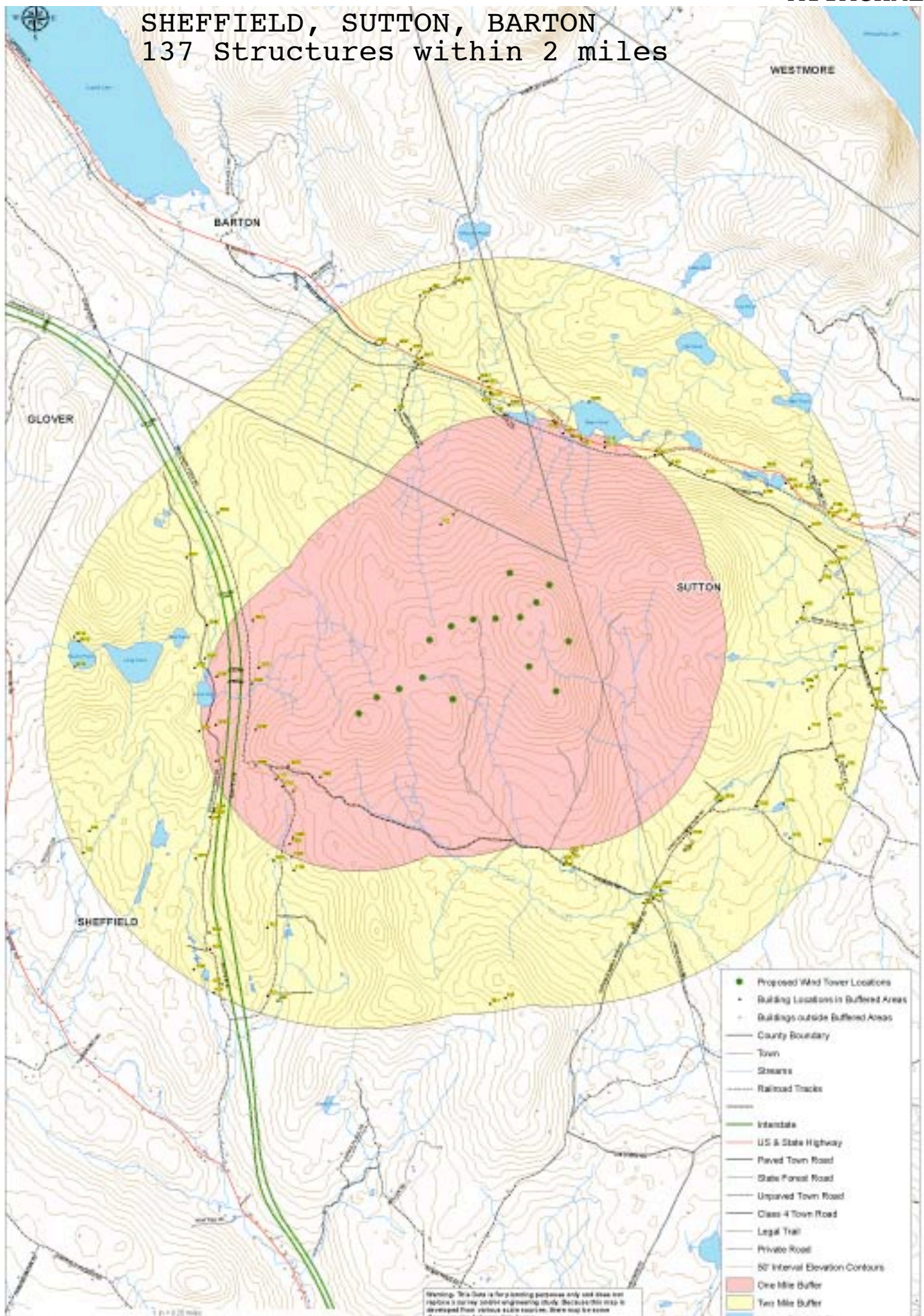
VCE staff now spend most of our time attempting to assist neighbors of wind turbines in effectively participating in regulatory proceedings, both prior to developers submitting applications and with post-construction noise issues. With an organizational focus on problem solving, the issue of wind turbine noise is one of the saddest problems we have encountered. The situation for neighbors seems hopeless and without any solution in sight, as long as regulators and politicians put the interests of the wind industry first. We recognize that the Board seems to be listening by opening this docket. We hope that our comments provide useful background to help the Board come up with a process that will yield meaningful results as you move forward with this investigation.

