FILE

FAX

(39)

614 752 8351

TO: OBSB

FROM: Valerie C Malicki, MA, LPCC

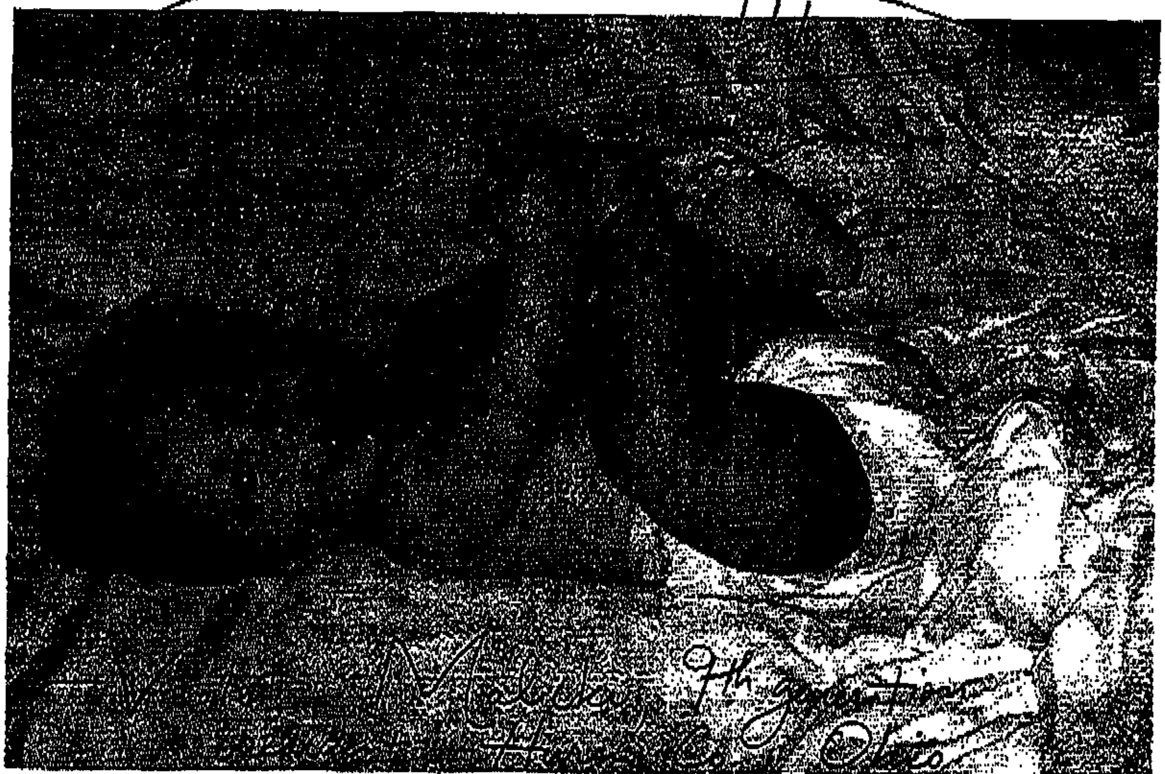
RE: case #13-0990-EL-BGN

Pages =

36 + cover page

The following images were scanned as received

August 14, 2014



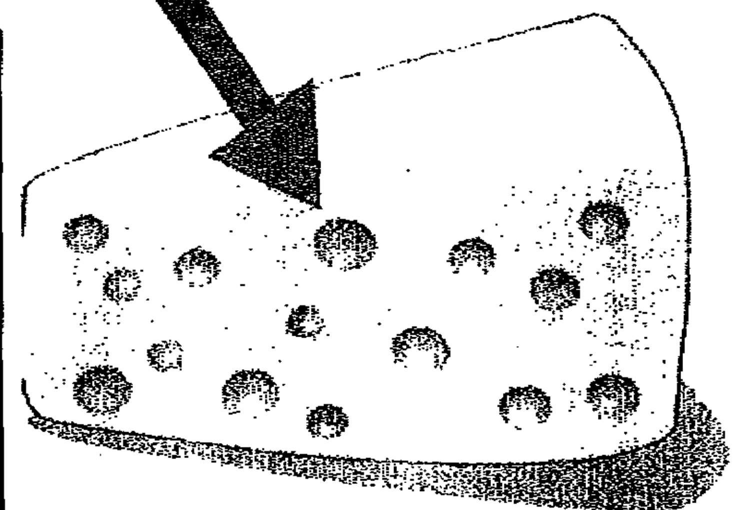
Dear Ohio Power Siting
Board Voting & Non-Voting Members,

Please review case
13-0990-EL-BGN. Please note
OPSB Staff Report does NOT
even comment on Infrasound and its
harm to brain and human health.

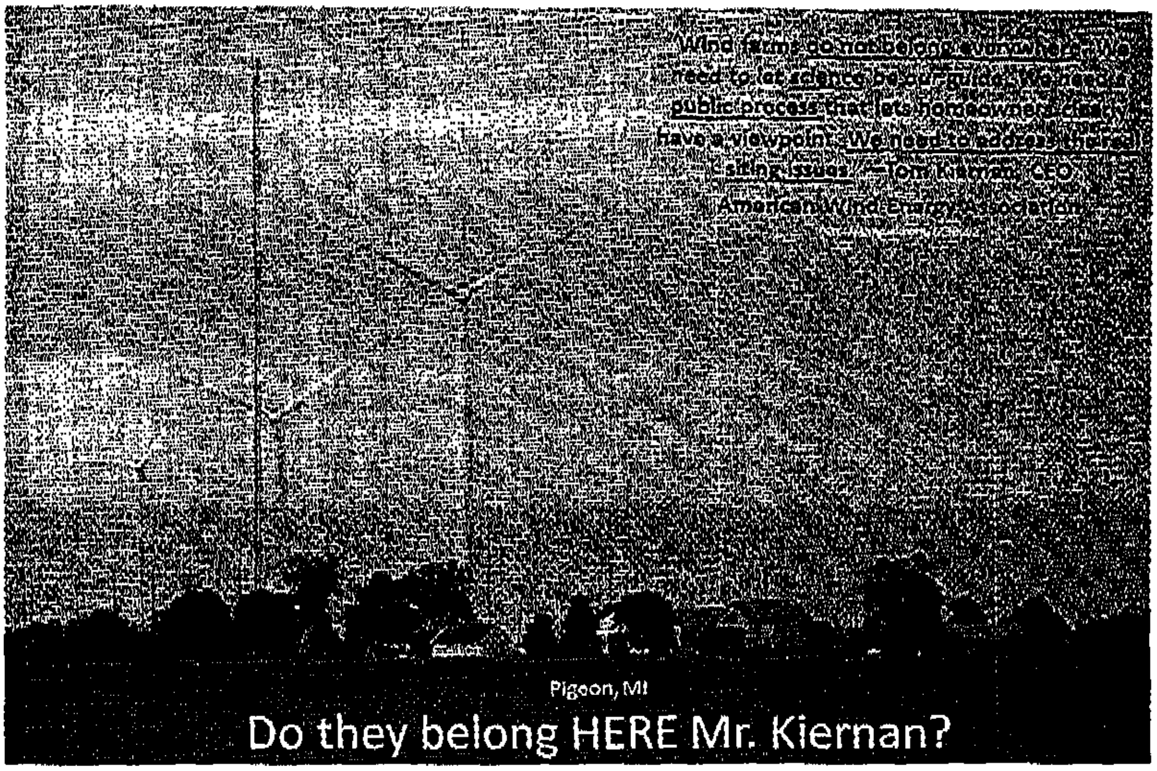
Thank you,
Valeri Malicki MA, LPCC

CC: OPSB members
All legislators possible!

This is your brain when you live next to a "wind park"!



Brain


Pigeon, MI
Do they belong HERE Mr. Kiernan?

13

I am a physician and scientist: my expertise lies in clinical and environmental matters. Whether or not wind proves to be a viable source of power, it is absolutely essential that windmills not be sited any closer than 1.25 miles (2 km) from people's homes or anywhere else people regularly congregate. (Highways are also a problem for motorists with seizure and migraine disorders and motion sensitivity, from the huge spinning blades and landscape-sweeping shadow flicker.)

I consider a 1.25 mile set-back a minimum figure. In hilly or mountainous topographies, where valleys act as natural channels for noise, this 1.25 mile set-back should be extended anywhere from 2-3 miles from homes.

Let me be clear. There is nothing, absolutely nothing, in the wind energy proposition that says windmills must be sited next door to people's homes. Siting, after all, is the crux of the issue.

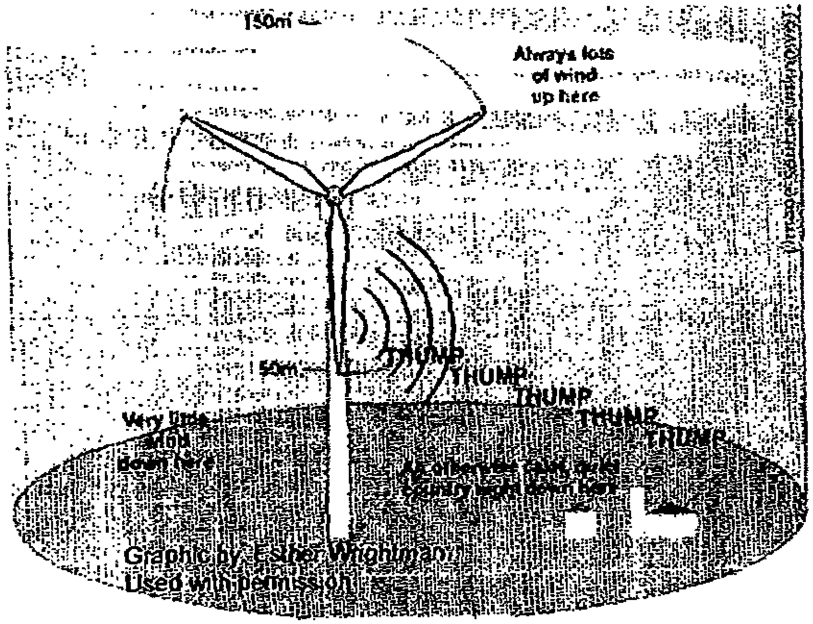
Irresponsible siting is what most of the uproar is about. Corporate economics favors building wind turbines in people's backyards; sound clinical medicine, however, does not.

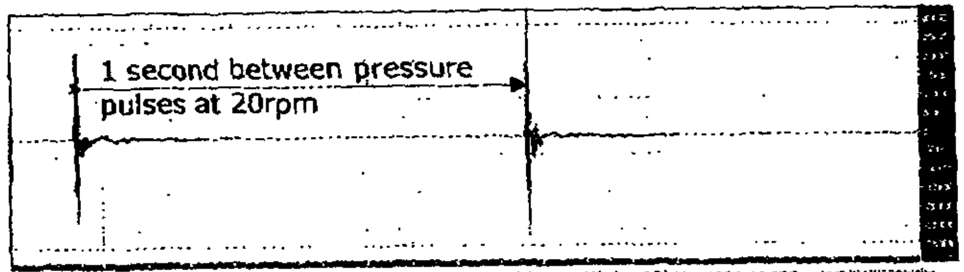
Nina Pierpont, MD, PhD
Fellow of the American Academy of Pediatrics

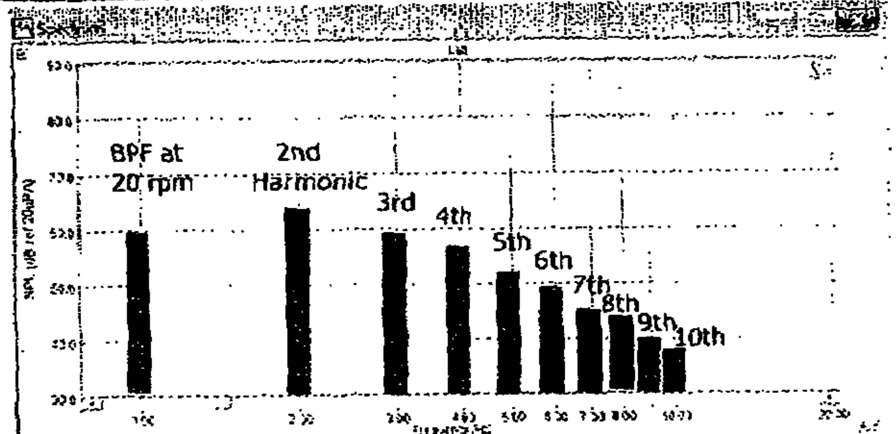
Greenwich Windpark

The Truth About Wind Power

	The Rhetoric	The Reality
Consumer Prices	Wind energy is expensive and costs *more than other sources of electricity.*	Wind power is the lowest cost of new generation; twenty year power contracts provide long-term level power costs. No fuel cost; no fuel transportation costs. Aging coal fleet is being decommissioned; will impact consumer prices upward.
Reliability	Wind is intermittent; therefore, it threatens the reliability of the electric grid.	Grid operators already rely on wind power and successfully integrate it in large amounts across the US power grid. Over 60,000 MW of wind energy is currently *on the US grid (roughly powers 45,000,000 homes).*
Sound	The sound of operating wind turbines *causes a variety of health effects,* including dizziness, headaches, and loss of sleep.	Independent studies conducted *worldwide* have *consistently found that wind farms have no direct impact* on physical health. Sound levels are modeled during development to avoid post-operational issues.
Shadow Flicker	The shadows of rotating wind turbines are bothersome and cause negative health effects.	*Shadow flicker is predictable* and is based on the sun's angle, turbine location, and the distance to an observer. Flicker is modeled during development to minimize and mitigation measures are available.
Fire	Turbines often catch fire and when they do they *send flaming shards into* fields and forests.	A wind turbine fire is a very rare event. Turbines are *closely monitored 24/7 for any operating inconsistencies.* Extensive precautions are taken, including emergency & first responder training.
[illegible] & Land Use	Wind takes too much land to make much of the nation's energy.	Wind energy accounted for 42% of all new energy installation in 2012. The project area may appear to spread across a large area, however, the infrastructure requires little land. Wind energy is compatible with agricultural activities; farmers can plant up to the turbine base and livestock enjoy the shade in summer.
Property Values	Wind farms hurt property values.	Studies have found that wind facilities do not affect long-term property values. Wind drives community economic development that benefits all property owners through *the tax revenues paid annually.*
Emissions	*Wind power does not reduce carbon and may even contribute to climate* change.	*Wind power* has no carbon emissions and emits no *pollutants or greenhouse gases. Wind power does not use* any water and does not contribute to water contamination. No energy expended to extract fuel.
Old Turbines	Old turbines are left abandoned.	History shows that old turbines are repowered with newer technology. Current wind practices require a bond be posted to protect landowners and community; in addition, turbines have a high salvage value.
Energy Incentives	*Renewable energy is subsidized at* higher rates than fossil fuels	Fossil fuels received about five times more in subsidies than renewable energy. Wind's primary incentive is the Product Tax Credit, *a performance based incentive.*
Wildlife	Wind turbines are killing birds, bats and eagles at an alarming rate.	Wind generates electricity without many of the environmental impacts associated with other energy *sources and is supported by wildlife agencies. Newer siting requirements and techniques continue to reduce* wildlife impacts.







