

## Wind Turbines, Health, Ridgelines, and Valleys

Montpelier, VT, May 7 2010

It is a medical fact that sleep disturbance and perceived stress result in ill effects, including and especially cardiovascular disease, but also chronic feelings of depression, anger, helplessness, and, in the aggregate, the banishment of happiness and reduced quality of life.

Cardiovascular disease, as we all now, leads to reduced life expectancy. Try and get reasonably priced life insurance if you are hypertensive or have suffered a heart attack.

If industrial wind turbines installed in close proximity to human habitation result in sleep disturbance and stress, then it follows as surely as day follows night that wind turbines will, over the long term, result in these serious health effects and reduced quality of life.

The question is, then, do they?

In my investigation of Mars Hill, Maine, 22 out of about 30 adults ('exposed') who live within 3500 feet of a ridgeline arrangement of 28 1.5 MW wind turbines were evaluated to date, and compared with 27 people of otherwise similar age and occupation living about 3 miles away (Not Exposed).

Here is what was found:

82% (18/22) of exposed subjects reported new or worsened chronic sleep deprivation, versus 4% (1 person) in the non-exposed group. 41% of exposed people reported new chronic headaches vs 4% in the control group. 59% (13/22) of the exposed reported 'stress' versus none in the control group, and 77% (17/22) persistent anger versus none in the people living 3 miles away. More than a third of the study subjects had new or worsened depression, with none in the control group. 95% (21/22) of the exposed subjects perceived reduced quality of life, versus 0% in the control group. Underlining these findings, there were 26 new prescription medications offered to the exposed subjects, of which 15 were accepted, compared to 4 new or increased prescriptions in the control group. The prescriptions ranged

from anti-hypertensives and antidepressants to anti migraine medications among the exposed. The new medications for the non exposed group were anti-hypertensives and anti-arthritics.

The Mars Hill study will soon be completed and is being prepared for publication. Preliminary findings have been presented to the Chief Medical Officer for Ontario, and have been presented to Health Canada, by invitation. Earlier partial results were presented to the Maine Medical Association, which passed a Resolution calling for caution, further study, and appropriate modification of siting regulations, at its annual meeting in 2009.

There is absolutely no doubt that people living within 3500 feet of a ridgeline arrangement of turbines 1.5 MW or larger turbines in a rural environment will suffer negative effects.

The study was undertaken as a pilot project to evaluate for a cluster of symptoms after numerous media reports, in order to present data to the Maine Medical Association, after the Maine CDC failed to more fully investigate.

While the study is not perfect, it does suggest a real problem that warrants not only further more detailed investigation, but the tenderest caution, in the meantime, when decisions on how to site industrial wind turbines are made.

What is it about northeast USA ridgelines that contribute to these ill effects, and how can they be avoided?

Consider, the Northeast is prone to icing conditions. Icing will increase the sound coming off of turbines by up to 6 dBA. As the icing occurs symmetrically on all blades, imbalance detectors do not kick on, and the blades keep turning, contrary to wind industry claims.

Sound is amplified coming off of ridgelines into valleys. This is because the background noise in rural valleys is low to begin with, increasing the sensitivity to changes, particularly the beating, pulsatile nature of wind turbine noise, and sound sources at elevation do not undergo the same attenuation that occurs from groundcover when noise sources are at ground level. The noise travels farther and hits homes and people at greater

amplitude that it would from a lower elevation. Even though this is not rocket science, it was conclusively proven in a NASA funded study in 1990.

Snow pack and ice contribute to increased noise transmission. Vermont valleys have both, I believe.

Preconstruction sound modeling fails to take the tendency of the homes that people live in to respond and vibrate perceptibly to sound at frequencies that the occupants of the dwellings cannot necessarily hear. They hear, and feel, the walls and windows rattle, and the floors vibrate, in a pulsing manner at a frequency or the turbine rpm.

When pre construction modeling fails to take the pulsatile nature, propensity for icing, and ridgeline elevation into account, as well as a linear as opposed to point source of noise, problems can be expected. What distance is safe? It depends on the terrain, the climate, the size of the project and the turbines themselves. Accurate preconstruction modeling with safe targets in mind is critical. The WHO says that 30dbA is ideal, and noise levels of above 40dbA have definite health consequences. At Mars Hill, where affected homes are present at 3500 feet, sound levels have been measured at over 52.5dbA. The fiasco there has been acknowledged by the local wind energy company, and by a former Maine governor.

Vermont would do well to learn from the affected people in Mars Hill.

I have seen the preliminary plans for the planned Deerfield Wind Facility, and have particular concerns regarding the dwellings to the north and northeast of the northernmost extension of the turbine layout. These homes are well within a mile, generally downwind, and downhill from what I am told may well be 2 MW turbines (or larger?), in a snowy and icy part of the Northeast.

The parallels to Mars Hill are striking.

We know that preconstruction sound modeling failed at Mars Hill. No matter what the preconstruction modeling at Deerfield shows, the real world experiment at Mars Hill suggests that there will be problems for homes at the setbacks that seem to be planned for Deerfield on the attached image.