Sincerely,



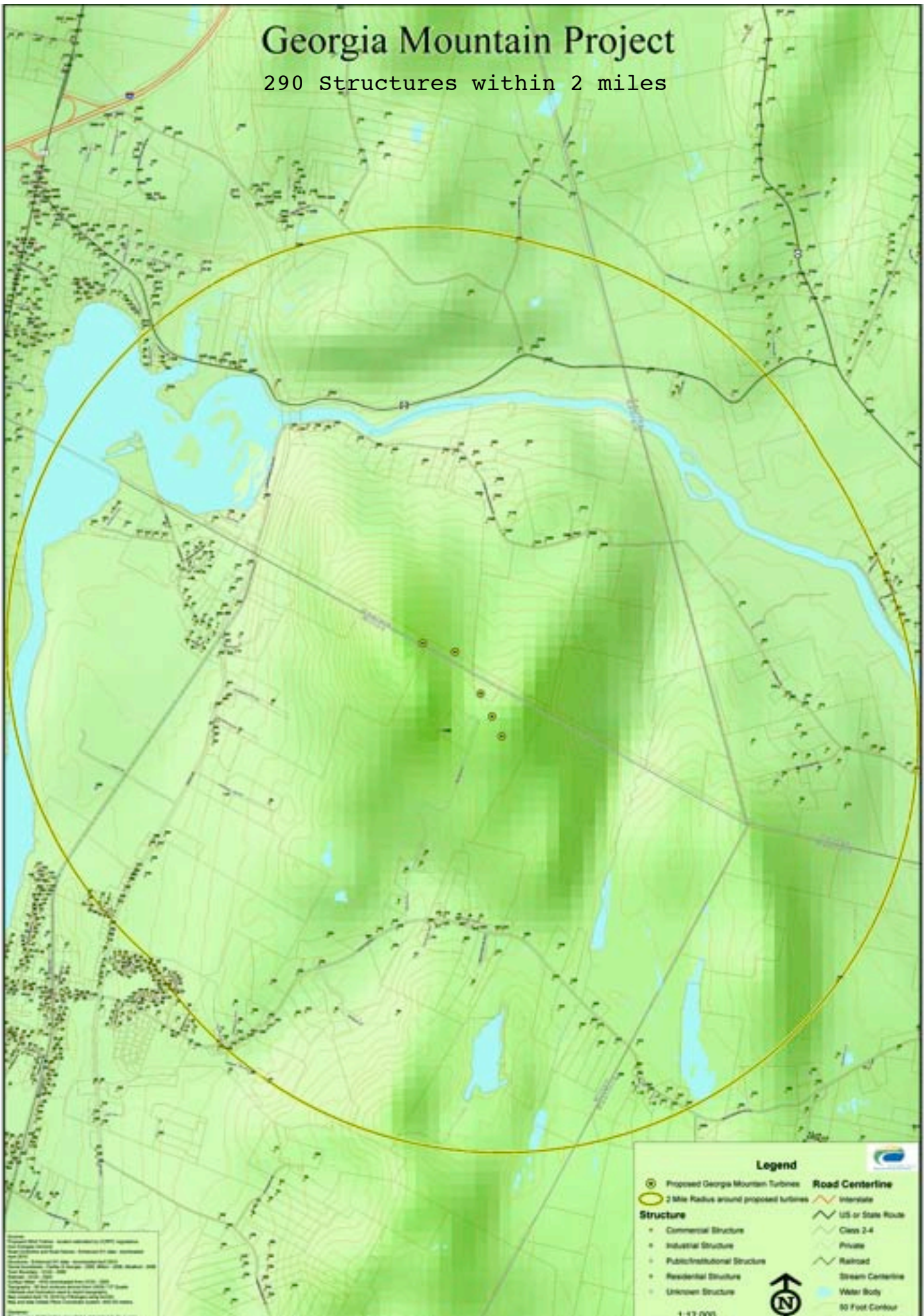
Annette Smith
Executive Director

SHEFFIELD, SUTTON, BARTON 137 Structures within 2 miles

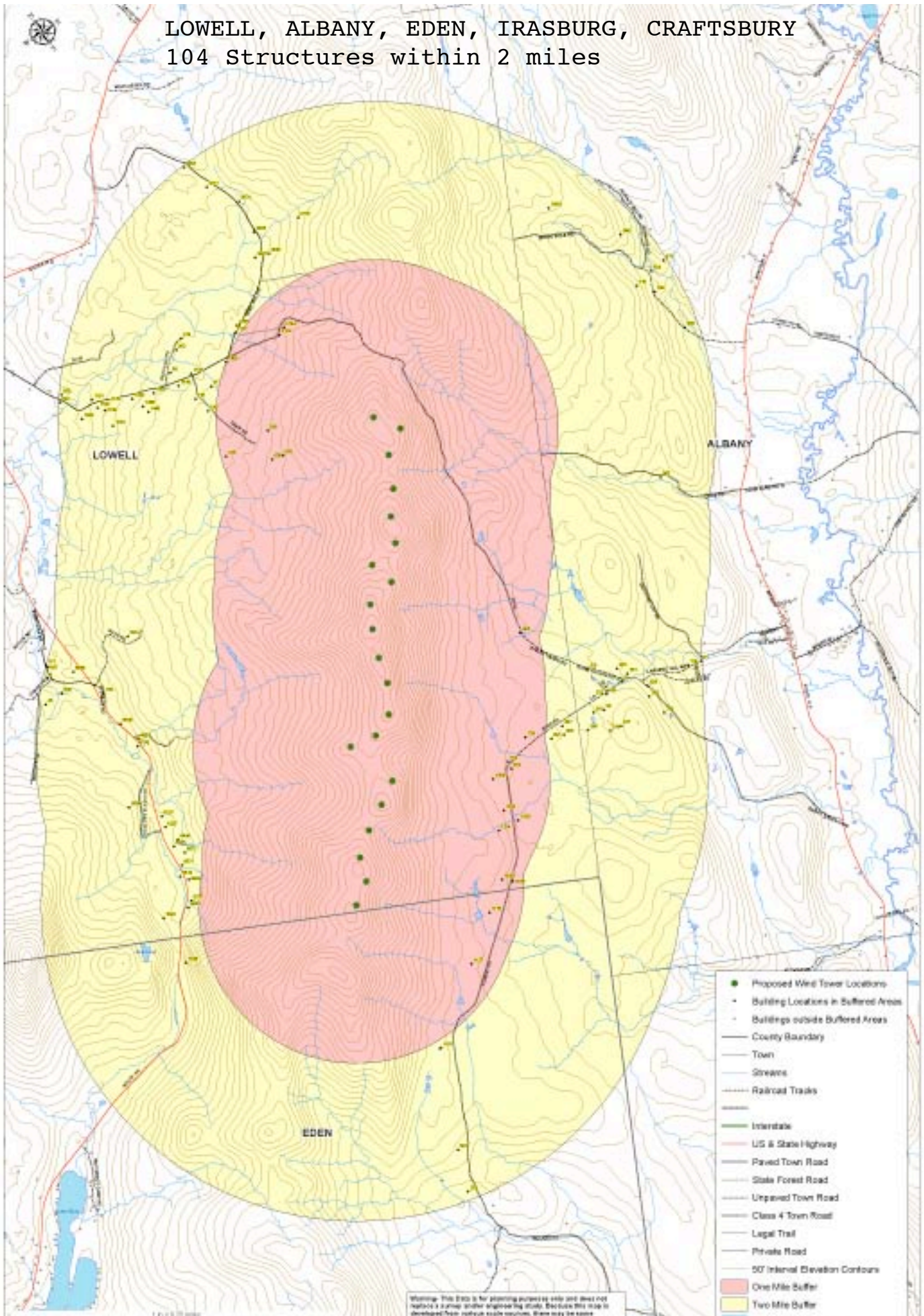


Georgia Mountain Project

290 Structures within 2 miles



LOWELL, ALBANY, EDEN, IRASBURG, CRAFTSBURY
104 Structures within 2 miles



**EXCERPTS FROM EXPERT WITNESS TESTIMONY ON NOISE
IN GMP'S LOWELL WIND PROJECT, DOCKET #7628**

	Pages
Rick James Direct¹	1 - 6
Les Blomberg Direct²	7
Dr. Teddi Lovko Rebuttal³	8 - 12
Rick James Rebuttal⁴	13
Dr. Teddi Lovko Surrebuttal⁵	14 - 21
Les Blomberg Surrebuttal⁶	22 - 27
Rick James Surrebuttal⁷	28 - 32

Rick James Direct 10-22-10

The background sound study conducted by RSG used improper locations for the test instruments that do not meet the requirements for outdoor testing established by ANSI-ASA_S12.18-1994_(R2009) Procedures for Outdoor Measurement of Sound Pressure Levels and ANSI-ASA S12.9-2005, Parts 3 and 4 Quantities and Procedures for Description and Measurement of Environmental Sound. The particular improprieties result in overstatement of the background sound levels for properties adjacent the wind turbine project's footprint.

The sound propagation modeling presented by RSG and used as the basis for conclusions by Mr. Kaliski under-estimates the sound levels that will be received on the properties and at homes adjacent to the wind turbine utility. The sound propagation modeling software used for the sound models is a general purpose model designed for modeling noise from common urban noise sources like industrial plants, roads, and railways, not wind turbines.

The Sound Power data used in the sound propagation models does not represent the noise produced by wind turbines during weather and operating conditions that are commonly associated with sleep disturbance and annoyance. The IEC 61400.11 test standard uses weather conditions that do not cause these higher noise emissions .

Links to Complete Testimony

¹ <http://www.vce.org/LowellNoiseTestimony/10-10-21-Direct-Pre-filed-Testimony-of-Richard-R.-James.pdf>

² [http://www.vce.org/LowellNoiseTestimony/2011-11-7_Blomberg_Testimony\(7628\).pdf](http://www.vce.org/LowellNoiseTestimony/2011-11-7_Blomberg_Testimony(7628).pdf)

³ http://www.vce.org/LowellNoiseTestimony/2010-11-22_Lovko_Rebuttal_TestimonyDocket7628.pdf

⁴ http://www.vce.org/LowellNoiseTestimony/2010-11-22_James_Rebuttal_TestimonyDocket-7628.doc

⁵ http://www.vce.org/LowellNoiseTestimony/2011-1-10_Lovko_Surrebuttal7628.pdf

⁶ http://www.vce.org/LowellNoiseTestimony/Blomberg_Surrebuttal_012411.doc

⁷ http://www.vce.org/LowellNoiseTestimony/2011-01-24_James_Surrebuttal7628.pdf

The noise criterion selected by RSG, "a standard of 45 dBA Leq(8)1, which is averaged over the entire night (11 pm to 7 am) outside the residence." (Section 4.7, page 11 of report) does not address the types of audible noise from wind turbines that people find most objectionable. That is, the rhythmic blade swish that occurs in synchronization with blade rotation of about one per second when the hub is rotating at 20 rpm. No consideration is given in the RSG report to the modulation (Dr. Nissenbaum refers to this as pulsitivity) from wind turbines and the increased effects of modulated sounds on annoyance and sleep disturbance. (Also see testimony of Dr. Michael Nissenbaum for more details about the modulation of wind turbine noise.)

The RSG report does not apply commonly accepted methods of assessing land use compatibility such as the procedures of ANSI S12.9, Part 4 (R_2005) Noise Assessment and Prediction of Long-term Community Response.

The RSG report uses methods for assessing the effects of low frequency acoustic energy on buildings and structures that are not appropriate for when the noise source emits modulated low frequency sound.

The RSG report and Mr. Kaliski's testimony only consider use of a fixed noise criteria. For quiet rural/wilderness areas fixed noise limits may not be sufficient to protect a community from wind turbine noise.

For wind turbines that operate 24/7 this target soundscape is the quiet time at night when surface level winds are low and winds at the blades are at or above nominal operating speeds.

The tests were conducted by Mr. Leslie Blomberg, using a protocol developed by Mr. George Kamperman and myself, published in our manuscript entitled: "The 'How To' Guide to Siting Wind Turbines to Prevent Health Risks from Sound." This study found that the background sound levels during these quiet night conditions ranged from lows of 22 dBA for properties owned by the Nelson and Magrath families, 26 at the Goodrich property, and 28 dBA at the Christianson property. These levels appeared to be much lower than the background sound data collected by RSG reported in Table 4 of the May 2010 report, but an update to this table was provided on October 21, 2010 by RSG that changed the table's data for two test sites (1B and 6) to sound levels more in line with the data collected by Mr. Blomberg. However, other data in Table 4 showing night time sound levels over 30 dBA (LA90) appear to be the result of improper test site selection and other artifacts introduced by the RSG protocol.

review of the background test graphs in the RSG report show data taken during times prohibited by these standards and test locations near reflecting objects, objects that induce localized high noise from leaf rustle, and/or situated near high noise areas such as streams and roads.

The background noise tests conducted by RSG are deficient and over-state the community's background sound levels because of errors introduced by not following the appropriate standards.

Claims that the ISO model is appropriate for modeling wind turbine noise have been made by many acoustical consultants working for wind utility developers including RSG. This is likely a result of the adoption of this model in the 1997 British wind industry sponsored guideline ETSU-R-97, where it was the recommended model; and its use for backward calculation of sound power level in the IEC 61400-11 test procedure, where the distance from test site to turbine is within the range where spherical spreading applies. Whatever the reason for its widespread use the fact that it underestimates the sound at locations distant from the turbines makes it unsuitable for noise impact assessments of properties at distances where the assumption of spherical spreading no longer apply. As noted by Mahatma Gandhi "An error does not become truth by reason of multiplied propagation, nor does truth become error because nobody sees it."

it does not include the sound power for the frequencies below 31 Hz for the Vestas turbines and below 63 Hz for the GE turbines. This region of infrasound and low frequency energy is where the dominant acoustical energy is emitted by modern upwind industrial scale wind turbines of the type planned for this project. Failure to include the infrasound and low frequency acoustic energy means that the impact of these frequencies on homes and properties is not considered in the RSG report. Further the test conditions under which the sound power data was derived do not include the effects of turbulence and other factors that cause the wind turbine noise emissions to increase by 5 to 14 dB over what is reported by the IEC 61400-11 test procedure. Thus, the predicted sound levels presented in the contour maps and tables of the RSG report understate the infra and low frequency sound at receiving properties and homes and do not represent conditions that cause complaints.

Research into wind turbine noise as it relates to sleep disturbance and annoyance has shown that amplitude and frequency modulated sounds from wind turbines at night are the most annoying audible sounds these machines produce. The Danish Health Council (2004) states that "at a given L_{night} value, the most unfavorable situation in terms of a particular direct biological effect of night-time noise is not, as might be supposed, one characterized by a few loud noise events per night. Rather, the worst scenario involves a number of noise events all of which are roughly 5 dBA above the threshold for the effect in question." Blade swish which is commonly associated with nighttime wind turbine noise modulates in just this range. The RSG report and Mr. Kaliski use average sound levels for predictions and assessments of annoyance, etc. The report cannot be considered a "Noise Impact Study" when it fails to consider the primary types of noise impacts associated with complaints and sleep disturbance from wind turbine noise at night.