As the blade passes the tower, the low frequency noise and infrasound is generated at a frequency related to the hub's rotation and number of blades. These pressure pulsations appear as tones during analysis but are not heard as tones by most people. Instead they may feel the pressure changes as pulsations, internal organ vibrations, or as a pain (like ear aches or migraines).

This frequency is called the Blade Pass Frequency often abbreviated as BPF.

For modern utility scale wind turbines this frequency is at 1 Hz or lower. A three bladed wind turbine with a hub rotation of 20 revolutions per minute (rpm) has a BPF of 1Hz. This means there is a pressure pulsation emitted into the community once every second. At 15 rpm the BPF is 0.75 Hz and at 10 rpm, 0.5 Hz.

When wind turbine blades rotate past the tower a a short pressure pulse (top graphic) occurs producing a burst of infrasound.

When analyzed the result is a well defined array of tonal harmonics below 10 Hz.

(red bars in figure above)

For impulsive sound of this type the harmonics are all "phase-correlated." This means the peaks of each occur at the same time. Thus, the peaks add together in a linear fashion with their individual maximum sound pressures all coinciding.

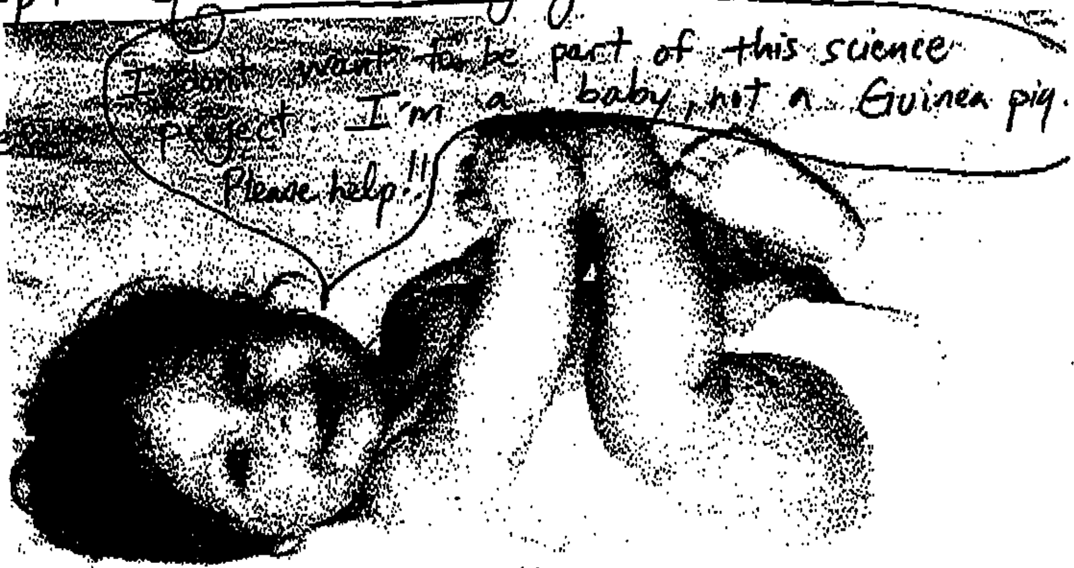
Thus, for an impulse having 4 equal amplitude harmonics (BPF, 2nd, 3rd and 4th) each of the same amplitude, the peak level is +12 dB.

10 equal harmonics would produce a peak level of +20 dB.

Rick James
acoustic engineer
rickjames@e-coustic.com

<This is referencing case #13-0990-EL-BGN.>
(Greenwich Industrial Wind Turbines, 717 ft. from my home.)

Please see the enclosed document. People have felt the acoustic & vibration measurements inside & outside their homes, & this has been in science journals since the late 70's & early 80's as in this article from the U.S. Dept of Energy.



"Strong resonances found in the acoustic pressure field .... resulting in sensation of whole-body vibration."
(Solar Energy Research Institute)

Violet Malicki,
9th generation Huron Co., Ohio resident.
2373 Alph Rd, Greenwich OH 44837

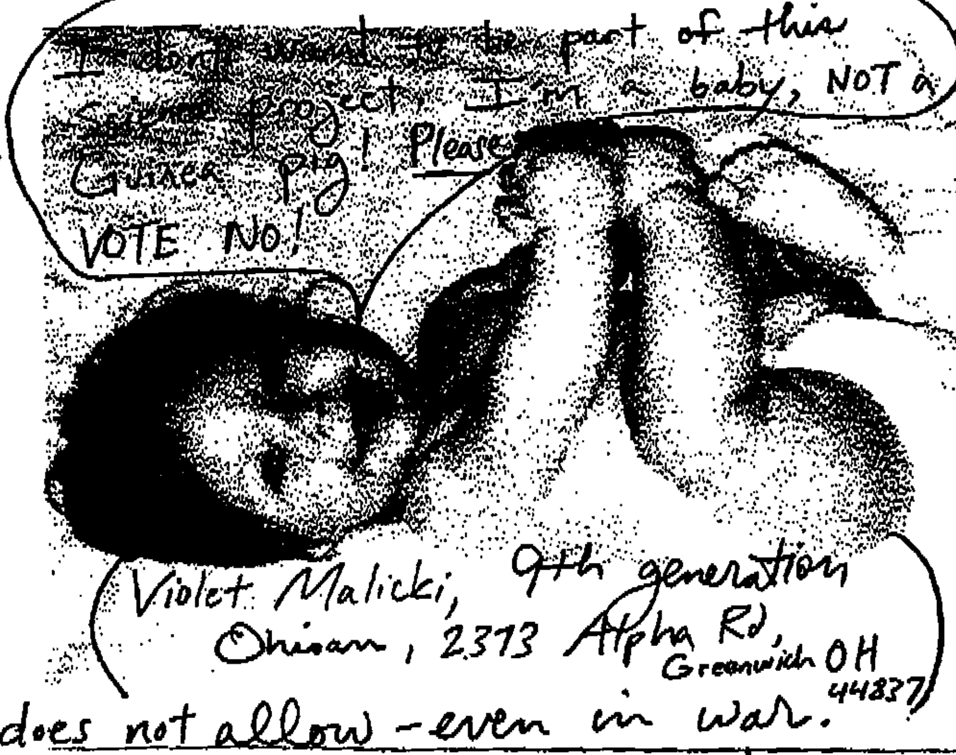
Please do NOT sacrifice my innocent sweet body on the alter of corporate greed, lies, "green" energy, and political agendas. I am a baby. —Violet Malicki

Dear OPSB, [Ref case #13-0990-EL-BGN] (cover page)
Aug. 14, 2014

"Please help me! Please protect my innocent brain and body and life and future." -Violet Malicki

Infrasound Low-Frequency Noise (ILFN) Emissions for the Greenwich Industrial Turbine Power Station are not regulated; ILFN is NOT addressed in the Staff Report; and Windlab refuses to answer questions about the ILFN (even after lying to my face & promising they would!)

ILFN destroys lives, thousands around the world have suffered, mainly sleep deprivation, a form of TORTURE the UN Council does not allow - even in war.



Violet Malicki, 9th generation Ohioan, 2373 Alpha Rd, Greenwich OH 44837

P.S.S. setback minimum, Sophia's pic enclosed

PS. MUCH more info in the public docket - please review with scrutiny!

Please do not allow my baby to be tortured.

Please deny the certificate.

(FROM: Russell, Valerie, Rosie & Violet)

(cc: all members of the OPSB)

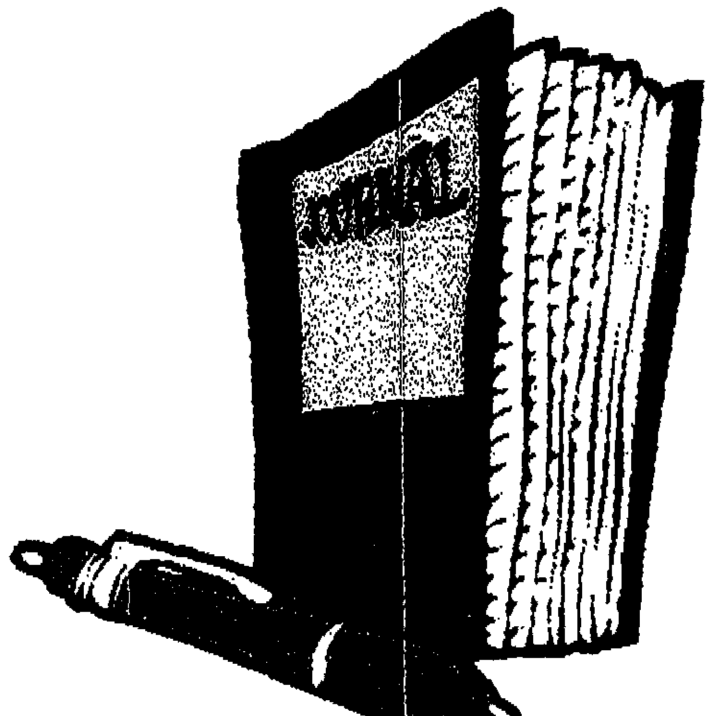
Sincerely,
Valerie Malicki MA, LPCC
[illegible]

(2)

windturbinesyndrome.com
http://www.windturbinesyndrome.com/2013/wind-turbine-syndrome-was-being-documented-in-science-journals-in-the-late-70s-early-80s-u-s-dept-of-energy/

Wind Turbine Syndrome was being documented in science journals in the late 70s, early 80s (U.S. Dept. of Energy)

Editor's note: Read this article—or skim it, with attention to the highlighted passages—to discover why the corrupt bastards with PhD's and MD's, who argue for the hilarious "nocebo effect" as the cause of Wind Turbine Syndrome, ought to be horsewhipped.



For it turns out that researchers were reporting and analyzing WTS decades ago, in the late 1970s and early 1980s—because the poor saps living within 3 km of wind turbines were complaining of the same symptoms away back then!

Horsewhipped or tarred and feathered? And definitely stripped of their professional credentials!

Dear OPSB,

Infrasound Low-Frequency Noise is NOT a part of "The Staff Report" yet is the main source of harm to humans reported by thousands around the world 3km - 10km from these massive Industrial Wind Turbines. Yet another reason to DENY this Certificate.

Sincerely,

(3)

Compare to Pierpont et al.

acoustic and vibration measurements inside and outside of their homes during turbine operations. In addition to the physical measurements, we visited many of the other complaining families and received a description of the annoying sounds. In summary, the complaints centered on the following perceptions:

(*i*) the annoyance was described as a periodic "thumping" sound accompanied by vibrations;

(*ii*) many persons reported they could "feel" more than hear the sounds;

(*iii*) the sounds were louder and more annoying inside their homes than out; and

(*iv*) some experienced the rattle of a loose glass in picture frames mounted on outside walls and small objects such as

114 / Vol. 104, MAY 1982

Aug 14, 2014

Dear OPSB,

Please deny the certificate! Protect our kids!

FROM: The Malicki's

Russell, Valerie, Rosie & Violet Malicki

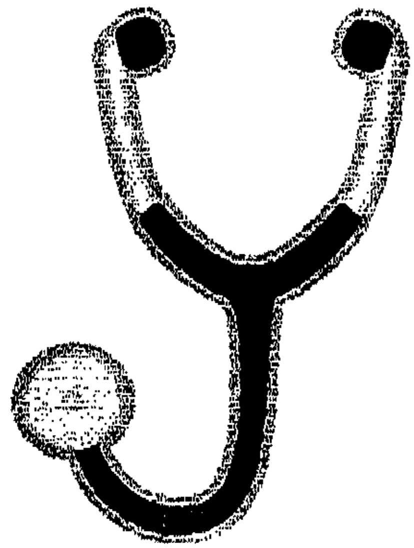
[signature] & Valerie Malicki

Medical doctor sees Wind Turbine Syndrome in his patients (Vermont)

"Wind Turbine Noise & Adverse Health Effects"

Testimony before the Vermont Public Service Board (PSB) 7/29/14

by Sandy Reider, MD



My name is Sandy Reider. I am a primary care physician in Lyndonville, and I have been practicing clinical medicine in Vermont since I received my license in 1971. [Dr. Reider is a graduate of the Harvard University School of Medicine — *Editor.*]

In the interest of full disclosure, I am not being paid for involvement in this issue, nor did I seek this out; rather, it found me by way of a patient I had known well for several years, and who, in late 2011, suddenly developed severe insomnia, anxiety, headaches, ringing ears, difficulty concentrating, and frequent nausea, seemingly out of the blue. This puzzled us both for a few months before we finally came to understand that he suffered from what was, then, a relatively new clinical entity known as "wind turbine syndrome", related in his particular case to the comparatively small NPS 100 KW turbine that began generating power atop Burke Mountain in the fall of 2011.

In the course of the 2012 legislative session, I described this patient in detail in testimony for the Senate Natural Resources and Health Care Committees, as well as the Governor's Siting Commission. Since his symptoms were so typical and similar to those described by thousands of other individuals living too close to large wind turbines all over the globe, I have attached my testimony for the Senate Health Care Committee and encourage you to review it for its very characteristic description of what it is that this board, I trust, hopes to mitigate by recommending more protective sound standards for those industrial wind installations.

I should add that I have seen 4 additional patients living close to the large Sheffield and Lowell projects, as well as an individual living near another single NPS 100KW turbine in Vergennes. All presented with similar, though not identical, symptoms to those described in my testimony.

That there have already been so many complaints here in Vermont related to wind turbines suggests that the current noise standards may be inadequate. Either the utilities have been regularly out of compliance with the current existing standards (Shirley Nelson's detailed daily records suggest this has indeed occurred with some regularity) and/or that the scientific data and studies upon which the current noise standards are based is incomplete, or possibly just plain wrong.

Over the past 2 years I have reviewed much of the relevant scientific literature, and out of my 42 years of experience and perspective as a clinician, respectfully offer the following observations and comments.

Firstly, I do not doubt at all that these large turbines can and do cause serious health problems in a significant number of persons living nearby, even though the vibrational-acoustic mechanisms behind this harm are not yet completely understood (1,5). Repetitive sleep disruption is the most often cited adverse effect, and disturbed sleep and its resulting stress over time is known to cause or exacerbate cardiovascular illnesses (2,), chronic anxiety and depression, as well as worsening of other pre-existing medical problems. This is especially concerning for the most vulnerable among us — children, the elderly, those who are naturally sensitive to sound, or prone to motion sickness or migraine headaches, and, as mentioned, those who are unwell to start with.

The position adopted by developers of large industrial wind projects, and thus far supported by regulatory and health agencies, has been that there is no evidence of a direct effect on health from wind turbines; rather, that the claimed adverse health effects are indirect, due mainly to the individual's negative attitude about the wind turbines (so-called "nocebo" effect), and therefore it is their fault, it's all in their heads, and so on. Not only is this incorrect, it is disingenuous. There is simply no clinical justification for ignoring harm being done to individuals and communities, whether direct or indirect, on these grounds — simply put, harm is harm, whatever the mechanism.