The people who live within 3500 feet at Mars Hill are truly suffering. Learn from Mars Hill. It is not a matter of not having wind turbines. It is a matter of putting them where they will not affect people's health.

Newer technology to accurately measure sound at a quantum level improvement in temporal, frequency and amplitude resolution over commonly used acoustician's equipment now exists, though it is costly and not readily available. But it will be widespread, soon, well within the tenure of the individuals responsible for making siting decisions today.

Avail yourselves of these findings and familiarize yourselves with the new technologies. You will not only be future proofing your current decisions, you will also be helping people who would otherwise end up too close to industrial wind turbines escape the fate of the exposed residents of Mars Hill, and many other sites in North America (Mars Hill, Maine, merely represents the first small 'controlled' study).

I have seen the results of this cutting edge equipment, and how it has revealed drastic short duration excesses over allowed sound levels, levels that set homes vibrating and rendering them unlivable, but also levels of lower frequency transient noise at the audible level, that demonstrates not only failure of preconstruction sound modeling as currently practiced, but also the inadequacy of the measuring tools in the toolkit of the everyday practicing acoustician-consultant who generates reports for industry and local government.

**Michael A. Nissenbaum, MD**

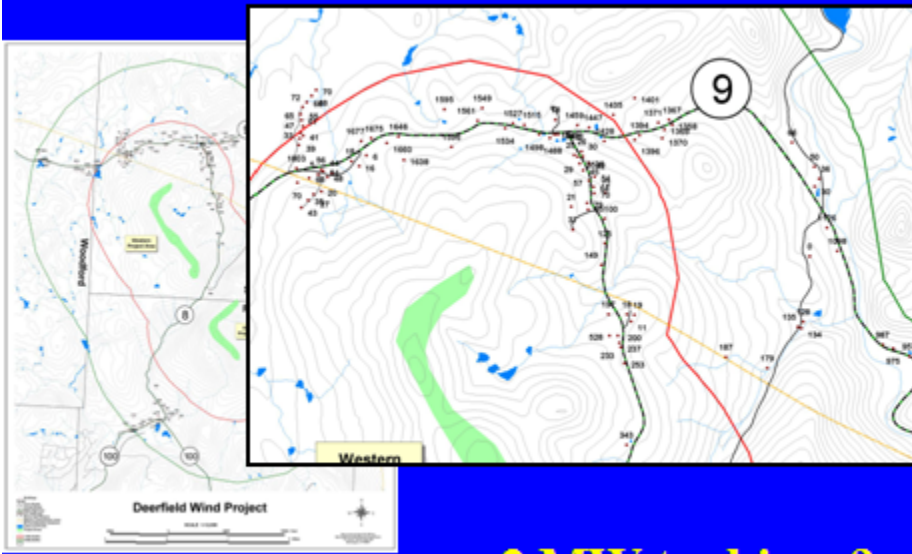
*University of Toronto (MD), McGill University (Specialty Diagnostic Imaging),*

*University of California (Fellowship)*

*Harvard University Medical School (junior faculty, Associate Director of MRI, BIH)*

*Currently, Radiologist, NMMC, Ft. Kent, Maine*

## Deerfield Wind Project, Vermont



**2 MW turbines?**

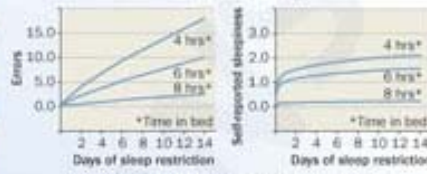
## Effects of sleep deprivation

Losing sleep, even for one night, can trigger a flood of changes throughout the body. Scientists don't fully understand how the sleep-starved body goes awry, but many studies find clear relationships between sleep and the health and function of body systems.

### Brain

Cognitive impairment, declines in memory and judgment, and brain chemical changes that can lead to depression

#### Attention and sleep



People's performance on an attention test declines with sleep loss (left), even though they don't feel much sleepier (right). SOURCE: VAN SOESTEN ET AL., SLEEP 2008

### Thymus

Immune system impairment

### Stomach

Increased hunger  
Hunger and sleep



### Pancreas

Insulin resistance and higher risk of type 2 diabetes

### Fat layer

Increased risk of obesity

#### Body mass index and sleep



### Muscle

Decreased reaction time and accuracy

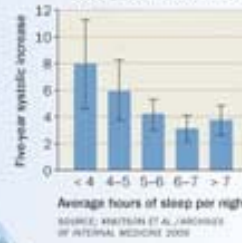
### Joints

Increased inflammation, which can lead to atherosclerosis (artery hardening) and rheumatoid arthritis

### Heart

Higher disease risk, irregular heart beat

#### Blood pressure and sleep



### Metabolism

Higher risk of "the metabolic syndrome," which includes high blood pressure and cholesterol and reduced insulin sensitivity, sometimes leading to diabetes and heart disease

#### The metabolic syndrome