Mr. Kaliski confuses the WHO annual average for adverse health effects with the

sleep disturbance that can occur during a portion of a single night.

one might believe that people will get accustomed to the noise, studies conducted in the U.K. show that this is not true. Unless complaints result in mitigation, the complaints continue.

Instead of applying standard acoustical engineering methods for assessing noise impact, the RSG report applies other novel (e.g. not following standard guidelines) methods and reasoning to support the Applicant's claim that wind turbine noise is compatible with quiet rural communities.

The RSG report does not represent a complete and standardized review of the Noise Impact of wind turbines on the community.

Acoustical engineers that design the air handling systems (HVAC) in large office buildings have known since the early 1980's that people exposed to inaudible modulated low frequency sound, such as what occurs when a HVAC system is either poorly designed or installed, report adverse health effects. These effects are similar in nature to those reported by people living near wind turbines and documented in the Wind Turbine Syndrome report by Dr. Nina Pierpont. ASHRAE (American Society of Heating Refrigeration, and Air Conditioning Engineers) has a well developed method (RC Mark II) for assessing when these conditions are present inside an occupied space. It is available in the ASHRAE Handbook in Chapter 46. The RSG report does not address this aspect of acoustical engineering and instead substitutes a different standard that has been shown to not apply to modulated low frequency sounds in occupied spaces.

I would apply a relative limit such as the commonly applied criteria that a new noise source shall not increase the background sound level by more than 5 dB is more suitable for this type of land-use. For example, the Vestas Policy on Noise from Wind Turbines (Exhibit LMG-RJ-3) states:

"Vestas recommends relative noise limits that take into account local background noise levels (where new wind turbines are sited near existing ones, already present turbine noise should not be calculated as part of the background noise). Vestas believes this type of regulation is the most effective and flexible, in that it ensures minimal noise disturbance for wind turbine neighbours while allowing turbines to be located in relatively noisy areas (areas with industry or roads, for example) that are rich in wind resources. Such areas are also often close to existing electrical grids, which can minimize the cost of connecting wind turbines to the grid." "Vestas also recommends that governments supplement relative noise limits with a low absolute maximum limit in areas of very low background noise (e.g. quiet countryside), which ensures minimal noise disturbance for turbine neighbours also in these places."

If use of relative noise limits and a low absolute maximum limit in areas of low

background sound like the Albany community is recommended by the manufacturer of one of the models of wind turbines under consideration for installation it would seem appropriate for this to be disclosed and included in the Noise Impact study.

RSG states in its summary and conclusion that a limit of 45 dBA would be appropriate and would not pose quality of life concerns. However, researchers state: "Wind turbine noise was ... found to cause annoyance at sound pressure levels lower than those known to be annoying for other community noise sources, such as road traffic. ...Living in a clearly rural area in comparison with a suburban area increases the risk of annoyance with wind turbine noise". In other papers by Pedersen wind turbine noise was perceived by about 85% of respondents to the study at sound levels as low as 35.0–37.5 dBA⁵. Currently, this increased sensitivity is believed to be due to the presence of amplitude modulation in the wind turbine's sound emissions which limits the masking effect of other ambient sounds and the low frequency content which is associated with the sounds inside homes and other buildings.

There are many occasions when the winds will be more than adequate at the height of the blades to power the wind turbines but the surface wind speeds at the ground will be calm. In that case, no wind noise at ground level will be present to mask the turbine noise. In fact, it is precisely this condition that requires necessary limits on noise increases over ambient levels. During periods when winds at the ground level are sufficient to cause leaf rustle the noise from wind interacting with surface objects has an entirely different frequency and temporal characteristics. When two sounds are different there is no masking of one by the other. Based on my experience with listening to wind turbine noise during moderate to high winds I find that the wind turbines are always clearly discernable.

masking does not have any effects on the sounds heard inside a home. This is especially true when low frequency sound is present outside homes and other occupied structures. This situation makes the noise often more an indoor problem than an outdoor one. The usual assumption about wall and window attenuation being 15 dBA or more, which is valid for most sources of community noise, may not be sufficiently protective given the relatively high amplitude of the wind turbines' low frequency emission spectra. Mr. Kaliski's references to the sound attenuation of homes is a general statement and not specific to the situation of wind turbine noise and quiet bedrooms where these sounds are still audible, especially at night.

It should be noted that in the earlier WHO Guidelines (Berglund, et.al.) based on data available in 1999 to which Mr. Kaliski refers, there is a cautionary note that warns that if significant low frequency noise is present a better assessment of the health effects would require using dBC weighting and an indoor criteria of less than 30 dBA. However, in 2009 WHO revised its guidelines and the new WHO criteria were made significantly more restrictive than those limits Mr. Kaliski recommends.

If this discussion were about urban or suburban areas where nighttime sound levels

may be 35 to 45 dBA or higher due to 'urban hum' then there might be less concern. However, **the existing background sound levels in rural areas inside proposed wind projects at night are typically 20-30 dBA. Should the Vermont PSB heed Mr. Kalisky's recommendation, it will be permit the introduction of a new sound into the area with levels at 45 dBA on a 24/7 basis at the homes and properties of people who previously enjoyed peace and quiet. In effect, this would take away their current conditions which meet the 2009 WHO criteria for safe and healthful sleep.**

Given that in its 2009 Guidelines, WHO has updated its prior recommendation of 30 dBA in a sleeping room/45 dBA outdoors to be Lnight-outside of 30 dBA; it would be appropriate for Vermont to reconsider its position also on the acceptability of 45 dBA outdoors for its citizens. The new guidelines call for outdoor sound levels to be 30 dBA or less outside to avoid adverse health effects from night time noise. 45 dBA greatly exceeds this recommendation. Given the lack of transparency of RSG in reporting the assumptions and parameters of the model, it is impossible to assess or validate the legitimacy of the predicted sound levels from the operating wind plant. To accept the results of the model on RSG's assertion that it is accurate and complete would be inappropriate.

Les Blomberg Direct 11-07-10

It is not possible to determine if the wind turbines meet the Board's criteria unless the following conditions are met: (1) All the turbines must be operating at a worst case sound power levels and (2) the atmospheric conditions must be worst case conditions (ideal for noise propagation), for a minimum amount of time to ensure that the Project is in compliance during these conditions. In addition, (3) the monitoring locations must be sufficiently distributed to account for spatial variability in noise levels, and (4) ambient noise levels at the monitoring locations must be quiet enough to make noise measurements of the turbines. Finally, as conditions change throughout the year, (5) measurements must be made throughout the year.

Measurements in less than worst case scenarios cannot show compliance with the noise criteria because they are not indicative of whether the project is in compliance under all conditions (i.e. there may be conditions when the noise levels are higher). If monitoring does not occur in worst case conditions, then the board has no idea if its criteria are met.

the board must ensure that GMP (and its ratepayers if the costs are passed on) is paying for usable data, and not worthless data. It is possible to design a monitoring program that produces only worthless data. The cost of designing an ineffective monitoring system includes risks to public health and a terrible waste of ratepayers' money. Tens of thousands of dollars could be spent collecting little or no usable data. Any investment in monitoring, in order to be prudent, must ensure that the monitoring provides usable data.

Dr. Teddi Lovko Rebuttal 11-22-10

There is well accepted evidence in the medical literature that shows noise can cause adverse health effects on people, including hypertension, heart disease, hormonal stress reactions, and sleep disturbance, as well as many other problems (WHO 2009). The WHO 2009 Report on nighttime noise gives a good overview of the mechanisms and effects of noise on health. It is believed that many of these effects arise as a result of sleep disturbance, although there are other pathways by which sound can also have adverse health effects on an individual both directly and indirectly (WHO 2009).

The recommendation in the VDH Report regarding sound levels is taken from the WHO 2009 Report which was based on studies of various noise sources and their effects on health. The WHO 2009 paper, while an excellent general overview on nighttime noise and health issues, is a general guideline and will not be equally applicable to all situations as the paper itself acknowledges. For example, the paper says that lower sound level limits will need to be provided for noise sources with high levels of low frequency sounds (such as wind turbines) as these sources are more likely to create health problems. Lower sound limits will also be required when sounds are not continuous (i.e. fluctuate like wind turbine noise) and in areas where background sound levels are low (such as rural areas like Lowell/Albany) (WHO 1999). It must also be kept in mind that the WHO 2009 Report does not make any specific references to wind turbine noise or cite any studies on wind turbine noise. Most of the studies they refer to are based on road noise, air traffic, and community noise.

Wind turbine sound has a number of attributes which make it different than these other commonly studied noise sources. Wind turbines are frequently placed in rural areas which often have very low background sound levels of 20-30dB. Wind turbines emit large amounts of low frequency and infrasound that travels farther than higher sound frequencies and which is poorly attenuated by walls and windows and is capable of causing noise related to the vibration of these structures (Colby et al 2009, Hanning 2010, Minnesota Department of Health 2009, Roberts and Roberts 2009). Wind turbine sound often shows amplitude modulation, a pulsatile nature to the sound that has been shown to be more annoying than steady noise (Bradley 1994, Holmberg et al 1997). Wind turbines will often be as loud or louder at night than they are during the day (van den Berg 2008). Wind turbines can be a source of continuous fluctuating sound for long periods of time depending on wind conditions. This unique combination of features makes it plausible that wind turbines might have adverse health effects more frequently and at lower sound levels than the noise sources cited in the WHO 2009 report.