However, good evidence for direct adverse effects has existed since the mid 80's when Neil Kelley headed a group of researchers, under the auspices of the US Department of Energy and NASA, and found conclusive evidence that adverse effects, very similar to those that describe "wind turbine syndrome" were due primarily to very low frequency sound and inaudible infrasound (6). This role of infrasound was subsequently confirmed by Kelley's team under controlled laboratory conditions, and resulted in a complete redesign of turbines from the downwind trestle-mounted turbines to today's upwind turbine on a single massive tower. Furthermore, he recommended protective maximum levels of this low frequency sound.

> *The joint radiation levels (expressed in terms of acoustic intensity and measured external to a structure) in the 8, 16, 31.5 and 63 Hz standard (ISO) octaves should not exceed band intensity threshold limits of 60, 50, 40 and 40 dB (re 1 pWm −2) more than 20% of the time. These figures compare favorably with a summary of low-frequency annoyance situations by Hubbard.*

(It is worth noting that very often infrasound levels are higher inside a building than outside, the structure acting as a resonating chamber and amplifying the lower "vibration" frequencies. Thus measurements for low frequency sound should be made inside the structure as well as outside. Also, low frequency sound levels are not only building design and geometry specific, but also site specific, especially in a place like Vermont where the topography and climactic conditions are so variable. There may be unacceptable indoor infrasound levels in one home, while another home over the hill may have undetectable or very low levels.)

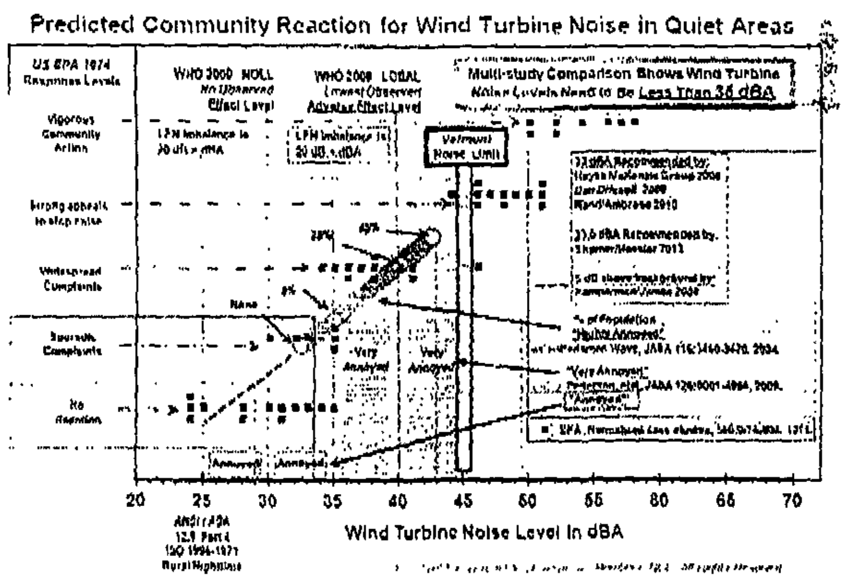
The wind industry's assertion that the Kelley study is irrelevant and that infrasound levels are negligible with the current, newer turbine design and may be ignored is unfounded, and more recent evidence confirms this. (See the 2012 Falmouth study by Ambrose and Rand, Bob Thorne's excellent quality of life study in 2011 [12], Steven Cooper's preliminary results in Australia, final results due in September 2014 [11]; and others.)

The aforementioned studies were performed by independent professional acousticians not connected to the wind industry. Incidentally, the severely affected patient described in my 2012 testimony never did perceive any audible noise from the turbine (and this is quite typical, the sound is more felt than heard), nor did he harbor any feelings pro or con about the installation when his problems began though after he understood the source of his ill-health, I have no doubt that the "nocebo" effect may have added to his stress, adding insult to injury. He has since abandoned that home, and is once again sleeping soundly and feeling well.

The current sound standards, based as they are on dBA weighted acoustic measurements, gives particular weight to audible frequencies in the soundscape, but very little or no weight to low sound frequencies and infrasound, particularly below 10 Hz, which comprises a significant proportion of the sound generated by large turbines. People do not hear dBA, they hear qualitatively different sounds, birds, insects, running water, wind in the trees, etc. Basing noise criteria solely on this single number ignores the unique nature of the sound produced by large wind turbines, with its constantly changing loudness, frequency, harmonics, pitch, and impulsive quality.

It is precisely these qualities that make the sound feel so intrusive and annoying, especially in quiet rural environments where these projects are usually located (12). Parenthetically, the word "annoying" is somewhat misleading, as it implies a minor, temporary, or occasional nuisance that perhaps might be mostly ignored, rather than what it is, a repetitive stressor that can degrade one's short and long term health and well being, and from which there is no escape over the lifetime of the project short of having to abandon one's home.

It is worth repeating here that the current Public Service Board threshold of 45 dBA of audible sound, averaged over an hour, *has never been proven safe or protective*, and that most studies agree that audible sound should not exceed 35 dBA, or 5dBA above normal background sound levels. *(This is especially important in rural areas where background noise is minimal.) The level should be a maximum, not an hourly average. Above 35 dBA there are likely to be significantly more complaints, particularly difficulty sleeping*



Before concluding, I would like to emphasize that the bulk of scientific evidence for adverse health effects due to industrial wind installations comes in the form of thousands of case reports like the patient I described. One or two sporadic anecdotal cases can legitimately be viewed with a wait-and-see skepticism, but not thousands where the symptoms are so similar, along with the ease of observing exposure and measuring outcomes, wherever these projects have been built. I agree with Epidemiologist Carl Phillips, who opined that "these case reports taken together offer the most compelling scientific evidence of serious harm. Just because the prevailing models have failed to explain observed adverse health effects does not mean they do not exist", and, as he succinctly though in my opinion a bit too harshly concluded: "The attempts to deny the evidence cannot be seen as honest scientific disagreement and represent either gross incompetence or intentional bias" (13)

I am aware that the members of the PSB bear a heavy responsibility for Vermont's overall energy future and have many other issues on their plate besides this one. Rather than presenting you with a long list of literature references, most of which would likely go unread (but they are included just in case), I recommend a careful review of just one study in particular: Bob Thorne, a professional acoustician in Australia, presented an excellent and well thought out clinical study to the Australian Senate in 2011 (12). It really does cover the waterfront, including WHO quality of life measures, audible and infrasound measurements, and health measures, in a balanced and scientific way. For your convenience there is a hard copy of this study included with my presentation today.

His comprehensive (including the full sound spectrum, not only dBA weighted sound) and protective recommendations for sound criteria are reasonable, and if adopted, would be likely more acceptable to neighboring households and communities. However, given that wind developers are these days building bigger turbines atop taller towers in order to maximize power generation and profits, adoption of these safer limits would necessitate siting the installations farther from dwellings. A 1-2 km setback is not nearly sufficient; significant low frequency sound pressure measurements have been recorded in homes 3-6 miles from large projects in Australia.

- *The outcomes of the study are concerned with the potential for adverse health effects due to wind farm modified audible and low frequency sound and infrasound. The study confirms that the logging of sound levels without a detailed knowledge of what the sound levels relate to renders the data uncertain in nature and content. Observation is needed to confirm the character of the sound being recorded. Sound recordings are needed to confirm the character of the sound being recorded.*

  The measures of wind turbine noise exposure that the study has identified as being acoustical markers for excessive noise and known risk of serious harm to health (significant adverse health effects):

  (1) Criterion. An LAeq or 'F' sound level of 32 dB(A) or above over any 10 minute interval, outside;
  (2) Criterion: An LAeq or 'F' sound level of 22 dB(A) or above over any 10 minute interval inside a dwelling with windows open or closed.
  (3) Criterion: Measured sound levels shall not exhibit unreasonable or excessive modulation ('fluctuation')
  (4) Criterion. An audible sound level is modulating when measured by the A-weighted LAeq or 'F' time-weighting at 8 to 10 discrete samples/second and (a) the amplitude of peak to trough variation or (b) if the third octave or narrow band characteristics exhibit a peak to trough variation that exceeds the following criteria on a regularly varying basis: 2dB exceedance is negligible, 4dB exceedance is unreasonable and 6dB exceedance is excessive.
  (5) Criterion. A low frequency sound and infrasound is modulating when measured by the Z-weighted LZeq or 'F' time-weighting at 8 to 10 discrete samples/second and (a) the amplitude of peak to trough variation or (b) if the third octave or narrow band characteristics exhibit a peak to trough variation that exceeds the following criteria on a regularly varying basis. 2dB exceedance is negligible, 4dB exceedance is unreasonable and 6dB exceedance is excessive
  (6) Definitions. 'LAeq' means the A-weighted equivalent-continuous sound pressure level [18]; 'F' time-weighting has the meaning under IEC 61672 1 and [18]; "regularly varying" is where the sound exceeds the criterion for 10% or more of the measurement time interval [18] of 10 minutes; and Z weighting has the meaning under AS IEC 61672 1 with a lower limit of 0 5Hz
  (7) Approval authorities and regulators should set wind farm noise compliance levels at least 5 dB(A) below the sound levels in criterion (1) and criterion (2) above. The compliance levels then become the criteria for unreasonable noise.

  Measures (1-6) above are appropriate for a 'noise' assessment by visual display and level comparison. Investigation of health effects and the complex nature of wind turbine noise require the more detailed perceptual measures of sound character such as audibility, loudness fluctuation strength, and dissonance.

To exclude careful independent well-designed case studies like Thorne's (and others) in a review of the scientific literature that purports to be thorough is, I repeat, a serious omission and is not "scientific". Careful consideration of these independent well done studies, if nothing else, should encourage regulatory agencies to adopt a much more precautionary approach to the siting of today's very big industrial wind projects in order to adequately protect public health.

For better or worse, in today's "information age" we are perhaps too fascinated by computers and mountains of data, but truth is truth, wherever you find it, even in small places.

Contact:

Sandy Reider, MD
PO Box 10
East Burke, VT 05832
(802) 626-6007
sandyreider@yahoo.com

*Many thanks to Dr. Sarah Laurie, CEO of the Waubra Foundation, for her tireless work, and generosity in sharing so much information

1. Pierpont, N 2009 from the executive summary of her peer-reviewed study, http://waubrafoundation.org.au/resources/wind-turbine-syndrome-executive-summary/

2. Cappuccio et al 2011 "Sleep Duration predicts cardiovascular outcomes: a systemic review and meta-analysis of prospective studies" *European Heart Journal*, (2011) 32, 1484–1492 http://waubrafoundation.org.au/resources/sleep-duration-predicts-cardiovascular-outcomes/

3. Nissenbaum, M Hanning, C and Aramini J 2012 "Effects of industrial wind turbines on sleep and health" *Noise and Health*, October 2012

4. Shepherd, D et al 2011 "Evaluating the impact of wind turbine noise on health related quality of life" *Noise and Health*, October 2011 http://waubrafoundation.org.au/resources/evaluating-impact-wind-turbine-noise-health-related-quality-life/

5. Arra, M & Lynn H 2013 Powerpoint presentation to the Grey Bruce Health Unit, Ontario, "Association between Wind Turbine Noise and Human Distress" http://waubrafoundation.org.au/resources/association-between-wind-turbine-noise-and-human-distress/

6. "Acoustic noise associated with Mod 1 Turbine, its impact and control" http://waubrafoundation.org.au/resources/kelley-et-al-1985-acoustic-noise-associated-with-mod-1-wind-turbine/

7. James, R 2012 "Wind Turbine Infra and Low Frequency Sound: Warning Signs That Were Unheard" *Bulletin of Science Technology and Society* 32(2) 108 - 127, accessed via Professor Colin Hansen's submission to the Australian Federal Senate Inquiry Excessive Noise from Windfarms Bill (Renewable Energy Act) November 2012 http://waubrafoundation.org.au/resources/testimony-hansen-excessive-noise-bill-inquiry-submission/ James references another useful bibliography of references of the early NASA research, compiled by Hubbard & Shepherd 1988 "Wind Turbine Acoustic Research Bibliography with selected Annotation" http://waubrafoundation.org.au/resources/hubbard-h-shepherd-k-nasa-wind-turbine-acoustics-research/

8. Hubbard, H 1982 "Noise induced house vibrations and Human Perception" http://waubrafoundation.org.au/resources/hubbard-h-1982-noise-induced-house-vibrations-human-perception/

9. Ambrose, Stephen and Rand, Robert 2011 "Bruce McPherson Infrasound and Low Frequency Noise Study" http://waubrafoundation.org.au/resources/bruce-mcpherson-infrasound-low-frequency-noise-study/

10. http://waubrafoundation.org.au/resources/schomer-et-al-wind-turbine-noise-conference-denver-august-2013/

11. http://waubrafoundation.org.au/2014/pacific-hydro-commended-initiating-wind-turbine-noise-acoustic-survey/

12. http://waubrafoundation.org.au/resources/wind-farm-generated-noise-and-adverse-health-effects/

13. "Properly interpreting the Epidemiological evidence about the health effects of Industrial Wind turbines on nearby residents" *Bulletin of Science, Technology and Society* vol 31 No 4 (August 2011) pp 303–315 http://waubrafoundation.org.au/resources/properly-interpreting-epidemiologic-evidence-about-health-effects/

See Bob Thorne, "The Problems with 'Noise Numbers' for Wind Farm Noise Assessment," *Bulletin of Science, Technology & Society* 2011 31 262 DOI 10.1177/0270467611412557, http://bst.sagepub.com/content/31/4/262

NINA PIERPONT M.D. PH.D.

June 30, 2014

Ms. Esen Fatma Kabadayi-Whiting
Cesme Belediyesi (Municipality)
İnönü Mah. 2001 Sk. No: 2 Çeşme / İZMİR
Turkey

Dear Ms. Kabadayi-Whiting,

I write to you at the request of Madeleine Kura, who tells me the charming, historical town of Cesme is about to have half a dozen 3 MW industrial wind turbines built on the edge of town, a mere 500 m from people's homes. (I'm told that at least one of the turbines will be 300 m from a school.) Furthermore, all this construction will be in hilly terrain.

Let me explain, clinically, why this is a bad idea. In 2009 I published what was then the definitive study of health effects caused by wind turbine infrasound on people living within 2 km of industrial turbines. The book, "Wind Turbine Syndrome: A Report on a Natural Experiment" (K-Selected Books), included 60 pages of raw data in the form of case histories (using case cross-over studies), demonstrating that living in proximity to wind turbines dys-regulates the inner ear vestibular organs controlling balance, position, and spatial awareness. Effectively, sufferers experience symptoms of sea-sickness, along with several related pathologies.

It turns out all this has been well known since the 1980s, when the US Department of Energy commissioned a report on wind turbine health effects — the report subsequently published by physicist Dr. N D Kelley and his colleagues at the Solar Research Institute in Golden, Colorado, bearing the title, "A Methodology for Assessment of Wind Turbine Noise Generation," *Transactions of the American Society of Mechanical Engineers*, v. 104 (May 1982), pp. 112-120.