Indeed the literature on this topic does show annoyance (an adverse health effect in its own right according to the WHO 2009 Report) and sleep disturbance from wind turbines at lower sound levels than for most other noise sources. Two of these studies done in Sweden show levels of annoyance and sleep disturbance starting to rise at or below 35dB, with 28% showing annoyance at sound levels of 37.5-40dBA

and continuing to rise as sound levels increase above 40dB (Pedersen and Persson 2004, Pedersen and Persson 2007). When looking at both studies, almost 50% of people reported annoyance at sound levels greater than 40dBA and in one of the studies 64% of those suffering annoyance also reported sleep disturbance. People living in rural areas also tended to suffer more annoyance from wind turbines, as did those living in „complex“ or hilly terrain (Pedersen and Persson 2007). Another study from the Netherlands showed wind turbine noise to be “more annoying than transportation noise or industrial noise at comparable levels, possibly due to specific sound properties such as a „swishing“ quality, temporal variability and lack of nighttime abatement” (Pedersen et al 2009) This same study showed 18% of people annoyed at 35-40dBA and evidence of sleep disturbance. **Given these studies that indicate adverse health effects correlating with sound levels as low as 35dB from wind turbines, the recommendation of 40dB in the VDH Report is too high to be protective of health.**

The WHO 2009 report relied on by VDH in fact specifically makes the point that 40dB is a threshold level of noise, and that once noise exceeds that level you are likely to have an adverse impact on public health. This does not even take into account the unique sound characteristics of wind turbines, as discussed above, and therefore, a noise limit must be set for this project that takes into the nature of wind turbine noise, the low existing background levels, and the WHO findings which suggest that even a 35dBA limit may result in annoyance and sleep disturbance.

The fact that wind turbine sound often shows amplitude modulation makes it even more possible for this to occur. It has been shown that these pulses of sound can occur over a range of 5dB, meaning that the sound could spike into ranges disruptive of sleep, and yet the average sound level would suggest that the sound levels are within the prescribed limits and protective of health and sleep when in fact they are not. It does not take prolonged noise elevation to disrupt sleep and these brief peaks of noise have the potential to disrupt sleep many times during a night. If the main goal is to prevent sleep disturbance, sounds should not be averaged or would need to be averaged over very short time periods, otherwise the „peaks“ of sound that are enough to disrupt sleep will be undetectable when averaged out with quieter times. If this is not done, compliance becomes uncoupled from the goal that it was set out to achieve, which is prevention of sleep disruption.

If using 40dB as a threshold for nighttime sound levels is a general guideline for protecting health (pursuant to WHO 2009), it follows that for a sound source such as wind turbines, which cause annoyance and sleep disturbance at lower levels than most noise sources (due to amplitude modulation, low frequency noise and their locations in quiet rural settings) that the 40dB recommendation will be too high and a lower level will be required.

The best available studies on wind turbines show that the levels of self reported annoyance and sleep disturbance start to rise at about 35dB as measured outside the building. The studies from Sweden and the Netherlands referenced above have

some important limitations and may underrepresent the problems we might see with current wind turbine proposals in Vermont. It is important when looking at these studies to remember that the Swedish studies were done looking at wind turbines which are significantly smaller than the sizes of most current wind turbines, were placed in smaller numbers per array, and often on flat terrain. The study from the Netherlands also did not closely match conditions in Vermont. Current wind turbine proposals in Vermont are likely to show even higher levels of annoyance and sleep disruption as evidence suggest that sound levels and annoyance are likely to be worse as turbines get larger (more noise), there are more turbines in an area (more noise), and when they are placed on hills or ridgelines (more noise which carries farther).

Given that sleep research suggests arousals can start to occur at sound levels around 35dBA (Hanning 2010) and current studies show a marked rise in annoyance and sleep disturbance at sound levels greater than 35dBA, 35 dB exterior or below is likely to be protective of public health.

Below are some recommendations from other health and sound experts that I have relied on, who support similar sound levels as noted in Hanning's 2010 paper. Hanning's paper Wind Turbine Noise, Sleep and Health is submitted as ALB-RJ-4.

- Phipps, based on his research on wind turbines in hilly and mountainous regions in New Zealand, recommended sound levels not to exceed the background sound level (L95) by more than 5dBA, or a level of 30dBA L95, whichever is less (Hanning 2010).
- Hanning, a world renowned expert on sleep and well versed on wind turbines and health, recommends a maximum external limit of 35dBA in the absence of excessive modulation (Hanning 2010)
- Kamperman and James suggest turbine noise should not be more than 5dBA above background levels and should not exceed 35dBA within 30 meters of any occupied structure. (Hanning 2010).
- New Zealand Standard 6808 provides that the evening and nighttime levels may be set at 35dB La90(10min) or 5dB above the background level, whichever is higher. (Hanning 2010).
- The Dutch National Institute for Public Health and Environment recommend an outdoor Lden limit of 40dBA as the "no effect level" (Hanning 2010).
- Thorne concludes that unreasonable noise occurs at noise levels above 30dBA L90 in the presence of amplitude modulation and with van den Berg states that 30dBA L95 in conditions of low wind speed with modulation restricted to 3dB would likely be protective of health and from annoyance. (Hanning 2010).
- The Minnesota Department of Health paper on wind turbines and health comments that complaints rise with sound levels above 35dBA. (Minnesota Department of Health 2009).
- A summary report by the Ohio Department of Health on wind turbines suggests "that operational noise levels at these distances should be kept to levels at or below

35dBA.” (Ohio Department of Health 2008).

A very important review of wind turbines and health by Dr. Christopher Hanning, a sleep expert, is important to read as it gives an excellent and thorough review of what we know about wind turbine sound and health. As mentioned, it has been submitted with the rebuttal testimony of Rick James as ALB-RJ-4. It is an excellent complement to the WHO 2009 paper in that it looks specifically at the data on wind turbines and sleep, which was not covered in the WHO reports. It helps to illustrate clearly how and why the sound limits proposed by the VDH are too high and not protective of health.

Additionally, an unpublished case control study by Dr. Michael Nissenbaum on wind turbines and health effects in Mars Hill, Maine is important to review. The study closely mimics conditions in Vermont (due to similarities in topography and ridgeline turbine placement) and thereby gives us a look at what kind of effects we might expect to see here. It is also one of the only studies to use a control group to compare the health of those near turbines (within 3500 feet) with those far away (3 miles). While this study does not define a safe sound level, it suggests that those within 3500 feet may suffer rates of sleep disturbance up to 82%, decreased quality of life in 95%, increased rates of use of prescription medications, headaches, stress, and depression (Nissenbaum 2010). This study emphasizes how important it is that sound levels be set at proper levels, as the adverse health effects can be very significant – however it must be noted that the Mars Hill project consisted of smaller 1.5 MW turbines, and therefore the effects of the current proposed project may be even greater due to increased noise levels from the larger turbines.

I think there is preliminary evidence to suggest that infrasound may have more physiological effects than was previously appreciated. There are number of studies in animals and some in humans to suggest that these sounds may have effects that were previously unappreciated (Pierpoint 2010). It will take more research to determine what clinical significance these may have in the long term, however by not addressing this issue, the Petitioner has not fully characterized the potential health impacts of the project.

45 dBA is too high and will not protect people from the health effects and sleep disturbance they will experience at these sound levels. These levels are higher than those recommended in the WHO 2009 report. The studies I have discussed earlier show significant sleep disturbance and annoyance at levels much lower than this. You could possibly see levels of annoyance in as many as 50% of people at these sound levels. I am not aware of any studies on wind turbines that show that these sound levels would prevent annoyance and sleep disruption. This standard is not protective of public health.

The best data available on wind turbines shows that annoyance and sleep disturbance start at levels as low as 35dB.

You would expect to see sleep disturbance, which is a health problem in and of itself but which also can lead to cardiovascular illness, depression, elevated heart rates, changes in stress hormones, impaired glucose tolerance, increased use of prescription medications (for sleep, depression, hypertension), depression, hypertension, weight gain, headaches, tinnitus, decreased attention, accidents, and decreased school performance. These and other effects have been documented in numerous studies on noise and many have also been shown with respect to wind turbines in particular (Colby et al 2009, Hanning 2010, Nissenbaum 2010, Pierpoint 2010, WHO 2009).

Rick James Rebuttal 11-22-10

I agree that the 2009 WHO Guidelines provide that 40 dBA outside a home is the threshold for adverse health effects; however, the WHO report further states that a sound level of 30dBA at the building façade causes no measurable harm, whereas levels of 40dbA and higher are clearly harmful, with the range between 30 and 40 considered to be potentially harmful. Additionally, medical sleep specialists have indicated that human sleep is disturbed, either with remembered awakenings or unremembered arousals, and changes from critically important deeper levels of sleep to more superficial levels when noise levels increase, only transiently, from 30dbA to 35dBa, for example.

due to the fact that the background sound levels in this quiet rural area at night currently meet the WHO 2009 criteria for safe sleep (e.g. they are currently below 30 dBA and may be as low as 20 dBA), this lower threshold should be preserved and not allowed to be raised to levels where risks to public health may occur. It would be inappropriate to subject people who currently have safe conditions for healthful sleep to higher sound levels that WHO has shown may not be protective of human health.

Wind turbine sounds are not steady but instead fluctuate with the movement of the blades. This 'blade swish' is most common at night. The 'swishes' occur about once a second and raise the sound level by 5 dB or more above the constant level. With the turbine noise fluctuating the average of 40 dBA (Leq) will be comprised of these rhythmic swishes at levels over 40 dBA. The Dutch Health Council in 2004 stated that "at a given Lnight value, the most unfavorable situation in terms of a particular biological effect of night-time noise is not, as might be supposed, one characterized by a few loud noise events per night. Rather, the worst scenario involves a number of noise events all of which are roughly 5 dBA above the threshold for the effect in question." (Page 83 of Exhibit ALB-RJ-[Reference is to Van den Berg Thesis]) WHO identifies the risks associated with the range of nighttime sound levels from 30 to 40 dBA as a function of the characteristics of the noise. Wind turbine noise has the characteristics to cause sleep disturbance at levels lower than many other common community noise sources and should be limited to the known safe sound level of 30 dBA at night.

Therefore, I do not agree with the VDH Report's conclusion that a 40 decibel standard would be sufficient to protect human health. If we are to rely on the WHO report, as VDH does, then to be fully protective of human health the standard must be set to 30 decibels.

Dr. Teddi Lovko Surrebuttal 01-10-11

It is quite clear that annoyance and sleep disturbance can occur at levels below this, and Dr. McCunney himself admits to this in his discovery responses, wherein he admitted “that indirect health effects from wind turbine noise (such as sleep disturbance, annoyance, stress) can occur below 45dBA.” Dr. McCunney thus chooses to ignore the fact that annoyance and sleep disturbance are direct adverse health effects in and of themselves (WHO 2009, also see my answer to Q-7 below), as well as risk factors for other diseases such as depression, hypertension, cardiovascular disease, arthritis, respiratory problems, and decreased quality of life (Niemann et al., 2006, also see my answer to Q-7 below). I have not seen a clear explanation from him as to why he discounts the effects of annoyance and sleep disturbance.

It is also unclear from his testimony why he has chosen 45dB(A) as acceptable and safe. He gives two references in his discovery answers to support that noise level - Miedema (2003) and the WHO Europe 2009 report. The WHO 2009 report to which he refers does not support his statement that “adverse health effects at levels below 45dB(A) [are] virtually nonexistent”. Even a cursory look at the main tables from this paper shows sleep disturbance starting at 35 dB L_{max} inside, use of somnifacient drugs and sedatives at 40dB L_{night} outside, self-reported sleep disturbance and environmental insomnia at 42dB L_{night} outside, and complaints at 35 dB L_{night} outside. The WHO 2009 report goes on to state, “adverse health effects are observed at the level above 40 dB L_{night} outside.”

I would like to point out that it is accepted in the medical field that community noise, whether from wind turbines or other sources (traffic, aircraft, trains, neighborhood noise), can have negative and serious impacts on people’s health. Given that fact, the question is no longer “can noise from wind turbines create health problems?” Clearly they can, the question is how to protect the public.

The problem with the limit of 45 dBA(exterior)(Leq)(1hr) is that it is simply too high to protect people from the adverse effects of noise from wind turbines. Averaging the levels over time further compounds this fact by allowing even higher sound levels to occur for periods of time. Please see my prior Rebuttal testimony to the Vermont Department of Health for more on this issue.

It is hard to reconcile setting a sound level of 45 dba for wind turbines when there is clear and consistent evidence in the peer reviewed literature (as discussed below) that people start to suffer adverse health effects, especially annoyance, at levels below this. There have been three major studies looking at more than 1,500 people examining this issue (which I have summarized below). These studies do not answer all the concerns regarding wind turbines and health; however they provide clear and consistent evidence that the sound standard proposed by GMP and standards previously used by the Public Service Board are too

loud to be protective of public health from wind turbine noise. The findings of these studies are important because they are well designed studies and they provide the best available evidence from which to base decisions regarding noise standards that would be protective of public health. Their results have also been remarkably consistent, making it possible to anticipate at what sound levels noise begins to be a problem.

One thing to keep in mind while I review these studies is that they may very well underestimate effects in Vermont. These studies looked at smaller wind turbines than those being currently proposed in Vermont. Most of the sites evaluated in these studies had fewer turbines in a given area than this current proposal. Many of the sites in the studies were on flatter, less varied terrain and those that were in hilly or rocky terrain tended to show higher rates of annoyance. Therefore these studies provide a conservative view of the potential impacts of wind turbine noise on the health of the public for the proposed project.

Pedersen and Waye-2004. The goal of this study was to evaluate the prevalence of annoyance due to wind turbine noise and to study dose-response relationships of noise and annoyance. A significant relationship was found between noise levels and annoyance. People were annoyed by sound from wind turbines at lower levels and the rates of annoyance increased more rapidly than for other sources of community noise. The following levels of annoyance were noted with regard to sound levels:

- At 30-32.5 dBA outside the building: 0% were annoyed
- At 32.5-35.0: 18% were rather or very annoyed with an additional 17% slightly annoyed
- At 35.0-37.5: 12% were rather or very annoyed with an additional 26% slightly annoyed
- At 37.5-40.0: 28% were rather or very annoyed with an additional 23% slightly annoyed
- At >40.0: 44% were rather or very annoyed with an additional 12% slightly annoyed

Other points to consider in this study:

- Of those who noticed the wind turbine noise 25% were disturbed daily or almost daily and an additional 17% were annoyed once or twice a week, suggesting that it is not a minor or infrequent occurrence.
- At levels >35dBA 16% stated that they were disturbed in their sleep by wind turbine noise.
- 85% of people could hear the wind turbines even at levels as low as 35-37.5dB.

As you can see, based on this study the noise standards proposed by GMP and previously used by the Public Service Board could result in as much as 50% of the people living in the vicinity suffering from annoyance as well as significant levels of sleep disturbance and its adverse health effects.

Pedersen and Waye-2007. This is a similar study to their 2004 paper, in which they again looked at annoyance and wind turbine noise and also tried to ascertain if terrain has a significant impact as well. They found that living in a rural area increased the risk for annoyance and a rural area with hilly or rocky terrain increased the risk for annoyance even further. They also found that annoyance was associated with lowered sleep quality and negative emotions. They conclude that "there is a need to take the unique environment into account when planning a new wind farm so that adverse health effects are avoided."

The following levels of annoyance were noted with regard to sound levels (dBA outside):

- At <37.5dBA-3-4% were annoyed
- At 37.5-40dBA-6% were annoyed
- At >40dBA-15% were annoyed

Other points to consider in this study:

- Noise annoyance was associated with reduced sleep quality and negative emotions. 36% of those who were annoyed by wind turbine noise reported their sleep was disturbed by noise.
- The authors state "annoyance is an adverse health effect". (See my answer to Q-5 in this testimony)

This study again shows that at ~35dBA or slightly higher you begin to see an increase in negative health impacts from wind turbine noise. Therefore according to this study, the noise standard previously used by the Board would be insufficient to protect public health.

Pedersen et al-2009. For this study, the authors collected data with the purpose of trying to come up with a dose-response relationship of noise and annoyance with the goal being to find levels which would avoid adverse health effects. As in both prior studies, the levels of annoyance increased with increasing sound levels. Again it was shown that wind turbine noise was more annoying than comparable sound levels from other noise sources.

The following levels of annoyance were noted with regard to sound levels (dBA):

- At 30-35 dBA-7% were rather or very annoyed with an additional 10% slightly annoyed.
- At 35-40 dBA-18% were rather or very annoyed with an additional 20% slightly annoyed.
- At 40-45 dBA-18% were rather or very annoyed with an additional 23% slightly annoyed.

Other points to consider in this study:

- Of those who expressed annoyance to wind turbine noise 92% were annoyed by sound at least once a week.

Taken together, these studies show that adverse health effects, primarily annoyance, begin to consistently increase at levels above 35 dBA. The prior standard used by the Public Service Board, and the standard requested by GMP, allow for 45dBA, which will not be protective to many people exposed to levels higher than 35 dBA. Any guideline proposal higher than that should explain why that will be protective when the best evidence to date shows higher levels will leave a significant number of people at risk for health problems.

It is important to understand that annoyance and sleep disturbance adversely impact health and quality of life in and of themselves. The viewpoints above show that this view is not fringe or out of the mainstream, but rather is widely accepted by many noise and health professionals. It is unsettling that the wind industry sponsored paper Dr. McCunney coauthored (Colby et al, 2009) states "It is important to note that although annoyance may be a frustrating experience for people, it is not considered an adverse health effect or disease of any kind." They provide no references to support or justify this statement. Current views on noise and health suggest that annoyance and sleep disturbance, and the hormonal reactions that accompany them (increased autonomic activity, increased cortisol levels), contribute to other health effects such as hypertension, cardiovascular disease, depression, migraines, decreased quality of life, arthritis and respiratory problems. (Shepherd et al, 2010, Niemann et al, 2006). The Board must therefore not accept Dr. McCunney's unsupported and erroneous assertions regarding the potential health impacts associated with wind turbine noise.

The scientific literature therefore shows that sound levels below 45 dBA are capable of creating sleep disturbance. The full impact of these findings on an individual's health is still being examined. Even though these parameters may not be associated with fully conscious awakenings, people who are experiencing them report less restful sleep, fatigue, longer reaction times, poor short-term memory, reduced motivation, distractability and decreased performance showing that they do create immediate adverse impacts. (Shepherd et al, 2010, Zaharna and Guilleminault, 2010).

Current models about how sound affects sleep and contributes to other adverse health problems suggest that even these seemingly minor changes in sleep may be one of the pathways that noise contributes to other problems such as hypertension and cardiovascular problems. (WHO 2009). These disturbances are associated with elevations in blood pressure and heart rate when they occur and over long periods of time may contribute to cardiovascular disease. Ising (2004) further states "that for reasons of medical prevention it is necessary principally to avoid noise-induced impairments [of sleep] even when below the arousal threshold."

The peer reviewed papers on wind turbines and annoyance that I discussed earlier clearly show that annoyance increases with sound levels. Thus annoyance is not simply a complaint made by people who do not like wind turbines. If noise levels

were not important, you would not see the correlation of increasing annoyance with increasing noise levels so consistently and at such similar sound levels in all three major studies on wind turbines (see answer 6 in this testimony). The wind industry would like you to believe that annoyance is simply a result of the fact that people do not like wind turbines and has nothing to do with the noise created by wind turbines.

As I have discussed above, the evidence does not support this. This wind industry view also fails to explain why even in areas where people have clearly welcomed wind turbines, problems with annoyance have occurred (Vinalhaven, ME, Johnsbury Survey, 2009).

Contrary to Dr. McCunney's statements in his testimony, annoyance from noise is clearly a public health issue and ultimately in his discovery testimony he admits as much. Some researchers are now suggesting that noise annoyance might be more closely related to noise related health effects than objective measures (such as sound levels). Annoyance captures the interaction of the sound level with the effects on an individual and is likely a mediator in many of the health effects we see from noise exposure via increased autonomic stimulation and stress reactions (Dratva et al, 2010, Shepherd et al, 2010, Hume, 2010).