> In this paper we have presented evidence to support the hypothesis that one of the major causal agents responsible for the annoyance of nearby residents by wind turbine noise is the excitation of highly resonant structural and air volume modes by the coherent, low-frequency sound radiated by large wind turbines.

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> *Further, there is evidence that the strong resonances found in the acoustic pressure field within rooms [in people's homes] . . . indicates a coupling of sub-audible energy [infrasound] to human body resonances at 5, 12, and 17 25 Hz, resulting in a sensation of whole-body vibration* (p. 120).

I discovered the same thing in my research. What Kelly et al. refer to as a "sensation of whole body vibration," I refer to as Visceral Vibratory Vestibular Disturbance (VVVD): "The internal quivering, vibration, or pulsation and the associated complex of agitation, anxiety, alarm, irritability, tachycardia, nausea, and sleep disturbance together make up what I refer to as Visceral Vibratory Vestibular Disturbance (VVVD)" ("Wind Turbine Syndrome," p. 59).

Five years later, Dr. Kelley gave a follow up paper at the Windpower '87 Conference & Exposition in San Francisco, titled "A Proposed Metric for Assessing the Potential of Community Annoyance from Wind Turbine Low-Frequency Noise Emissions." Just so *you understand the terminology, "emissions" means "noise & vibration." And the term* "low frequency" includes infrasound. And the antiseptic phrase "community annoyance" is code for Wind Turbine Syndrome — except the name had not been coined in1987. (I created it decades later.) Kelley's research once again had been funded by the US Department of Energy, Contract No. DE-AC02-83CH10093.

> We electronically simulated three interior environments resulting from low-frequency acoustical loads radiated from both individual turbines and groups of upwind and downwind turbines. . . .
>
> Experience with wind turbines has shown that it is possible . . . for low-frequency acoustic noise radiated from the turbine rotor to interact with residential structures of nearby communities and annoy the occupants.
>
> The modern wind turbine radiates its *peak* sound power (energy) in the very low frequency range, typically between 1 and 10 Hz [i.e., infrasound]. . . .
>
> Our experience with the low-frequency noise emissions from a single, 2 MW MOD-1 wind turbine demonstrated that . . . it was possible to cause annoyance within homes in the surrounding community with relatively low levels of LF-range [low frequency range] acoustic noise. An extensive investigation of the MOD-1 situation revealed that this annoyance was the result of a coupling of the turbine's impulsive low-frequency acoustic energy into the structures of some of the surrounding homes. This often created an annoyance environment that was frequently confined to *within the home itself* (p. 1, emphasis in original).

I am attaching a copy of Kelley's 1987 paper.

Besides my research, which pretty much duplicates Kelley's, there is the work of Dr. Alec Salt, Professor of Otolaryngology in the School of Medicine at Washington University (St. Louis, Missouri), where he is director of the Cochlear Fluids Research Laboratory.

Professor Salt is a highly respected neuro-physiologist specializing in inner ear disorders and in particular the mysteries of the cochlea.

Prof. Salt's research dovetails with mine and with Dr. Kelley's. For many years, acousticians and noise engineers have vigorously maintained that "if you can't hear it, it can't hurt you." That is to say *in the case of wind turbines, "If you can't hear the low frequency noise in the infrasound range, it can't hurt you."* (Infrasound, by definition, is noise below the hearing threshold, typically pegged at 20 Hz and lower. People feel infrasound in various parts of the body, though typically they cannot hear it.) In any case, Professor Salt and his colleagues have demonstrated conclusively, definitively, that infrasound does in fact disturb the very fine hair cells of the cochlea.

With this discovery, one of the main arguments advanced by the wind energy industry namely, that wind turbine infrasound was too low to be harmful to people, since they could not hear it — was demolished. Prof. Salt has proven that, "If you can't hear it, it <u>can</u> still harm you."

This past winter, Professor Salt and his colleague, Professor Lichtenhan, published "How Does Wind Turbine Noise Affect People?" *Acoustics Today*, v. 10 (Winter 2014), pp. 20-28. The following is a lengthy excerpt:

> The essence of the current debate is that on one hand you have the well-funded wind industry (1) advocating that infrasound be ignored because the measured levels are below the threshold of human hearing, allowing noise levels to be adequately documented through A-weighted sound measurements; (2) dismissing the possibility that *any variants of wind turbine syndrome exist (Pierpont 2009) even when physicians (e.g., Steven D. Rauch, M.D. at Harvard Medical School)* cannot otherwise explain some patients' symptoms; and (3) arguing that it is unnecessary to separate wind turbines and homes based on prevailing sound levels.
>
> On the other hand, you have many people who claim to be so distressed by the effects of wind turbine noise that they cannot tolerate living in their homes. Some move away, either at financial loss or bought-out by the turbine operators. Others live with the discomfort, often requiring medical therapies to deal with their symptoms. Some, even members of the same family, may be unaffected. Below is a description of the disturbance experienced by a woman in Europe *we received a few weeks ago as part of an unsolicited e-mail.*
>
>> *From the moment that the turbines began working, I experienced vertigo-like symptoms on an ongoing basis. In many respects, what I am experiencing now is actually worse than the 'dizziness' I have previously experienced, as the associated nausea is much more intense. For me the pulsating, humming, noise that the turbines emit is the predominant sound that I hear and that really seems to affect me.*
>>
>> *While the Chief Scientist [the person who came to take sound measurements in her house] undertaking the measurement informed me that he was aware of the low frequency hum the turbines produced (he lives close to a wind farm himself, and had recorded the humming noise levels indoors in his own home) he advised that I could tune this noise out and that any adverse symptoms I was experiencing were simply psychosomatic. . . .*

> Given the knowledge that the ear responds to low frequency sounds and infrasound, we knew that comparisons with benign sources were invalid and the logic to A-weight sound *measurements* was deeply flawed scientifically. . . .
>
> From this understanding we conclude that very low frequency sounds and infrasound, at levels well below those that are heard, readily stimulate the cochlea. Low frequency sounds and infrasound from wind turbines can therefore stimulate the ear at levels well below those that are heard . . .
>
> No one has ever evaluated whether tympanostomy tubes alleviate the symptoms of those living near wind turbines. From the patient's perspective, this may be preferable to moving out of their homes or using medical treatments for vertigo, nausea, and/or sleep disturbance. The results of such treatment, whether positive, negative, would likely have considerable scientific influence on the wind turbine noise debate....
>
> Another concern that must be dealt with is the development of wind turbine noise measurements that have clinical relevance. The use of A-weighting must be reassessed as it is based on insensitive, Inner Hair Cell (IHC)-mediated hearing and grossly misrepresents inner ear stimulation generated by the noise. In the scientific domain, A-weighting sound measurements would be unacceptable when many elements of the ear exhibit a higher sensitivity than hearing. The wind industry should be held to the same high standards. Full-spectrum monitoring, which has been adopted in some reports, is essential. . . .
>
> Given the present evidence, it seems risky at best to continue the current gamble that infrasound stimulation of the ear stays confined to the ear and has no other effects on the body. For this to be true, all the mechanisms we have outlined (low frequency-induced amplitude modulation, low frequency sound-induced endolymph volume changes, infrasound stimulation of type II afferent nerves, infrasound exacerbation of noise-induced damage and direct infrasound stimulation of vestibular organs) would have to be insignificant. We know this is highly unlikely and we anticipate novel findings in the coming years that will influence the debate.

I suspect you are beginning to get a clear picture of the problem — and why I'm writing to you.

The typical symptoms of what is now known worldwide as Wind Turbine Syndrome are: sleep disturbance, headache, tinnitus (ringing or buzzing in the ears), ear pressure, dizziness (a general term that includes vertigo, light-headedness, sensation of almost fainting, etc.), nausea, visual blurring, tachycardia (rapid heart rate), irritability, problems with concentration and memory, and panic episodes associated with sensations of internal pulsation or quivering which arise when awake or asleep.

Does everybody living near wind turbines experience Wind Turbine Syndrome? By no means! What I discovered is that people with (a) motion sensitivity, (b) migraine disorder, (c) the elderly (50 years and older), (d) inner ear damage, and (e) autistic children and adults — all these are at statistically significant high risk.

The solution is simple: industrial wind turbines must be set back, well away from people's homes, schools, places of work, and anywhere else people regularly congregate. In my 2009 report, I recommended a minimum setback of 2 km in level terrain. Studies done around the world since then have persuaded me that 2 km is not sufficient, especially in hilly or mountainous terrain - as with Cesme. In Cesme's case, setbacks should be more on the order of 5 km or greater.

Hence my alarm when notified by Ms. Kura that Cesme is considering 500 m (or less) setbacks. This is wholly inadequate. I guarantee that, unless the setbacks are increased substantially, there will be numerous victims of Wind Turbine Syndrome.

There's more. Dr. Salt referred to Dr. Steven Rauch, above. Dr. Rauch, a physician, is the Medical Director of Harvard Medical School's renowned Clinical Balance and Vestibular Center, part of the Massachusetts Eye & Ear Infirmary. Dr. Rauch was recently interviewed by The New Republic:

> Dr. Steven Rauch, an otologist at the Massachusetts Eye and Ear Infirmary and a professor at Harvard Medical School, believes WTS [Wind Turbine Syndrome] is real. Patients who have come to him to discuss WTS suffer from a "very consistent" collection of symptoms, he says. Rauch compares WTS to migraines, adding that people who suffer from migraines are among the most susceptible to turbines. There's no existing test for either condition but "Nobody questions whether or not migraine is real."
>
> "The patients deserve the benefit of the doubt," Rauch says. "It's clear from the documents that come out of the industry that they're trying very hard to suppress the notion of WTS and they've done it in a way that [involves] a lot of blaming the victim" ("Big Wind Is Better Than Big Oil, But Just as Bad at P.R.," by Alex Halperin in *The New Republic*, June 16, 2014).

Dr. Rauch made a similar statement to ABC News last fall.

I met with Dr. Rauch in Cambridge, Mass., several years ago. He has read my "Wind Turbine Syndrome" book. You're welcome to contact him for his clinical opinion. Notice, he actually treats WTS victims, and furthermore his specialty is neuro-otology — precisely the clinical specialty appropriate to WTS, since WTS is mainly a vestibular disorder. (You might consider Dr. Rauch the "pope" of vestibular disease.)

Shifting gears, a group of mechanical engineers at the University of Minnesota recently mapped the airflow turbulence patterns of a 2.5 MW wind turbine. Their technique was ingenious: "A large searchlight with custom reflecting optics generated a two-dimensional light sheet next to the 130 m-tall wind turbine for illuminating the snow particles in a 36 m-wide by 36-m-high area." They literally mapped the vortices being hurled off the turbine blades, using a blizzard (!) as a kind of background screen. Visit this website to see and savor the dramatic results.

http://discover.umn.edu/news/science-technology/new-study-uses-blizzard-measure-wind-turbine-airflow

Click open the video and notice the pulsed pressure waves from the blades — punching holes, *as it were, in the swirling snow. You can watch the video on YouTube:* http://www.youtube.com/watch?v=OHI_0s4qqUY.

Think of volleys of acoustic artillery, much of it in the low frequency and infrasound range. Imagine the residents of Cesme being bombarded by this day and night.

You are looking at the huge, pulsed, sound pressure waves responsible for Wind Turbine Syndrome.

Ms. Kura tells me the turbines destined for Cesme are 3 MW. Several years ago, the noted Danish noise engineer, Professor Henrik Moller at Aalborg University, published a paper titled "*Low-Frequency Noise from Large Wind Turbines,*" *Journal of the Acoustical Society of America*, vol. 129, no. 6 (June 2011), pp. 3727-3744. Moller and his colleague, Christian Sejer Pedersen, demonstrated that "the larger the turbine, the greater the ILFN (infrasound and low frequency noise) produced." The following is the abstract of their paper.

> As wind turbines get larger, worries have emerged that the turbine noise would move down in frequency and that the low-frequency noise would cause annoyance for the neighbors. The noise emission from 48 wind turbines with nominal electric power up to 3.6 MW is *analyzed and discussed.*
>
> The relative amount of low frequency noise is higher for large turbines (2.3-3.6 MW) than for small turbines (2 MW), and the difference is statistically significant. The difference can also be expressed as a downward shift of the spectrum of approximately one-third of an octave.
>
> A further shift of similar size is suggested for future turbines in the 10 MW range.
>
> Due to the air absorption, the higher low-frequency content becomes even more pronounced when sound pressure levels in relevant neighbor distances are considered.
>
> Even when A-weighted levels are considered, a substantial part of the noise is at low frequencies and, for several of the investigated large turbines, the one-third octave band with the highest level is at or below 250 Hz.
>
> It is thus beyond any doubt that the low-frequency part of the spectrum plays an important role in the noise at the neighbors

Given all of the above, you can see why I am concerned for the residents of Cesme.

A final word. The clinical literature, including publications by the World Health Organization on health effects from infrasound exposure, typically use the word that Dr. *Kelley used in his reports to the US Department of Energy — "annoyance." It's really not* an appropriate word. It vastly understates the sickness caused by infrasound exposure.

(A mosquito bite is an annoyance. Wind turbine infrasound, on the other hand, triggers a debilitating cascade of illnesses whose features I enumerated, above.)

In medicine, we clinicians are morally bound to exercise what's called the "precautionary principle." That is, if we don't know for certain that a procedure is harmless, we are obliged to exercise extreme caution in performing the procedure, in this instance building industrial wind turbines — which are well-known to produce impulsive (i.e., amplitude-modulated) infrasound - near people's homes. This is, after all, common sense.

For decades, the wind industry flatly denied their turbines produced infrasound. It took monumental efforts by people like me to debunk this fallacy. Wind industry advocates likewise argued that only downwind turbines created noise, that is, low frequency noise. Dr. Kelley and his research team effectively debunked that falsehood, in the articles referred to above. Finally, the wind industry clung to the fiction that, "If you can't hear it, it can't hurt you." Professor Salt deflated that one.

It's time to recognize that the global wind industry has hidden behind a series of (what turned out to be) falsehoods. Their untruths have been exposed and corrected in the published clinical and scientific literature, as shown above.

There is no excuse for building wind turbines in proximity to people's homes.

Sincerely,

Nina Pierpont

Nina Pierpont, M.D.*, Ph.D.**

*M.D. from The Johns Hopkins University School of Medicine
**Ph.D. from Princeton University in Population Biology/Evolutionary Biology/Ecology
***B.A. (Biology, with honors), Yale University

(4)

Read this article—or skim it, with attention to the highlighted passages—to discover why the corrupt bastards with PhD's and MD's, who argue for the hilarious "nocebo effect" as the cause of Wind Turbine Syndrome, ought to be horsewhipped. For it turns out that researchers were studying WTS decades ago—because the poor saps living within 3 km of wind turbines were complaining of the same symptoms decades ago!

Horsewhipped or tarred and feathered? And definitely stripped of their professional credentials!

—Calvin Luther Martin, PhD, who wonders why wind companies are still allowed to put these goddam machines near people's homes!