If the Public Service Board and Green Mountain Power wish to protect the public health they will need to protect the public from sound levels which may create annoyance. The standard previously used by the Board will not accomplish this, and it is my opinion that a 35dBA standard is necessary to protect public health.

Wind turbines have been shown to cause sleep problems and annoyance at levels well below 40 dB(A) and thus wind turbines appear to be more likely to cause problems at lower sound levels than they are to be „safe“ at higher levels as Dr. McCunney suggests.

Wind turbines have been shown to emit audible low frequency sounds. Audible low frequency sound can create annoyance more readily in some people. An excellent review of low frequency sound makes the point that it “has been recognized as a special problem, particularly to sensitive people in their homes” (Leventhall, 2004). The WHO 2009 report also makes a point of emphasizing how low frequency sound deserves special attention and can create problems for people at noise levels that otherwise might not be problematic. The WHO report states that:

-“For noise with a large proportion of low frequency sounds a still lower guideline (than 30dBA) is recommended”.

-“It should be noted that a large proportion of low frequency components in a noise may increase considerably the adverse effects on health.”

-“The evidence on low frequency noise is sufficiently strong to warrant immediate concern.”

It has also been shown that annoyance from low frequency sound tends to be

greater than that from higher frequency noise at the same A-weighted level (Leventhall, 2004 referring to Persson study).

Leventhall (2004) also makes the point that “conventional methods of assessing annoyance, typically based on A-weighted equivalent level, are inadequate for low frequency noise and lead to incorrect decisions by regulatory authorities”.

As I stated in my earlier testimony the amplitude modulation of wind turbines makes them more likely to create problems with annoyance. This also holds true for low frequency sounds where fluctuations and temporal variations of low frequency noise are correlated with annoyance. Fluctuating noises tend to be more annoying than predicted by their average sound levels. Levels close to threshold can cause annoyance if there is also fluctuation (Leventhall, 2004).

Reading Leventhall's (2004) review, it is striking how many of the features that he ascribes to low frequency sound annoyance are seen with the complaints associated with wind turbine noise. Since low frequency sounds from wind turbines can be audible at times and many of the symptoms people complain of are similar to complaints from people suffering from low frequency sound annoyance this is an area worthy of further investigation.

It is also worthwhile to look at some of the factors that make low frequency sounds more likely to cause annoyance, as the current project potentially shares some of these characteristics. For example some of the factors that were correlated with complaints from low frequency sound include:

- problems arose in quiet rural environments**
 - the noise was often close to inaudible and heard by a minority of people**
 - the noise was more audible at night**
 - the noise had a throb or rumble characteristic**
 - the noise was typically heard indoors and not outdoors**
- (Leventhall, 2004)**

With regards to infrasound, Dr. McCunney has admitted in discovery that “infrasound may become audible through vibration induced by airborne energy and potentially augmented by resonance in homes or other structures”. Infrasound also has the potential to act on the human body even at subaudible levels. A study on guinea pigs has exemplified this fact (Salt, 2010) as has the fact that infrasound has been approved for therapeutic massage by the FDA (McCunney, January 2010). Dr. McCunney has used this to show that infrasound is safe but it is interesting to note that 1) it did require FDA approval and 2) suggests that the sound, while inaudible, is presumably having some effect on the person being treated. Ultimately, what affect if any infrasound is having in relation to the problems people are having with sound from wind turbines is unclear, but it is an area worthy of further investigation.

Infrasound therefore has the potential to influence the body even at levels of

sound that are below the audible range.

In discussing infrasound, it is important to keep in mind that people are suffering adverse effects from noise sources and in this respect wind turbines are not exempt. In fact, evidence shows wind turbines being more problematic than most other noise sources. **These debates about how and why people are being affected do not change that fact and in some ways can be a distraction from the important point that audible wind turbine noise can clearly cause problems for some people. Whether infrasound and low frequency sound are contributing to this problem remains unclear but does not alter the clear findings that problems are occurring from audible noise, and that wind turbines do have the potential to affect public health.**

Again Dr McCunney likes to point out that „effects are highly individualized“ as if this somehow makes the impact less true or problematic for the individual suffering from the problem. As I mentioned, many „effects“ on people from all sorts of insults from pain, to smoking to cancer can be highly individualized. This fact does nothing to lessen their seriousness or the serious effects noise creates on sleep. These adverse effects on individuals cannot be discounted as they are members of the public and must be accounted for when looking out for the public good and public health.

It is also very clear that a number of effects of sound on sleep do not habituate, most significantly the autonomic changes that occur with increased heart rates and vasoconstriction (Griefahn et al. 2008). Maschke, in a 2002 study, showed permanently increased cortisol levels from nighttime noise, again arguing against habituation (Ising, 2004). These changes occur at sound levels lower than those that usually create conscious awakenings. They are important because these autonomic changes may be linked in the long term to adverse cardiovascular events such as cardiac disease and hypertension.

The truth is many people are annoyed by wind turbine noise and this has been shown consistently in the studies published to date (Pedersen 2004, 2007, 2009). There are also numerous case reports and literature reports showing that the extent of this annoyance is having a large impact on people's immediate quality of life (Nissenbaum, 2010, Phipps, 2007, Gillis, 2009, Johnsbury Survey, Pierpoint, 2010, Harry, 2007, Hanning, 2010). There is documentation of people leaving their homes or having wind companies buy their homes because their distress is so high (Cummings, 2010, Pierpoint, 2010). So at least for a subset of people, this annoyance is not temporary or minor but as is shown by their actions is having a profound and serious effect on their lives.

Wind turbine studies have shown problems arising at ~35 dB(A) so I am not sure how Dr McCunney would mitigate the adverse effects experienced by individuals at 35 dBA when he recommends a 45 dB(A) standard. 45dBA would be perceived as

doubling of sound level by those already suffering annoyance at 35 dB(A). This also does not take into account that by using an average time limit, such as the 1-hour average used by the Public Service Board in prior dockets or the 8-hour average requested by GMP, that sound levels could be even higher than 45 dB(A) for considerable periods of time.

Wind turbines are actually somewhat unique compared to other noise sources in that the levels at which annoyance begins to occur have been consistently ~35dBA. Despite this observation there has been no consensus on acceptable sound guidelines with regards to wind turbines (see Walsh, 2010 which provides a summary of standards that exist worldwide, and indicates that there is no consensus on appropriate setbacks to protect public health).

The reasons for this are many. Unfortunately, the standards and guidelines implemented are often not protective of health for all the reasons I have been discussing. The wind industry has misrepresented the extent and nature of wind turbine noise, whether unintentionally or not, so that people have been taken off guard when the turbines are not „as quiet as a refrigerator“. Given the clear health related problems and decreased quality of life noise can create, it stands that if the Public Service Board wishes to protect the public health they will need to follow the precautionary principle and use the best available data with regards to wind turbines and revise the prior standard previously used to a lower level. (See Pederesen, 2004, 2007, 2009).

Les Blomberg Surrebuttal 01-24-11

Mr. Kaliski relies heavily on selected statements in the World Health Organization and EPA documents concerning specific impacts. Whatever noise level is permitted or not, or recommended or not, in Europe or by the EPA, is, however, irrelevant to this case. The Board should not substitute the World Health Organization's judgment or the EPA's judgment for its own judgment, because the criteria used by these other organizations are in many cases not pertinent to the criteria applicable to the Lowell Mountain wind turbine project. For example, the EPA's 55 dBA recommendation is based primarily on communication interference. This is irrelevant to an analysis of health impacts and only one of many aesthetic concerns. The WHO's Lnight 40 dBA recommendation is related to health impacts, and only indirectly related to aesthetic criteria used by the Board.

One of the criteria of a conditional use is that it not adversely impact the character of the area. By including windmills as a conditional use, Lowell clearly intended that windmills could be allowed in this area, but only if they do not adversely affect the character of the area.

Here is where a crucial distinction must be recognized. The incorporated Act 250 standard is an undue adverse impact, but, Lowell's conditional use criterion is only adverse impact (LMG-LB-8). It is important to trace the path of these criteria to not be confused by them. Section 248 requires that the facility not have an undue adverse impact on aesthetics. One of the tests for undue impacts is that it not violate a clear written community standard. The community standard in this case, is that the facility not have an adverse impact on the character of the area. The community standard in this specific case is very restrictive. Because of this, in order for the adverse impact of the turbines to be found to be undue, it is sufficient to show that the impact is adverse.

Unless residences are immediately adjacent to the development, a noise limit at a residence or place of frequent use does not protect the character of the area. If the area is to be protected, a property line standard is needed, particularly in this case, as there is a lot of land between the residences and the residents' property lines.

GMP is using the neighbors' land, land they do not have permission to use, as a "buffer" against the noise and other health and safety effects. Focusing on the residence instead of the property line is a defacto granting of a noise pollution easement to GMP without consent of the property owner. A property line standard could prevent this.

The character of the area is one of rural lands, suitable for farming or residences. In order to protect the area, so that it remains suitable for rural residential uses, the property line maximum standard should be 35 dBA for non-participating properties. That level would not elicit significant community reaction, would limit the range where the turbines would be audible, and would help protect against sleep interference. At the very least, the Board's previously used standard of 45 dBA

should be applied. While it is my testimony that 45 dBA is not sufficient to protect residences, that was the Board's intent when setting that level, and at the very least, it should be applied to property where residences are allowed so as not to change the character of that area.

It fails the sensibilities of the average person test. A person of average sensibility would feel that noise emanating from a neighbor that interferes with that person's sleep inside his or her own house is highly offensive. Moreover the erection of a 443 foot high wind turbine only 200 or less feet from one's property line, when the turbine is the only industrial-type structure in the area, also would offend the sensibilities of the average person who lives in a rural area.

This project also fails the third Quechee test. It fails the mitigation test because design options that would have improved the harmony of the proposed project with its surroundings were not taken, nor were adequate setbacks established. Specifically, a property line limit, larger setbacks, and lower at-residence limits are needed in order to satisfy the third Quechee standard. There has been no evidence provided to demonstrate that noise levels set by the Board in previous wind turbine cases are sufficient to protect the character of the area of Lowell and Albany. In fact, GMP aggravated the conditions because now they want to use even larger wind turbines which they admit will violate the Board's noise standard.

the 30 dBA limit utilizes an hourly average, but hourly averaged noises don't interfere with sleep. It is individual instances of noise that causes the interference. A 45 dBA noise can persist for more than a minute, but if averaged over an hour, can still meet the Board's Standards. It is not uncommon for people who wake up to clock radios to set the radios in the 40 to 50 decibel range. Clearly this is a level that can wake people up. Scenarios that expose people to 15 dBA more than the averaged limit are possible.

For night time noise, the interior instantaneous levels should not exceed 30 to 35 dBA so the exterior levels should be between 35 and 40 dBA. If hourly average levels are used, the levels should be lower to protect against higher instantaneous levels that can be averaged with lower ones. I would recommend 35 dBA.

The Lmax levels of 35 and 32 dBA cited by Mr. Kaliski as consistent with the 30 dBA Leq 1hour are an example of this. Since they are consistent with the existing standard, using them is a much more appropriate way to set a shorter term criterion.

The area immediately adjacent to the wind facility is zoned to permit residential uses. As such, the Board should set a property line standard that protects these lands against the possibility of sleep interference. Currently, the character of the area is that it is suitable for sleeping and residential uses. With the proposed

development, there are 678 acres of land that would not be suitable because the noise represents a health hazard, and 5,156 acres where sleeping could be negatively affected.

In order to protect the character of the area, at the very least, the Board should extend its previous residential limit of 45 dBA to all properties not controlled by GMP for which residential uses are allowed uses. More stringent standards are required to protect against sleep interference, however.

a property line standard should be used to protect against annoyance and community reaction. The proposed wind turbines are loud enough to trigger widespread complaints from over 7,581 acres. This in an area that is currently without noise sources of similar magnitude.

Mr. Kaliski states that the wind turbine noise levels diminish below 55 dBA in a few hundred feet. But the Nelsons' own property is within a few hundred feet of the turbines. So by Mr. Kaliski's own logic, a property line standard is needed. The turbines will exceed 55 dBA on their property. The levels required to protect against adverse community reaction and sleep interference, however, are lower than those that protect against speech interference, so if the property line standard protects against former impacts, no further protection is required.

given the quiet character of the area, the turbines will dominate the soundscape, particularly in the lower frequencies below 1000Hz, for example, at the Nelson residence.

the turbines will be audible on more than 10,000 acres of land. This is a significant change to the soundscape of the area.

Moreover, since research shows that noises that are unpredictable and uncontrollable are more difficult to tolerate, we can infer that the turbine noise, which can occur at any hour of the day or night, any day of the year, and is beyond the control of the neighbors, will have a significant impact on the neighbors.

The methodology overstates the background levels. At the Nelson residence, for example, there are hundreds of acres of land on which to place meters, yet the meter was placed 1-2 meter from the road and 24 meters from the home. A measurement 1 meter from a road is not an accurate representation of background noise for that home. It is simply representative of noises 1 meter from a road. Where and when the background is its quietest, the turbines' noise will have the most severe impact. It is important not to inflate noise levels to hide this impact.

The RSG and NPC monitoring at the Christiansen property location clearly shows that the RSG monitoring is not representative of the quieter locations along Route 100. Again, the Christiansen monitoring location shows that Mr. Kaliski chose a noisy location at which to make measurements.

RSG's monitoring is consistently higher than NPC's. If, however, you exclude the short term background noise from the RSG data as RSG should have done, then with the exception of the Eden Rd. location, the measurements are reasonably consistent.

Camps and second homes are clearly places of frequent human use. They are residential dwelling units. They are taxed similarly to residences. They are used at the pleasure of the owner, either full time or part time. As they are used for sleeping, their occupants are entitled to the same protection from sleep interference as other residential structures. They can be rented or leased, so noise levels can impact the income and/or economic viability of the property.

The Vestas 112 and Siemens SWT 101 turbines are louder than the previously modeled turbines, as Mr. Kaliski acknowledges. Their impact will be greater than the impacts shown on my Prefiled Exhibits and maps. My earlier conclusions are still valid, although they understate the impact for these turbines.

I do not believe 45 dBA at residences is an appropriate standard in the Lowell Case, as I have explained in detail.

Mr. Kaliski is seeking to use the NRO mode as a "Get Out of Jail Free" card. He puts the card down for the Board, and magically, the problem is solved. GMP has not provided enough information on how the noise will be monitored and the NRO mode implemented, so the effectiveness of the NRO mode cannot be analyzed. The Board has no idea how and when the NRO mode will be used; GMP has only provided one possible scenario (see page 27, line 6 of Mr. Kaliski's Rebuttal Testimony). There are no details on how the monitoring will be used to implement the NRO mode. The effectiveness of the NRO mode depends on the monitoring and implementation, but by not providing information on how the monitoring and implementation will occur, GMP is asking the Board to consider it effective, when there is no evidence that it is effective. The Board should not wait until after the facility is permitted to learn if the monitoring and implementation are effective.

We know from Mr. Kaliski's testimony that without the NRO mode, they will violate the standard . We have no idea if they will meet it with the NRO mode, because we don't know how they will monitor and implement it. The issue of monitoring is important because modeling cannot and does not come with a guarantee that those levels will not be exceeded. The issue of monitoring is critical for noise sources when modeling indicates the turbines will violate the standard. Will GMP monitor all the locations where a violation might occur? We don't know. There are numerous times when a violation could occur. Will GMP monitor at these times? We don't know. GMP has not said. Various monitoring schemes may result in numerous violations going undetected.

To avoid undetected violations of a standard, you need a very robust monitoring program. Both when monitoring occurs and where it occurs is very important. The

application is incomplete because GMP hasn't provided this, and without it, neither GMP, the Board, nor the neighbors can know if violations will go undetected.

If the NRO mode is used as part of the normal operation of the facility (Mr. Kaliski suggests 44% of the time for some turbines, Discovery Responses, Dec 23, Answer 32), the project's ability to mitigate noise impacts is compromised. Mitigation strategies become more costly and unpalatable for GMP.

"Turbine layout was not specifically designed to reduce turbulence, although once a turbine model is selected, turbine location will be micro-sited to maximize project electrical output, which may include minimizing the effect that each turbine will have on neighboring turbines" (emphasis added).

His discovery statement not only contradicts his testimony, it shows that one of the most important mitigation measure available to GMP, since turbulence is responsible for some of the most serious complaints about wind turbine noise, was not considered. Moreover, any mitigation will be as a result of maximizing production, not minimizing impacts on neighbors.

There are three general mitigation techniques available to reduce noise: quiet the source, mitigate noise in the path to the receiver, or insulate the receiver. GMP has failed to consider quieter sources. In fact the two newly proposed turbines are louder than the original ones they proposed. Smaller, quieter, and fewer turbines which would have been more harmonious with the soundscape should have been proposed.

Since building a sound wall to address the path is impossible, setbacks or buffers that lengthen the path or distance to receiving properties become one of the most important mitigation measures.

It is important to note that Mr. Kaliski, in his testimony, relies heavily on setbacks, claiming the turbines are more than 3,000 feet from residences. This setback, however, is almost entirely on neighbors' property, especially considering properties to the east. The neighbors should be under no obligation to provide their land to the developer to attenuate noise from the project.

Minimum setbacks should be on the developer's land. Since noise decreases with distance, separating noisy sources from neighbors' property is a very important mitigation measure.

Setbacks become even more important because it is very difficult to insulate receiving properties from noise. It is possible to insulate homes to some extent, but this will do little to mitigate the impact of the turbines on the character of the area. setbacks can be for safety reasons, such as to avoid tower collapse onto neighboring property, or blade or ice throw onto neighboring property. Setback can also be for

noise reasons. And they can be for other aesthetic reasons.

GE recommends that the setback be greater than 1.5 X (Hub Height + Rotor Diameter) for their turbines if icing is likely at the wind turbine site. In the Lowell case, that would mean 607 feet. Exhibit LMG-LB-13.

A paper prepared for the New York State Energy Research and Development Authority notes that in the cases of tower collapse, most of the debris has fallen between one to two hub height distances from the base. With respect to ice throw, the paper notes that the risk of ice throw becomes significantly smaller between 750 feet and 1150 feet. Exhibit LMG-LB-14.

In the Lowell Mountain case, property line setbacks are clearly insufficient. It is also important to note that setbacks designed with public safety in mind such as the GE recommended distance, or the distances from the New York State Energy Research and Development Authority paper, are not sufficient to protect the character of the area with respect to noise.

Moreover, in the Lowell Mountain case, even the exact size of the currently proposed property line setback is in dispute (see Nelsons' Rebuttal Testimony). I asked Mr. Kaliski what the distance from the turbines to the property lines were in discovery, but he was unable to tell me. Clearly the proposed setback depth is insufficient for both safety and noise.