A Methodology for Assessment of Wind Turbine Noise Generation

N. D. Kelley

R. R. Hemphill

H. E. Mc Kenna

Solar Energy Research Institute, Golden, Colo. 80401

The detailed analysis of a series of acoustic measurements taken near several large wind turbines (100 kW and above) has identified the maximum acoustic energy as being concentrated in the low-frequency audible and subaudible ranges, usually less than 100 Hz. These measurements have also shown any reported community annoyance associated with turbine operations has often been related to the degree of coherent impulsiveness present and the subsequent harmonic coupling of acoustic energy to residential structures. Thus, one technique to assess the annoyance potential of a given wind turbine design is to develop a method which quantifies this degree of impulsiveness or coherency in the radiated acoustic energy spectrum under a wide range of operating conditions. Experience has also shown the presence of annoying conditions is highly time dependent and nonstationary, and, therefore, any attempts to quantify or at least classify wind turbine designs in terms of their noise annoyance potential must be handled within the proper probabilistic framework. A technique is described which employs multidimensional, joint probability analysis to establish the expected coincidence of acoustic energy levels in a contiguous sequence of octave frequency bands which have been chosen because of their relationship to common structural resonant frequencies in residential buildings. Evidence is presented to justify the choice of these particular bands. Comparisons of the acoustic performance and an estimate of the annoyance potential of several large wind turbine designs using this technique is also discussed.

Introduction

3 km!

Until the fall of 1979, noise from large wind turbines had not been a major concern. The situation changed however as the 2 MW, MOD-1 turbine installed near Boone, North Carolina began to undergo a series of operational tests which resulted in a number of sporadic and totally unexpected noise complaints from a few residents living within 3 km of the installation. Since that time, a considerable effort has been undertaken by a number of organizations who have studied the phenomena to find out the exact nature of the noise responsible for annoying the neighbors, its origin and production mechanism, its propagation path, and what could be done to eliminate or at least reduce it to below perceptible levels. Some of the results of these studies have been reported previously [1].

To date, acoustically-related annoyance from large wind turbines has been confined to a dozen families living within 3 km of the MOD-1. There have been no documented complaints of noise the author is aware of with any of the four MOD-OA turbines currently operating, and two surveys of the MOD-2 turbine have failed to find a tendency for impulsive noise generation similar to the MOD-1 in the measurements taken so far [3, 4]. Some impulsive noise has been detected in a recent survey of the 17-m Darrieus/VAWT [5]. The situation in Boone, however, has been severe enough to warrant a close examination of the details of the MOD-1 experience. The causal factors responsible for the noise had to be identified; this information would then be used to develop a methodology to assess the annoyance potential of other wind turbine designs by measuring their acoustic radiation with reference to the MOD-1 data.

Contributed by the Solar Energy Division and presented at the 5th Biennial Wind Energy Conference and Workshop, Washington, D.C., October 5-7, 1981. Manuscript received by the Solar Energy Division March 4, 1982.

Characteristics of Large Wind Turbine Noise

Figure 1 summarizes the acoustic pressure spectrum associated with large wind turbines and indicates the dominate noise sources as a function of frequency. Not all wind turbines will exhibit the features of the spectrum shown. The ultimate cause of aerodynamically generated sound is the unsteady loading of the blades. The degree of this unsteadiness, for the most part, is responsible for the distribution of acoustic energy across the spectrum of Fig. 1.

Conventional classifications of rotor noise include rotational, broadband or vortex, and impulse noise. Rotational noise is characterized by the large number of discrete frequency bands which are harmonically related to the blade passage frequency. The amplitude of these bands is determined by the sum of the steady load, which is a function of the commanded level of operation of the machine, and the unsteady loading at any moment arising from such sources as inflow turbulence and upstream wakes. Broadband or vortex noise results from the slightly viscous interaction of the unsteady lift and the blade boundary layer and is responsible for such mechanisms as flow separation and tip-and trailing-edge vortex shedding. Broadband noise, which is described as

(5)

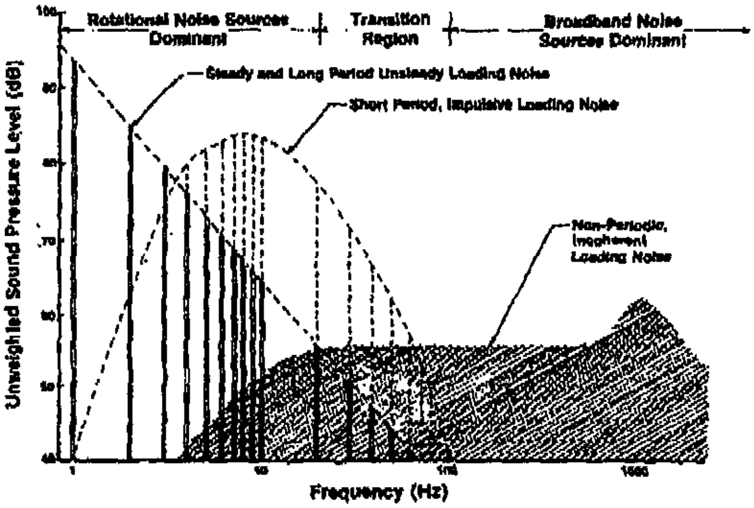

Fig. 1 Schematic representation of wind turbine noise spectrum characteristics

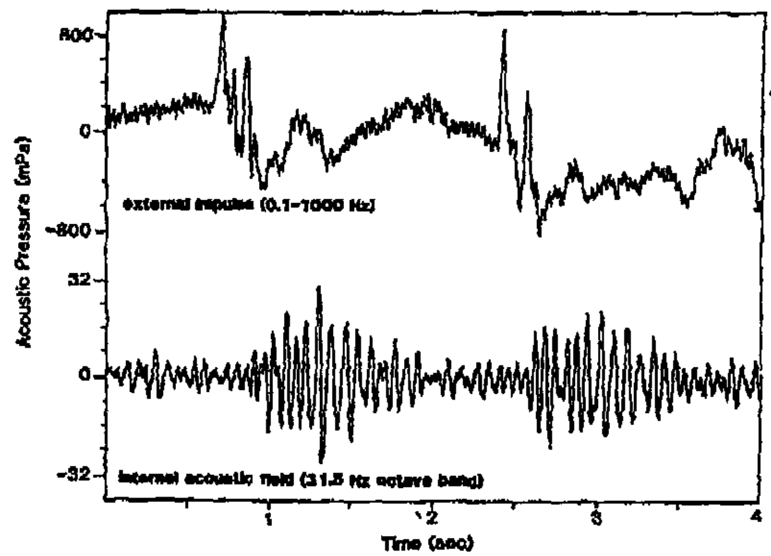

Fig. 2 Pressure-time plots of MOD-1 impulse excitation and internal 31.5 Hz octave band pressure level in house No. 8, Boone, N.C.

the "swishing" sound associated with the turbine operation, is characterized by largely incoherent radiation over a wide frequency range with a spectral "hump" sometimes found at relatively high frequencies. Recent measurements of the MOD-2 turbine have found just such a "hump" in the region shown in Fig. 1 [4]. Impulsive noise, such as has been found with the MOD-1, is identified with short, transient fluctuations in the radiated acoustic field which can contain considerable energy. The dashed lines in the region transcending the rotational and broadband regions of the spectrum in Fig. 1 are indicative of impulsive behavior and reflect the very large number of harmonics necessary to describe the blade loading spectrum which are the sources of the radiation. Impulsive noise tends to be the most annoying because it dominates all other sources due to a high degree of coherence and radiation efficiency. From Fig. 1, the highest levels of acoustic energy can be seen to reside in the low-frequency and subaudible (< 20 Hz) ranges in the form of discrete bands. The presence of short period, unsteady blade loads will increase the amount of discrete radiation in the higher rotational harmonics, usually peaking in the 8–15 Hz range.

Low Frequency Sound. The low frequency dominated spectrum of Fig. 1 is a result of the low rotational speed of wind turbines as compared with other forms of turbine machinery. At the present time no adequate standard exists for evaluating impulsive noise, particularly when the sound energy is concentrated below 100 Hz. This gap is due to our limited knowledge of the psychological response and the physical parameters involved with transient sounds which are perceived by humans as annoyance. As part of their program to develop a proposal for wind turbine noise criteria, the psychoacoustics group at the NASA Langley Center has performed a series of tests to establish the perception threshold for low-frequency audible, impulsive-type sounds. Their results are reported in reference [1].

More than "psycho-logical"! Physio-logical!

A Possible Low Frequency Annoyance Mechanism

During our March 1980 field measurement program at the MOD-1, we were very fortunate to obtain permission from two very cooperative families living near the machine (who had a history of complaints) to make a series of detailed

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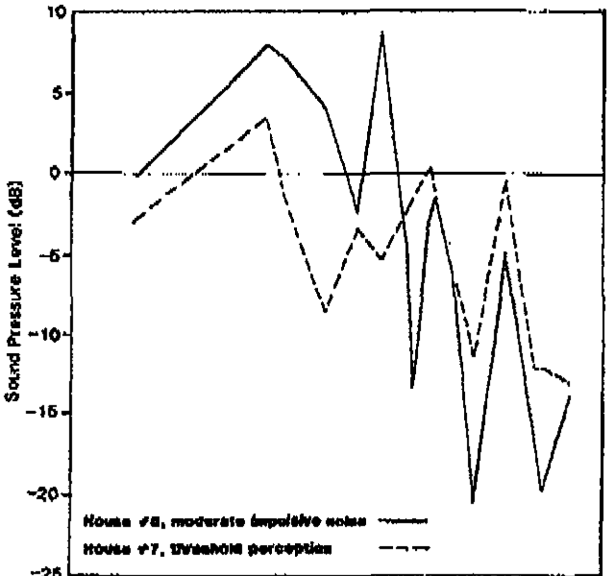

Fig. 3 Peak indoor-outdoor sound pressure level difference for moderate annoyance and threshold perception in houses #7 and #8, Boone, N.C.

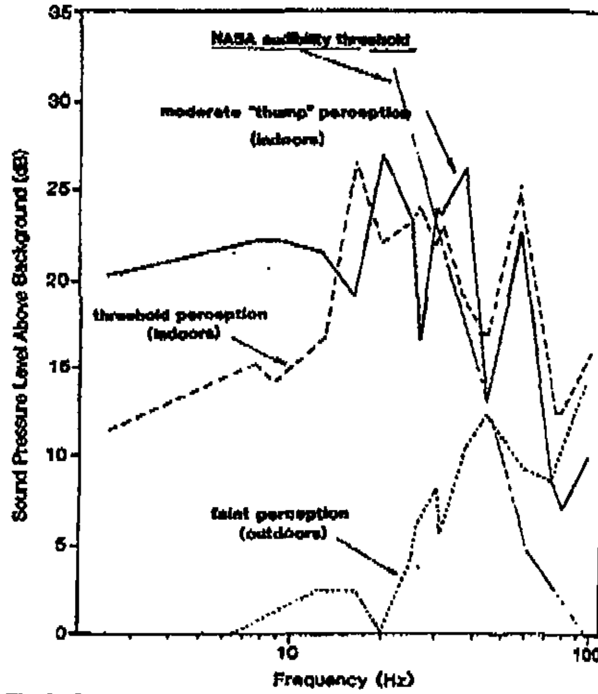

Fig. 5 Peak indoor sound pressure levels above existing background (B_e = 1.25 Hz)

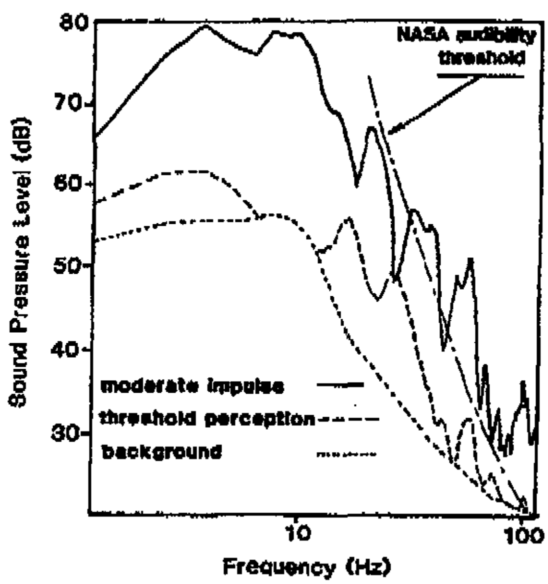

Fig. 4 Peak indoor sound pressure levels

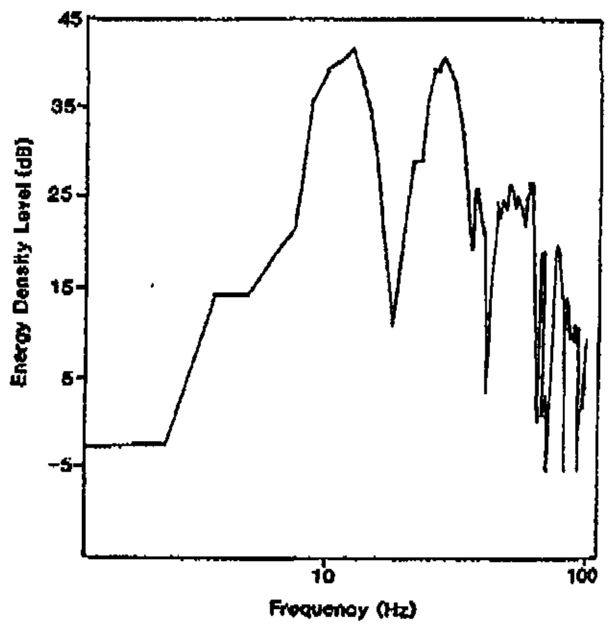

Fig. 6 Moderate-to-severe impulse perception excitation

Compare to Pior pont et al.

acoustic and vibration measurements inside and outside of their homes during turbine operations. In addition to the physical measurements, we visited many of the other complaining families and received a description of the annoying sounds. In summary, the complaints centered on the following perceptions:

(*i*) the annoyance was described as a periodic "thumping" sound accompanied by vibrations;

(*ii*) many persons reported they could "feel" more than hear the sounds;

(*iii*) the sounds were louder and more annoying inside their homes than out; and

(*iv*) some experienced the rattle of a loose glass in picture frames mounted on outside walls and small objects such as perfume bottles atop furniture making contact with an inside wall.

In our visits to other complaining homes, we asked in which room the occupants believed the sounds were the most annoying. Without fail, we were shown rooms which had at least one window which faced the turbine. More often than not, the room was a smaller one, usually a bedroom.

Physical Measurement Results. We were able to obtain a range of slight to severe annoyance levels while recording in the conventional two story, frame structure we have identified as house #8, which is located about 1 km and 300 m below the turbine. We also obtained a well-documented measurement of threshold level perception stimuli while recording in the double-wide, mobile home identified as house #7, which is located approximately the same distance from the turbine and less than 0.5 km from house #8. These two data sets have allowed us to compare the impulse excitation levels from both inside and outside the homes. We also have been fortunate to compare these low-frequency impulsive measurements with one involving a slowly varying, broadband source connected with the operation of gas turbine peaking station.

Acoustics. Figure 2 shows the external pressure excitation of the radiated impulse and the resulting indoor pressure trace in the 31.5 Hz octave frequency band. As can be seen, the indoor impulse lasts for a period of over a second compared with the individual impulses outside the house lasting for only a few milliseconds. To compare the moderate annoyance level stimuli with the perception case, we analyzed the differences between indoor and outdoor sound pressure levels and the levels indoors as a function of the existing background. These results are presented in Figs. 3 and 4. Figures 6 and 7 display the acoustic energy density spectra of typical individual impulses striking the homes and invoking moderate-to-severe annoyance and perceptible level responses, respectively. Figure 5 relates this data to local background.

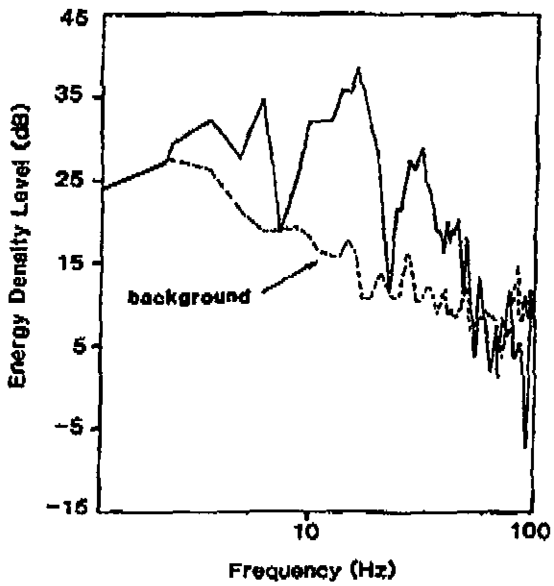

Fig. 7 Threshold level perception impulse excitation (B_e = 1.25 Hz)

Vibration. Figures 8 and 9 plot the frequency spectra of the horizontal component of the floor vibration under both conditions of perception. In both cases, the sensitive axis of the accelerometer was parallel to the major floor support members and in the direction towards the wind turbine. Figure 10 plots the relative transmissibility function for the acoustic and vibration data which indicates the level of dynamic coupling between the mechanical forcing of the floor vibration and the room acoustic pressure field. As is evident, the horizontal floor vibration is more highly coupled to the pressure field in several frequency bands than is the vertical mode vibration. This is in agreement with the low acceleration levels measured in this orientation.

Comparison with a Non-Impulsive Excitation. Because the strong impulses associated with the MOD-1 may be unique, and evidence from other turbines seems to indicate that partially coherent radiation may be much more common, we needed to find a documented source of low-frequency sound to compare with the measurements taken in Boone. We were fortunate to obtain a data set connected with the operation of a 100-MW gas turbine peaking station located in Southwestern Oregon [6]. The complaints of several homeowners living about 3–5 km north and northeast of the plant paralleled those of the Boone residents. Figure 11 compares typical outdoor sound pressure spectra from the two types of turbines. The characteristic sound of the gas turbine, which was caused by resonances in the exhaust stacks, was not impulsive, but a slow modulation was reportedly evident. While the peak frequencies of the two spectra are different, the levels are about the same at 12 Hz. Figure 12 replots the comparison with interior background of Fig. 5 with the data from one of the homes near the peaking station added. This home reported similar sensations as the

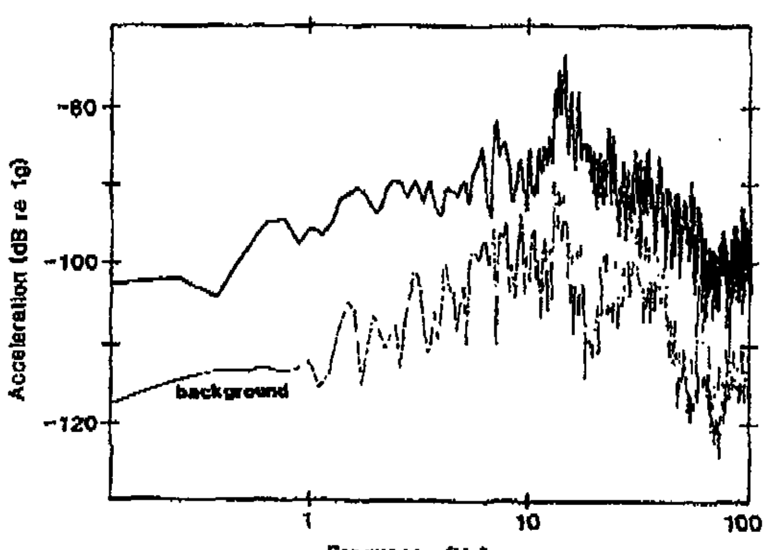

Fig. 8 Background and peak horizontal floor acceleration levels in House #7 under threshold level impulse forcing (B_e = 0.125 Hz)

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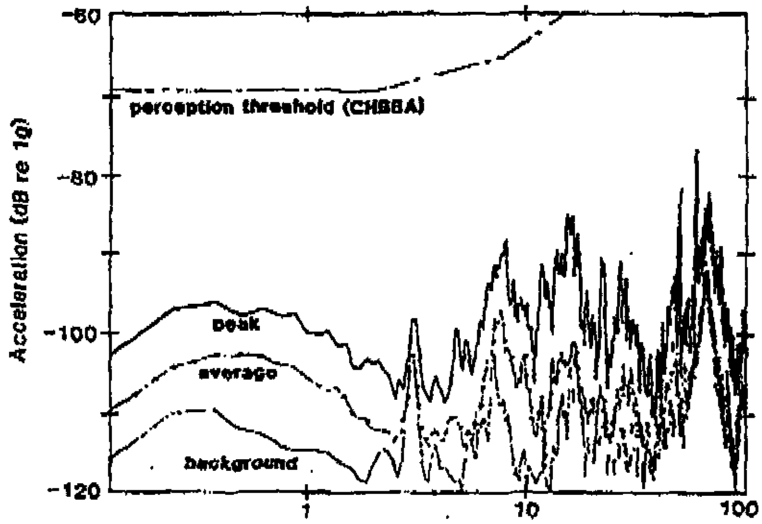

Fig. 9 Horizontal floor acceleration in house #8 under moderate impulsive excitation (B_e = 0.125 Hz)

Boone residents, but very little audible sound, i.e., the feeling of a pressure wave, uneasiness, vibrations, etc.

Interpretation of the Results. The repeated tendencies for both the acoustic pressure field and the vibration data to show discrete peaks at the same frequencies—the room dynamic overpressures shown in Fig. 3—and the strong resonant behavior of the indoor pressure field when excited by an external impulsive excitation, all point to a complex resonance condition between the volume of air in the rooms and the vibration (displacement) of the walls and floors surrounding it. One of the finest sources of data on the structural dynamics of residential buildings is a NASA Langley study authored by Carden and Mayes [7]. Through the use of sinusoidal excitation and aircraft flyover and sonic boom noise, they determined the characteristic responses of typical frame houses appeared to be largely independent of location and age due to the standardization of building codes which call out such design details as stud and beam spacing, etc. They also found, due to the construction similarities called for by the code, the resonant frequencies associated with the structural elements of most residential buildings fall within the same range but individually depend on the construction details of each house.

The acoustic pressure field within a room of a house is dynamically controlled by (*i*) changes in the shape of the room due to diaphragm action from internal and external pressure changes, (*ii*) higher mode resonances in the walls and floors, (*iii*) cavity oscillations (Helmholz-type resonances) from air moving in and out of the room through a door or window, and (*iv*) the resonant modes of the volume of air in the room itself. The ranges of these resonances are plotted on the data of Fig. 1 along with the factors controlling structural mode damping in other frequency ranges in Fig. 13. Table 1 lists the various resonant modes measured and calculated from the dimensions of the two rooms in the Boone homes.

From an examination of Figs. 3, 4, 5, 8, and 9, the peak acoustic and vibration spectra indicate strong resonances at many of the frequencies listed in Table 1, particularly at the 9 and 14 Hz diaphragm modes. Figure 14 presents an illustration from [7] showing the relationship of these modes to the structural features. From the available data, we have concluded the internal pressure field in these rooms and the house in Oregon is being driven primarily through the diaphragm action of the outside walls facing the turbines. The overshoot of the internal pressure levels evident in Fig. 3 indicates a dynamic amplification is taking place and in-

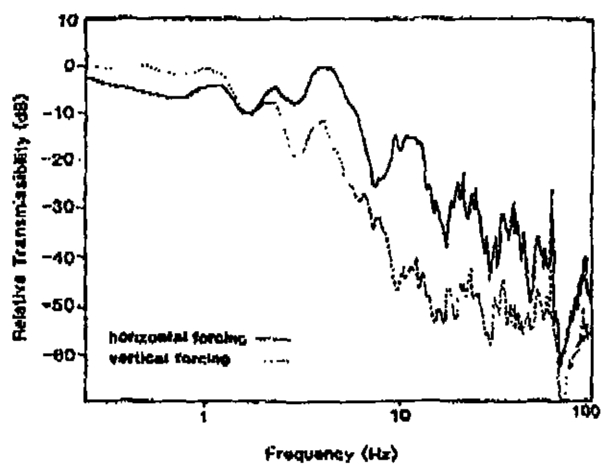

Fig. 10 Acceleration forced acoustic pressure transmissibility

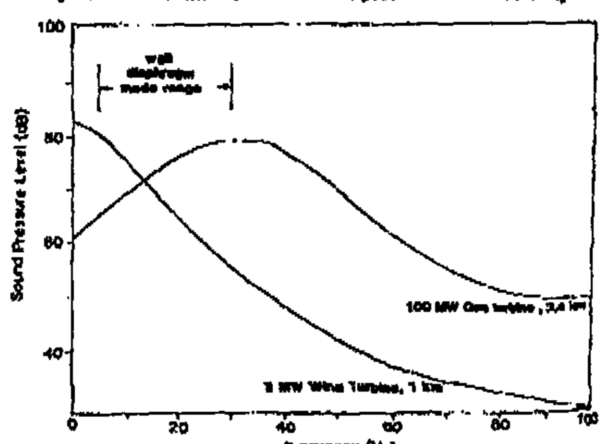

Fig. 11 Comparison of 100-MW gas and 2-MW wind turbine acoustic emissions

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tensifying the low-frequency pressure fluctuations in the rooms. Audible sounds are heard in the Boone homes and not in the Oregon house due to the higher wall/floor resonances and room modes being excited by the MOD-1 impulse energy at 12, 25, and 50 Hz (Figs. 6 and 7). The audibility conclusion has been drawn by comparing the above background levels with the NASA perception threshold criteria plotted in Figs. 5 and 12 [1]. Thus the results show the audible sounds are connected with more impulsive-type excitation, but slowly varying, broadband sources with similar levels of sub-audible acoustic energy are also capable of causing annoyance to the residents of exposed homes.

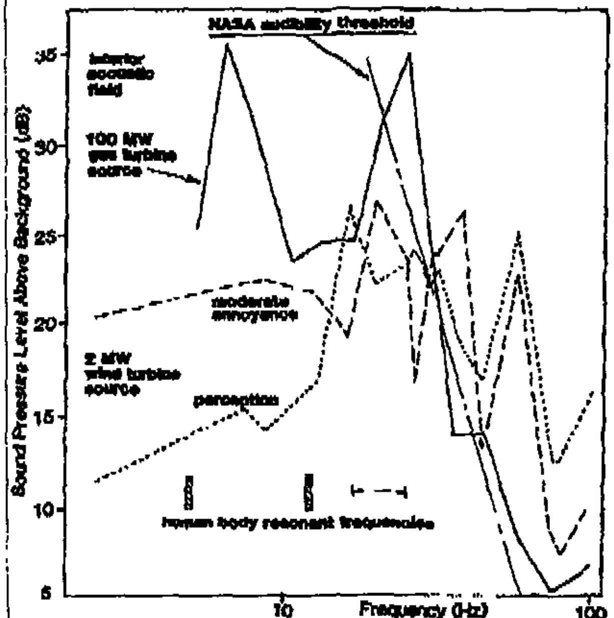

Fig. 12 Same as Fig. 5, with indoor response of home to gas turbine in Oregon

Human Perception. Comparisons of Figs. 3, 4, 5, 8, and 9 show the major difference in the acoustic energy distributions between the moderate annoyance perception (thumping sounds and vibration) and the threshold stimuli (a barely discernible thumping sound but no vibration) appears to be the peak level of subaudible energy present. The first modes of human body resonance (in the direction parallel to long dimension of a standing person) occur at approximately 5, 12, and 17-25 Hz [8]. The position of these frequencies with respect to the room resonant pressure fields is shown in Fig. 12. Some additional supporting evidence for a sensitivity to subaudible sounds is plotted in Fig. 15. This graph shows the threshold/exposure time for continuous sound pressure levels close to the peaks we have measured (see Fig. 4) around the most sensitive frequency of 12 Hz [9].

We hypothesize one of the causal factors related to the annoyance associated with the pulsating pressure fields in the rooms measured is a coupling with human body resonances

Table 1

Resonant modes of rooms in houses 7 and 8 (Hz)

	House #7	House #8
Dimensions (m)	3×3×2.1	3.6×3.5×2.4
Wall/floor resonances (measured)	9,14,20,30,59,79	9,14,21,26,50,60,65
Cavity oscillation frequency (door open)	≈44	≈35
Room mode frequencies	56[100,010]* 79[110] 80[001] 98[101,011]	47[100,010] 68[110] 70[001] 85[101,011] 98[111]

*[ ] give the x,y,z normal modes.

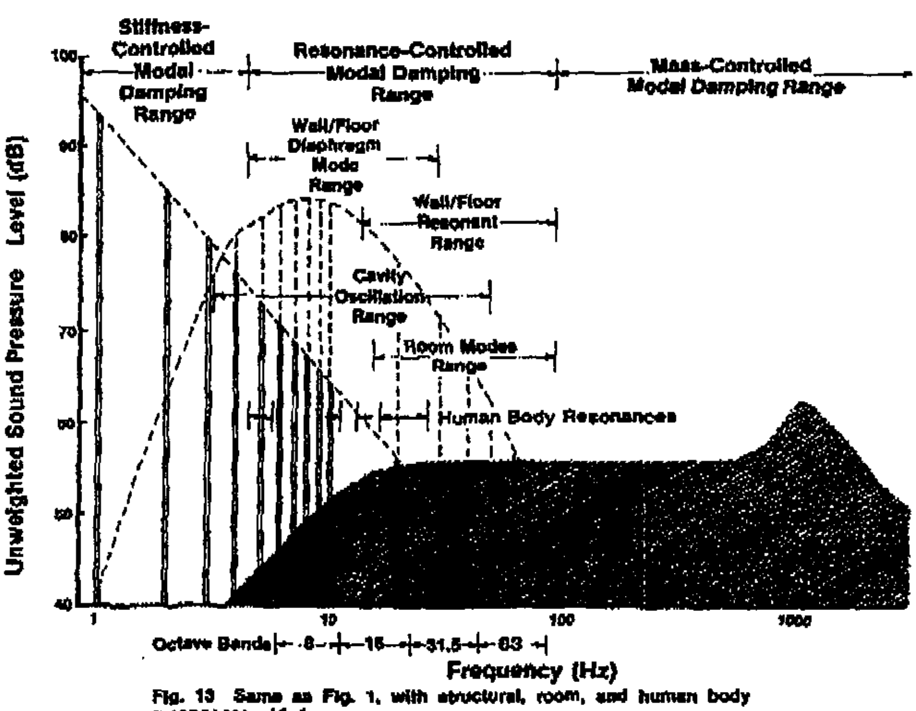

Fig. 13 Same as Fig. 1, with structural, room, and human body resonances added

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which in turn are responsible for creating the sensation of a whole-body vibration. This perception is more noticeable indoors due to the increased reverberation time and dynamic overpressures from the interaction between the structural and air volume resonances. From the meager information available from our measurements, we have crudely estimated the perception levels for the body resonance frequencies as 60 dB for 5 Hz, 55 dB for 12 Hz, and 48 dB for the 17–25 Hz band, or +5, 0, and +10 dB above the existing background for the respective frequencies. Such a process as proposed would explain the perceived annoyance within homes when no perceptable sounds could be heard outdoors.