Rick James Surrebuttal, 01-24-11

Here we are debating a specific type of noise. Wind turbine noise is not like other commonly encountered noises in rural communities. WHO states that for sounds in the range between 30 and 40 dBA the risks are dependent on the character of the outdoor noise source and the vulnerability of the people to it. Sources with significant low frequency content and whose sound rises and falls by 5 dBA or more about once each second would be expected to have a higher likelihood for causing sleep interference and subsequent adverse health effects. WHO's 30 dBA Lnight-outside is the level at which adverse health effects from any type of outside noise are not expected - it is the level at which we would not expect sleep disturbance from any outdoor noise source. We know from the experiences of people who live near wind turbines that sleep disturbance occurs at sound levels below the 40 dBA LOAEL for general noise. To be protective of the more vulnerable members of the population who will be expected to live with nighttime turbine noise, the nighttime noise from the turbines must be less than 40 dBA. My statement was that in this case, limiting outdoor noise to 30 dBA level or less would be protective of those individuals

This cool layer of calm air forms at night and it can be anywhere from 20 to 100 meters thick. Under a stable atmosphere the wind shear gradient is much sharper which means that the difference in wind speed at the top and bottom of the blade's rotation can be much more than what occurs with a neutral atmosphere. Unstable atmospheric conditions can also cause this to occur and with unstable atmospheric conditions there is a greater likelihood of other meteorological effects from vertical or cross-wind turbulence that would increase the turbine's noise. We do not have any test data from GMP that shows the sound power levels under these conditions.

If we were to take a conservative estimate that the sound levels received on properties during non-neutral atmospheric conditions are at least 5 dBA, and that is very conservative, the effect will be seen as a 5 dBA increase in the sound levels at the receiving properties. The easy way to do this is to take the contour maps produced by Mr. Kaliski and add 5 dBA to each contour. That means the homes and properties that were borderline acceptable for the 40 to 45 dBA criteria Mr. Kaliski espouses would now be 45 to 50 dBA. All of the properties that were within the 35-40 dBA contour lines will now be within the 40 to 45 dBA contour lines, etc.. Because the margin of safety for Mr. Kaliski's models and preferred criteria is very slim, the night time conditions will not meet his limits.

Mr. Kaliski interprets the WHO 2009 night time noise limits in the narrowest manner possible. He provides considerable testimony showing that the proposed turbines will not exceed the WHO 40 dBA LOAEL by means of year long averages and other mathematical manipulations. But, the WHO LOAEL is the threshold for adverse health effects. If we were to use it as the design goal, we face the distinct possibility that some of the more vulnerable members of the community will suffer adverse health effects. There is no hard boundary at 40 dBA. This value should be

seen as a not-to-exceed limit - not one that is the design goal. If turbine noise is more likely to awaken people, or if the model's predicted values are not what occurs in the real world, then there is a very good possibility that some people may be adversely effected. As I described above, the model does not even reflect the higher noise emission conditions that are possible on the site. We already have an error that understates nighttime noise by 5 dBA or more just because the models represent the quieter operation in a neutral atmosphere. There needs to be a safety margin. That is one reason why I have stated that the sound level outside a home at night should be limited to 35 dBA. I stand by that recommendation. It provides a safety factor that can offset the inability of the models to replicate sound propagation under common nighttime weather conditions.

The Noise reduced modes (NRO) are also tested under the neutral atmospheric conditions. There is no data that shows sound power output when using the NRO modes under stable or unstable weather. We should not accept an untested and unproven technology as a form of mitigation.

What does this data [at Vinalhaven ME] show? It shows that the wind turbines are noisier at night under a stable atmosphere than they are during the day under a neutral atmosphere. All turbines are running in NRO modes at night and do not use the NRO mode during the day time. Yet the sound levels at the test locations around the island are 40 dBA or less for the neutral atmosphere and 48 to 52 dBA at night, in NRO mode, but under a stable atmosphere. The results show that the NRO modes do not make the turbines quieter at night. We have many nights worth of data under stable atmospheric conditions that show the NRO modes do not work as a mitigation method for commonly occurring weather conditions.

GMP provided no information that would cause me to change my opinion from what I have seen in practice at Vinalhaven. The NRO modes may make a small difference during the day when there is a neutral atmosphere, but it will not reduce the higher noise levels associated with operating turbines at night under stable or unstable atmospheres. NRO modes cannot be considered as an effective mitigation method.

I understand what Mr. Kaliski is trying to describe, but I do not think he understands that the concern is not about vibration of things in one's home; it is about people who, because they are more sensitive to infra and low frequency sound than the average person, sense it in some manner that is not necessarily as an audible sound. The problem is not about things, it is about people and the impacts the vibration may have on their well-being. Some people are more susceptible to the modulated infra and low frequency sound emitted by wind turbines than others. This effect is mediated through the vestibular organs and vestibular parts of the cochlea. In a recent personal communication, I asked Dr. Salt (a recognized expert whose opinion I routinely rely on) the question: "Does infrasound from wind turbines affect the inner ear?" Dr. Salt responded: "There is controversy whether prolonged exposure to the sounds generated by wind turbines adversely affects human health. The un-weighted spectrum of wind turbine noise slowly rises with

decreasing frequency, with greatest output in the 1-2 Hz range. As human hearing is insensitive to infrasound (needing over 120 dB SPL to detect 2 Hz) it is claimed that infrasound generated by wind turbines is below threshold and therefore cannot affect people. The inner hair cells (IHC) of the cochlea, through which hearing is mediated, are velocity-sensitive and insensitive to low frequency sounds. The outer hair cells (OHC), in contrast, are displacement-sensitive and respond to infrasonic frequencies at levels up to 40 dB below those that are heard." "A review found the G-weighted noise levels generated by wind turbines with upwind rotors to be approximately 70 dBG. This is substantially below the threshold for hearing infrasound which is 95 dB G but is above the calculated level for OHC stimulation of 60 dB G. This suggests that most wind turbines will be producing an unheard stimulation of OHC. Whether this is conveyed to the brain by type II afferent fibers or influences other aspects of sound perception is not known. Listeners find the so-called amplitude 30 modulation of higher frequency sounds (described as blade "swish" or "thump") highly annoying. This could represent either a modulation of audible sounds (as detected by a sound level meter) or a biological modulation caused by variation of OHC gain as operating point is biased by the infrasound. Cochlear responses to infrasound also depend on audible input, with audible tones suppressing cochlear microphonic responses to infrasound in animals. These findings demonstrate that the response of the inner ear to infrasound is complex and needs to be understood in more detail before it can be concluded that the ear cannot be affected by wind turbine noise."

Dr. Salt's observation that these vestibular effects might be triggered by infrasound that is above 60 dBG is relevant to wind turbine noise. Many of the modern upwind turbines being installed in current projects have dBG levels above 60 dBG. Some studies by wind industry consultants have found dBG levels in the 70 to 80 dBG range. They have concluded that these levels will cause a problem because they are below the threshold of audibility. My concern, however, is not about audibility. It is about vestibular disturbances that cause the more sensitive people living near wind turbines to experience the set of symptoms that Dr. Pierpont has described as Wind Turbine Syndrome.

The real problem is how the modulated infra and low frequency sound affects a person's organs of balance, not building vibration. The sound pressure levels created by wind turbines are sufficient to trigger these adverse health effects. The proof of this is that people who live near wind turbines at distances similar to those for the GMP project report very similar health effects. There is a great similarity in these symptoms that can be explained if one considers that their organs of balance are responding to low levels of modulated infra and low frequency sound. Although this linkage may still need more research to fully understand, it is repeatable enough that we should be considering the effects of infra and low frequency sounds from turbines in new projects. GMP did not conduct any such study or evaluation.

I asked Mr. Kaliski, through discovery, whether he had conducted his own version of these audibility assessments or other such studies. His responses indicate that

almost every type of study that may have resulted in a negative finding for the project was not conducted by GMP. Mr. Kaliski did not follow up on his monitoring to find out why his background sound levels had anomalies. He did not conduct an audibility study as did Mr. Blomberg. He did not conduct a study to determine the annoyance potential of the wind turbines. This would seem to be an obvious requirement for a Noise Impact Study when the new noise source will raise the long term background sound levels by more than 10 dBA. Mr. Kaliski is a very experienced acoustical consultant. He should be aware that this type of increase will result in people objecting to the new noise source. Yet, he chose not to consider annoyance or audibility in his report, rebuttal or response to Discovery questions. I find this problematic.

Given his qualifications and experience, it would seem that he would know that these types of studies would show results that are not favorable to his client. That would be an indication that he is not acting as an unbiased expert, but instead is cherry picking what he does and says to avoid negative results. This is not unbiased work, but instead it is advocacy for his client. If this bias is shown in what he chooses not to study, we must be suspect as to whether this bias introduced other errors in the work he did perform. In my opinion this clear bias, combined with the fact that GMP's models only represent the conditions for which wind turbines operate most quietly and that there was no attempt made to consider what effect non-neutral atmospheres may have on nighttime noise levels and modulations, suggests that the Board cannot be convinced by GMP's testimony that the turbines will not have an adverse impact on nearby residences.

My final conclusions are that this project has a very great potential to cause adverse health effects for people who are most vulnerable to nighttime sleep disturbance and the effects of infra and low frequency sound. Based on the reasoning I used earlier in this response I would expect nighttime noise at the properties now bordering the project to exceed the 45 dBA (Leq 1Hr) limits that Mr. Kaliski is recommending. I base this not only on my review of the GMP information, but also on my experience in working for clients who live at similar distances to wind turbine. I routinely find that nighttime noise during non-neutral atmospheric conditions are 5 dBA or more that what is modeled for the neutral atmospheric conditions. At times this exceedance can be as much as 10 or more dBA. I have personally experienced these conditions by staying overnight in the homes of people whose sleep is disturbed by the turbines. I found that I was also awakened by the sound of the turbines. I am not susceptible to the effects of infra or low frequency sound, but I have observed my clients who are sensitive. They are able to tell whether the turbines are operating outside their homes by internal sensations. I have personally confirmed their ability to do so under a number of conditions and for a number of people.

Q-27 Would you agree or disagree that a permit should be issued for this project?

A-27 **In my opinion this project, as it is currently formulated, should not be**

granted any permits, as it would not meet the noise standard previously employed by the Board, which as I have previously testified is itself not protective of public health. The Board should utilize a more restrictive standard (35dBA), and GMP should have to show that that standard could be met in all atmospheric conditions in order for this project to proceed.

NELSON SOUND MONITORING, LOWELL, OCT - DEC, 2013