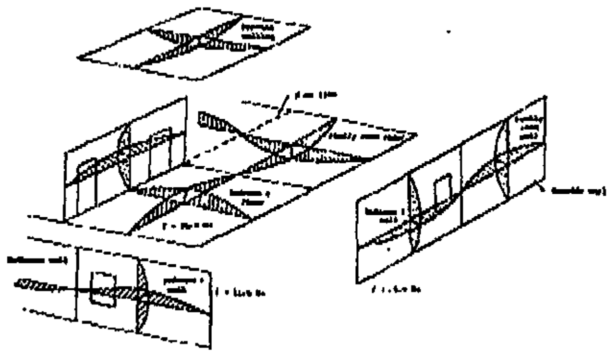

Fig. 14 Example of wall/floor diaphragm modes (source: reference [7])

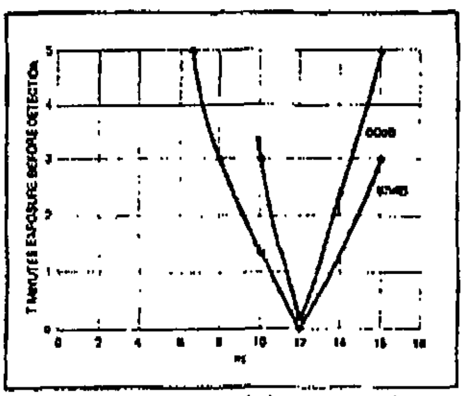

Fig. 15 Threshold/exposure time relationship around most sensitive frequency (source: reference [9])

Assessment Methodology

We have devised a technique by which the potential for community annoyance from the low frequency sound radiated by large wind turbines may be evaluated from recordings or direct measurements. The method allows for a direct comparison of various turbine designs or retrofits. The approach is based on measuring a parameter related to the phase coherence between the discrete frequency bands present in the acoustic energy spectra of wind turbines (see Figs. 6 and 7) and responsible for the level of annoyance perceived by residents in both indoor and outdoor environments.

The phase coherence between discrete energy bands is determined by computing the joint probability distributions of band sound pressure levels in a series of contiguous octave frequency bands. These bands, which include more than 90 percent of the resonance-controlled frequency range shown in Fig. 13, consist of the 8, 16, 31.5, and 63 Hz octaves. In order to properly take into account the nonstationary nature of wind turbine noise, we have found it is necessary to use the time for one complete rotation of a blade as the analysis period for the computing of distributions.

The actual technique involves the use of an 800-line resolution spectrum analyzer under the control of an external computer. The analyzer acquires a time-series record corresponding to the desired analysis period, transforms it into a narrowband spectrum, and then transfers this spectrum to the computer for calculation of the four octave band levels. The computer, using the method of bins, develops the density functions using a 5 dB increment for the band combinations (8/16), (16/31.5), (31.5/63), and the triple combination (8/16/31.5). The results are then plotted as a series of surfaces containing isopleths of equal joint probability.

Figures 16–19 contain plots of the results of measured joint sound pressure distributions listed above, and a plot reflecting the triple combination and a conditional probability of an 8 Hz band level of 70 dB or more (Fig. 19). These distributions have been derived from on-axis, below the centerline

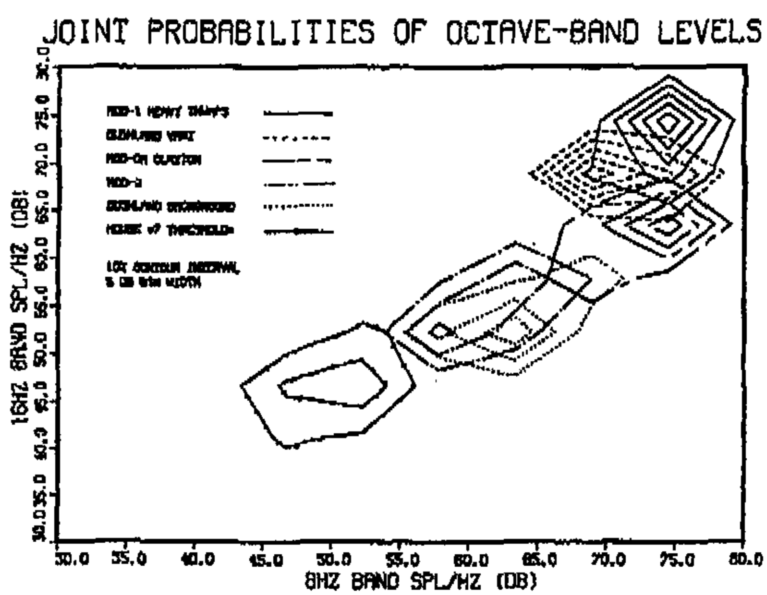

Fig. 16 8/16-Hz band joint probability distribution

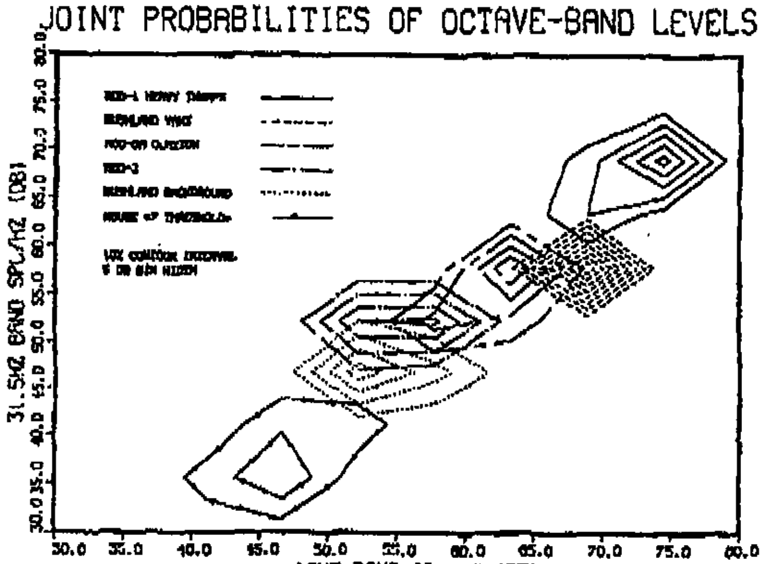

Fig. 17 16/31.5-Hz band joint probability distribution

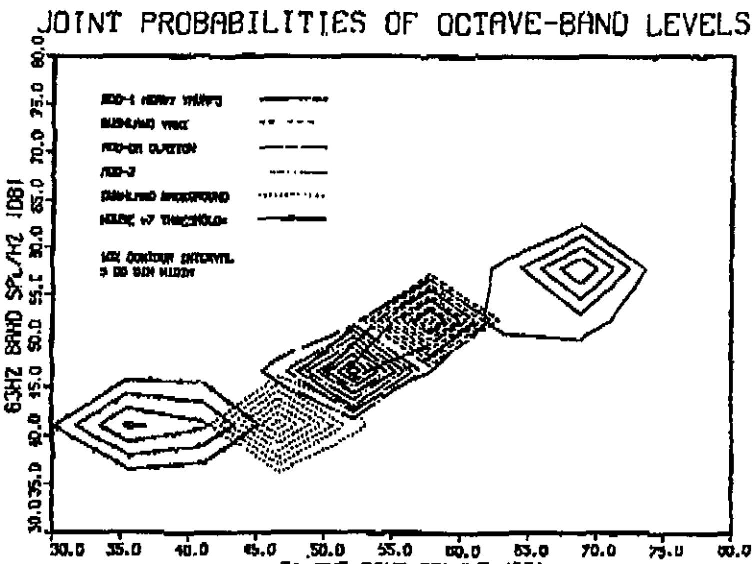

Fig. 18 31.5/63-Hz band joint probability distribution

measurements at a distance of 1.5 rotor dia for the MOD-1, the MOD-OA at Clayton, New Mexico, the unit #1 MOD-2, and the 17-m Darrieus/VAWT at Bushland, Texas. Also plotted in Figs. 16–18 are the reference background levels for Bushland and the threshold perception levels measured outside of house #7 in Boone. Unfortunately, the data from each site were not recorded under similar atmospheric conditions. The MOD-1 data represent the most severe sequence of impulsive noise and the accompanying adverse community reaction we have on tape and corresponds to a period late in the evening. The MOD-2 and MOD-OA surfaces were based on a very limited sample taken in the afternoon at both sites. The VAWT data represents the distribution for a series of measurements recorded right at local sunset when the machine began to exhibit some impulsive noise characteristics.

The results of this analysis indicate the following:

(*i*) The MOD-1 data represent a good measure against which to compare the acoustic performance of other turbines because of the known annoyance levels associated with the record used to compute the distribution.

(*ii*) The shape of the distribution appears to be related to a specific machine design.

(*iii*) The acoustic pressure patterns radiated from large wind turbines have a definite structure as compared with the natural, wind-induced background (as is shown by Fig. 19 in particular) with the radiation from downwind HAWT supported by truss-type towers and the Darrieus/VAWT exhibiting the *maximum structural detail*.

(*iv*) The importance of the existing background on the detection of turbine noise is graphically illustrated in the comparison of the Bushland background distribution and that associated with the threshold perception in Boone which indicates this would not be heard in Bushland.

(*v*) An interpretation of Figs. 16–19 indicates if the peak coherent radiation from a wind turbine can be held simultaneously at or below 55–65 and 45–55 dB band pressure

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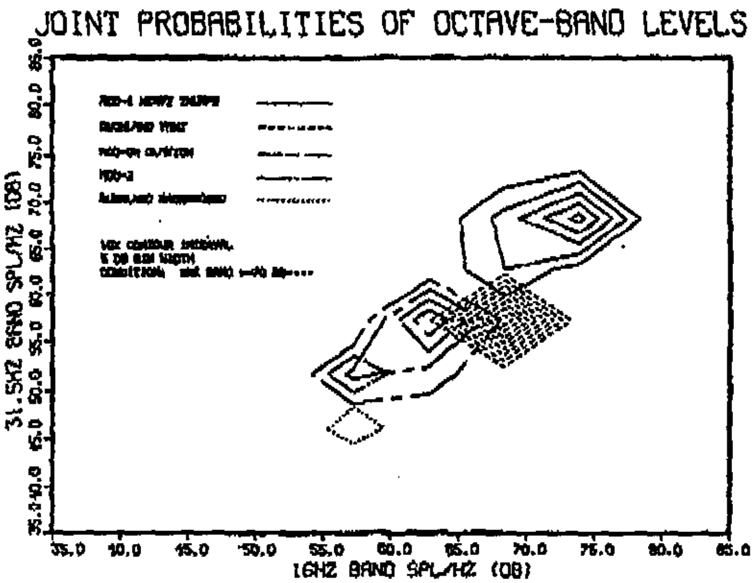

Fig. 19 8/16/31.5 joint distribution with condition of a BPL > 70 dB in the 8-Hz octave band

levels in the 8 and 16 Hz octave bands and under 35-45 dB in the 31.5 and 63 Hz bands at a distance of 1.5 rotor dia, the probability of community annoyance from low-frequency turbine sounds appears remote even under the quietest background conditions.

Conclusions

Not much room, here, for the so-called Nocebo Effect!

In this paper we have presented evidence to support the hypothesis that one of the major causal agents responsible for the annoyance of nearby residents by wind turbine noise is the excitation of highly resonant structural and air volume modes by the coherent, low frequency sound radiated by large wind turbines. Further, there is evidence that the strong resonances found in the acoustic pressure field within rooms actually measured indicates a coupling of subaudible energy to human body resonances at 5, 12, and 17-25 Hz, resulting in a sensation of whole-body vibration. The audible sounds indoors associated with the impulsive excitation of the structure appear to be due to the coupling of energy from the higher frequency discrete bands in the impulse to higher frequency room resonances related to the air volume itself.

We have described a turbine noise evaluation technique which, in effect, measures the degree of coherence in the acoustic radiation being emitted from a given turbine under existing atmospheric conditions. The approach is based on computing the joint probability distributions of the band pressure levels in a series of octave frequency bands which are known to encompass the very lightly damped, structural resonances in typical housing construction in the U.S. The results of the analysis for a range of wind turbine designs has shown the MOD-1 to be capable of producing the highest coherent band pressure levels, but the Darrieus/VAWT is capable of the highest probability of coherence over a much narrower range of band pressure levels.

Acknowledgments

The authors gratefully acknowledge Mrs. Carol Etter and Mr. Richard Garrelts for their dedicated assistance and skills. We are indebted to Mr. Scott Turner of the Portland General Electric Company for furnishing us the noise data from the gas turbine measurements and the Robin Towne Associates for their skill in making them. This work was supported by the DOE Wind Energy Technology Division under contract No. EG-77-C-01-4042.

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I am a physician and scientist; my expertise lies in clinical and environmental matters. Whether or not wind proves to be a viable source of power, it is absolutely essential that windmills not be sited any closer than 1.25 miles (2 km) from people's homes or anywhere else people regularly congregate. (Highways are also a problem for motorists with seizure and migraine disorders and motion sensitivity, from the huge spinning blades and landscape-sweeping shadow flicker.)

I consider a 1.25 mile set-back a minimum figure. In hilly or mountainous topographies, where valleys act as natural channels for noise, this 1.25 mile set-back should be extended anywhere from 2-3 miles from homes.

Let me be clear. There is nothing, absolutely nothing, in the wind energy proposition that says windmills must be sited next door to people's homes. Siting, after all, is the crux of the issue.

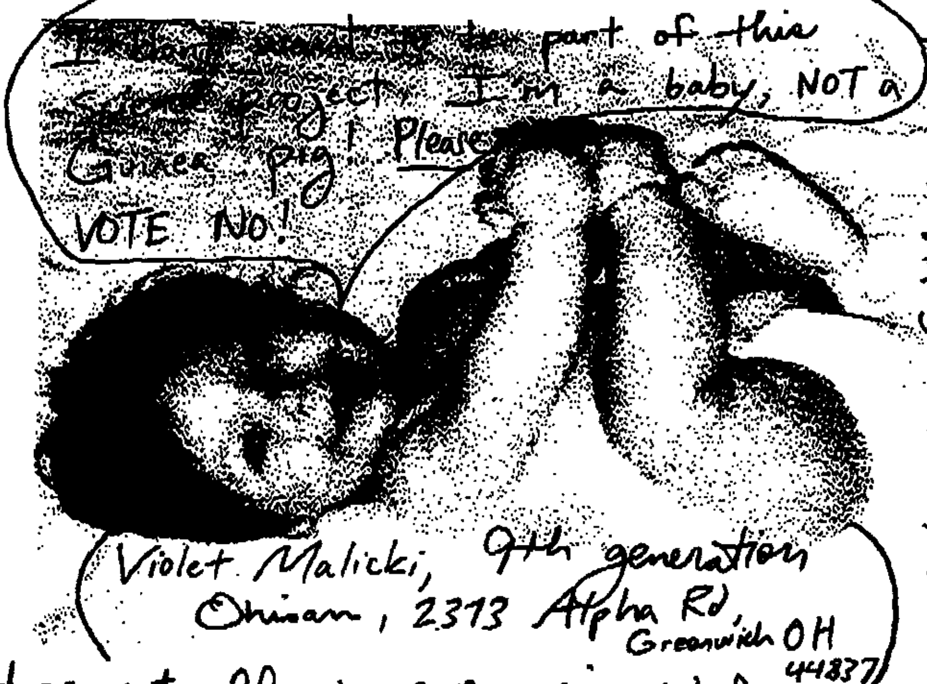
Irresponsible siting is what most of the uproar is about. Corporate economics favors building wind turbines in people's backyards; sound clinical medicine, however, does not.

Nina Pierpont, MD, PhD
Fellow of the American Academy of Pediatrics

Dear OPSB, [Ref case #13-0990-EL-BGN] (Cover page)
Aug. 14, 2014

"please [illegible] protect my innocent brain and body and life and future." -Violet Malicki

Infrasound Low-Frequency Noise (ILFN) Emissions for the Greenwich Industrial Turbine Power Station are not regulated; ILFN is NOT addressed in the Staff Report; and Windlab refuses to answer questions about the ILFN (even after lying to my face & promising they world!)



ILFN destroys lives, thousands around the world have suffered, mainly sleep deprivation, a form of TORTURE the UN Council does not allow - even in war.

Please do not allow my baby to be tortured.

Please deny the certificate.
(FROM: Russell, Valerie, Rosie & Violet)

Sincerely,
Valerie Malicki MA, LPCC
[signature]
Russell Malicki & Rosie too

(cc: all members of the OPSB)

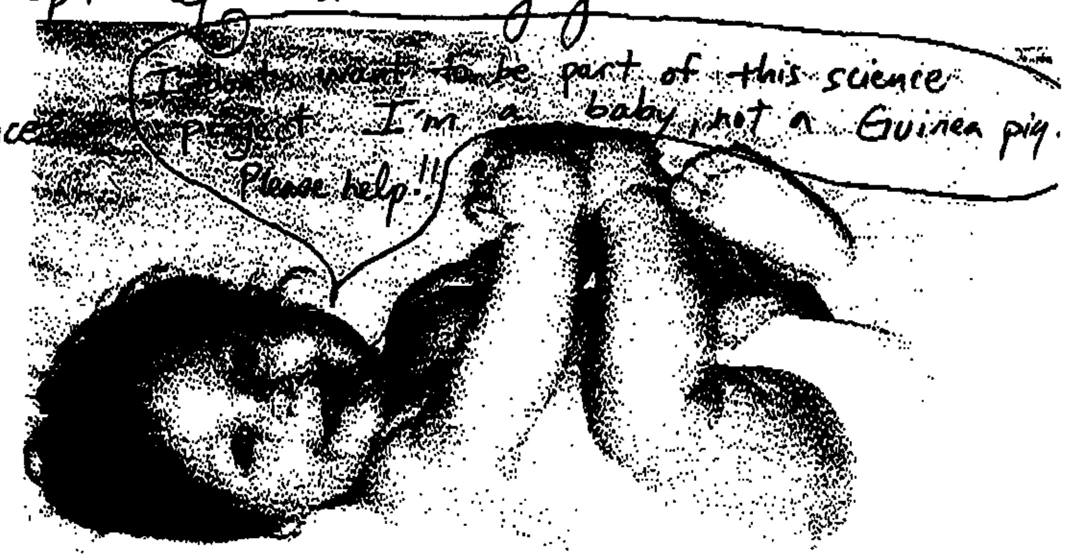
PS. MUCH more info in the public docket - please review with scrutiny!

PSS. setback minimum; Sophia's pic enclosed

This is referencing case # 13-0990-EL-BGN.
(Greenwich Industrial Wind Turbines, 717 ft. from my home.)

Please see the enclosed document. People have felt the acoustic & vibration measurements inside & outside their homes, & this has been in science journals since the late 70's & early 80's as in this article from the U.S. Dept of Energy.

"Strong resonances found in the acoustic pressure field .... resulting in sensation of whole-body vibration."
(Solar Energy Research Institute)



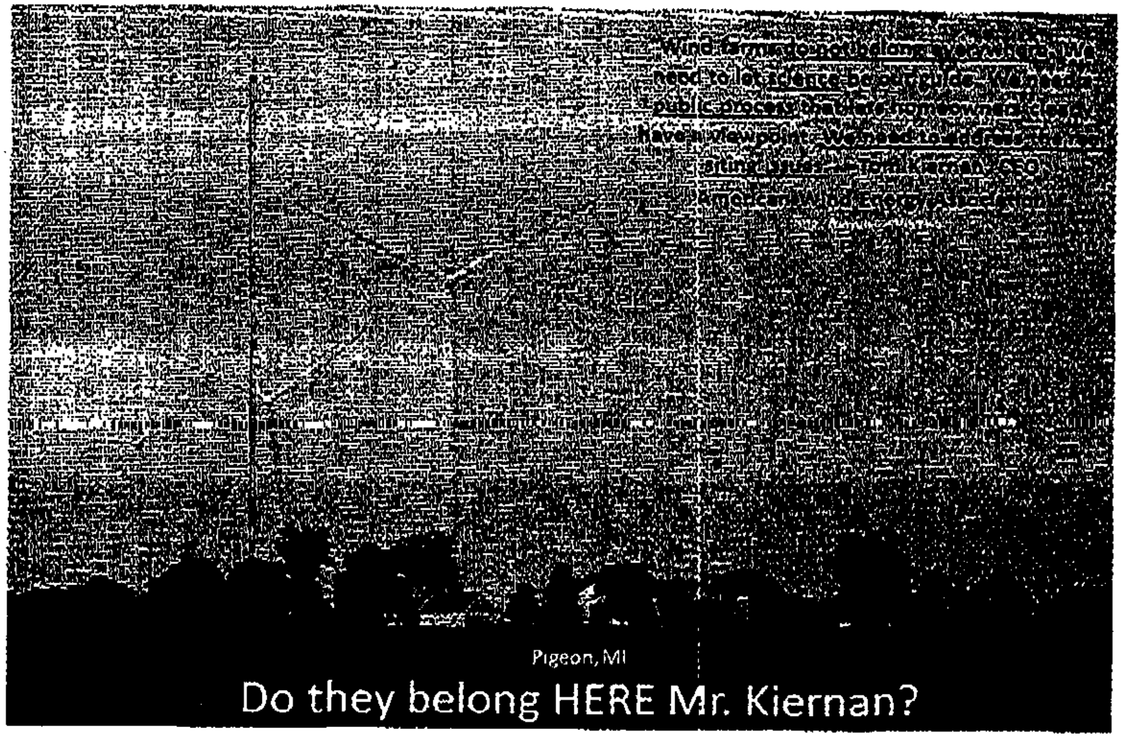
Violet Malicki,
9th generation Huron Co., Ohio resident.
2373 Alph Rd, Greenwich OH 44837

Please do NOT sacrifice my innocent sweet body on the alter of corporate greed, lies, "green" energy, and political agendas. I am a baby. — Violet Malicki

Greenwich Windpark

The Truth About Wind Power

	The Rhetoric	The Reality
Consumer Prices	Wind energy is expensive and costs more than other sources of electricity.	Wind power is the lowest cost of new generation; twenty year power contracts provide long-term level power costs. No fuel cost; no fuel transportation costs. Aging coal fleet is being decommissioned; will impact consumer prices upward.
Reliability	Wind is intermittent; therefore, it threatens the reliability of the electric grid.	Grid operators already rely on wind power and successfully integrate it in large amounts across the US power grid. Over 60,000 MW of wind energy is currently on the US grid (roughly powers 45,000,000 homes).
Sound	The sound of operating wind turbines causes a variety of health effects, including dizziness, headaches, and loss of sleep.	*Independent studies conducted worldwide* have consistently found that wind farms have no direct impact on physical health. Sound levels are modeled during development to avoid post-operational issues.
Shadow Flicker	The shadows of rotating wind turbines are bothersome and cause negative health effects.	*Shadow flicker is predictable* and is based on the sun's angle, turbine location, and the distance to an observer. Flicker is modeled during development to minimize and mitigation measures are available.
Fire	Turbines often catch fire and when they do they send flaming shards into fields and forests.	A wind turbine fire is a very rare event. Turbines are closely monitored 24/7 for any operating irregularities. Extensive precautions are taken, including emergency & first responder training.
[illegible]	Wind takes too much land to make much of the nation's energy.	Wind energy accounted for 42% of all new energy installation in 2012. The project area may appear to spread across a large area, however, the infrastructure requires little land. Wind energy is compatible with agricultural activities; farmers can plant up to the turbine base and livestock enjoy the shade in summer.
Property Values	Wind farms hurt property values.	Studies have found that wind facilities do not affect long-term property values. Wind drives community economic development that benefits all property owners through the tax revenues paid annually.
Emissions	Wind power does not reduce carbon and may even contribute to climate change.	Wind power has no carbon emissions and emits no pollutants or greenhouse gases. Wind power does not use any water and does not contribute to water contamination. No energy expended to extract fuel.
Old Turbines	Old turbines are left abandoned.	History shows that old turbines are repowered with newer technology. Current wind practices require a bond be posted to protect landowners and community; in addition, turbines have a high salvage value.
Energy Incentives	Renewable energy is subsidized at higher rates than fossil fuels	Fossil fuels received about five times more in subsidies than renewable energy. Wind's primary incentive is the Product Tax Credit, *a performance based incentive.*
Wildlife	Wind turbines are killing birds, bats and eagles at an alarming rate.	Wind generates electricity without many of the environmental impacts associated with other energy sources and is supported by wildlife agencies. Newer siting requirements and techniques continue to reduce wildlife impacts.


Pigeon, MI
Do they belong HERE Mr. Kiernan?

13

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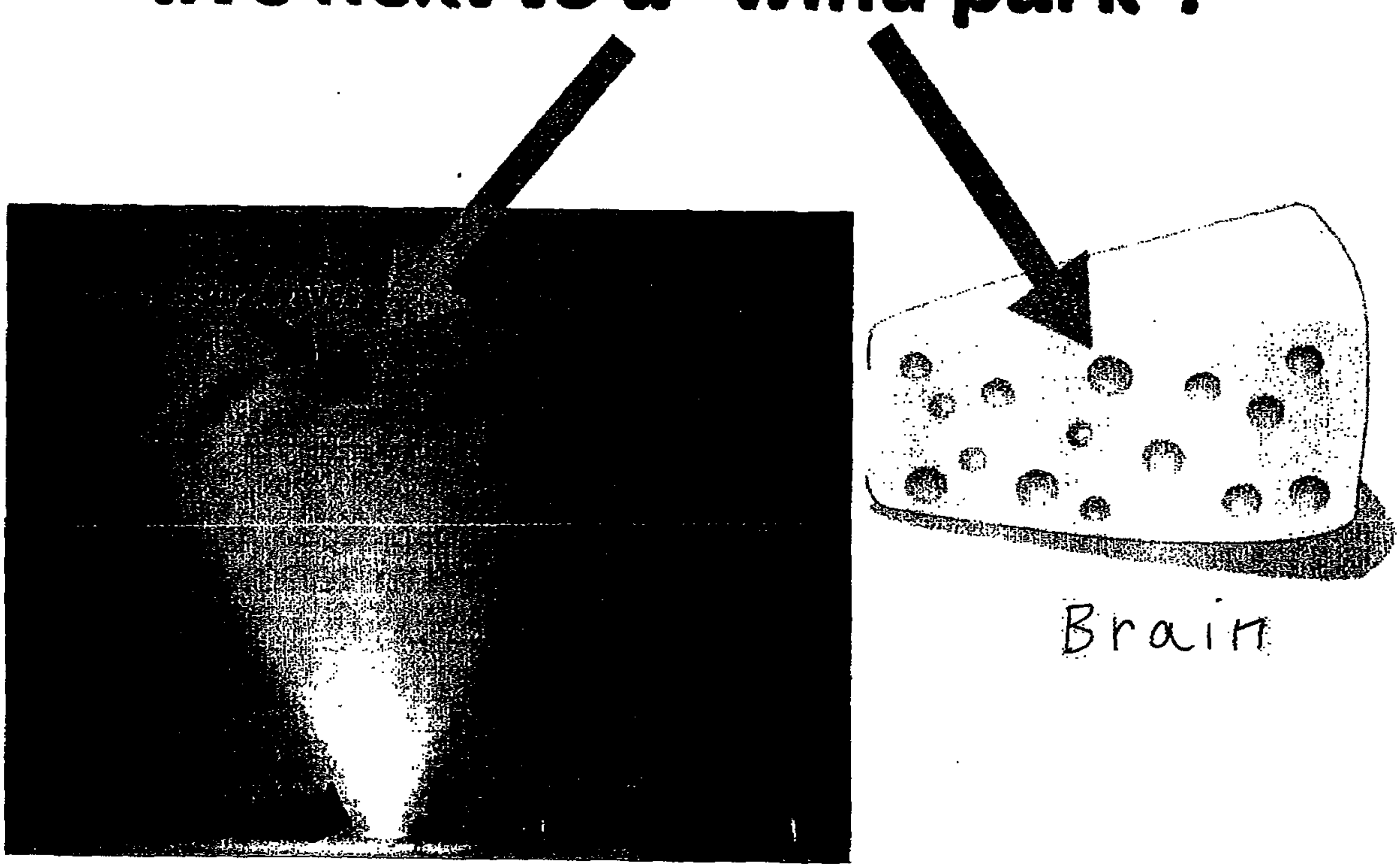
Irresponsible siting is what most of the uproar is about. Corporate economics favors building wind turbines in people's backyards; sound clinical medicine, however, does not.

Nina Pierpont, MD, PhD
Fellow of the American Academy of Pediatrics

This is your brain when you live next to a "wind park"!



August 14, 2014

Dear Ohio Power Siting
Board Voting / Non-Voting [illegible]

Please review case
13-0990-EL-BGN. Please note
OPSB Staff Report does NOT
even comment on Infrasound and its
harm to brain and human health.

Thank you,
Valerie [illegible] MA, LPCC

CC: OPSB members
All legislators possible!