The Wind Turbine Timeline

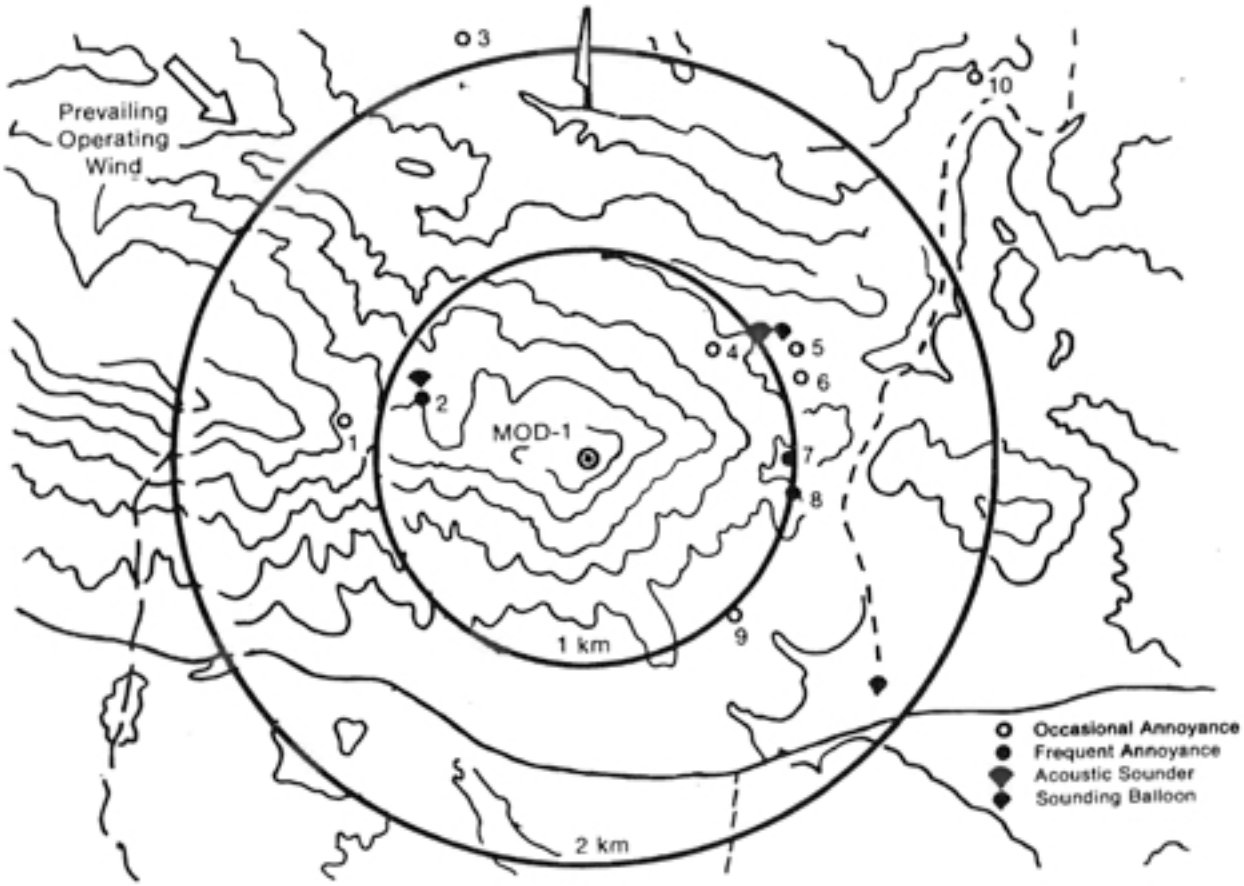
July 1, 1979

2MW MOD-1 Turbine installed
To trial industrial-level wind energy generation in the US, the 5th operational wind turbine is installed near Boone, North Carolina.

September 1, 1979

First complaints received from a dozen families within a 3km radius of turbine.

Much to everyone's surprise, complaints were made by some residents (see dots on image for location). The annoyance was described as an intermittent "thumping" sound accompanied by vibrations. .. A "feeling" or "presence" was described, felt rather than heard, accompanied by sensations of uneasiness and personal disturbance. .. The "sounds" were louder and more annoying inside the affected homes. .. Some rattling of loose objects occurred. In one or two severe situations, structural vibrations were sufficient to cause loose dust to fall from high ceilings, which created an additional nuisance.



October 1, 1979 — January 1, 1981

Wind turbine operation creates enormous sound pressure waves

Many collaborators, including NASA and SERI fully investigated acoustic, seismic and atmospheric aspects using turbine operational information and data recordings in a series of field experiments (the NASA research). This image from the field studies shows the sound pressure caused by rotating blades passing the tower.

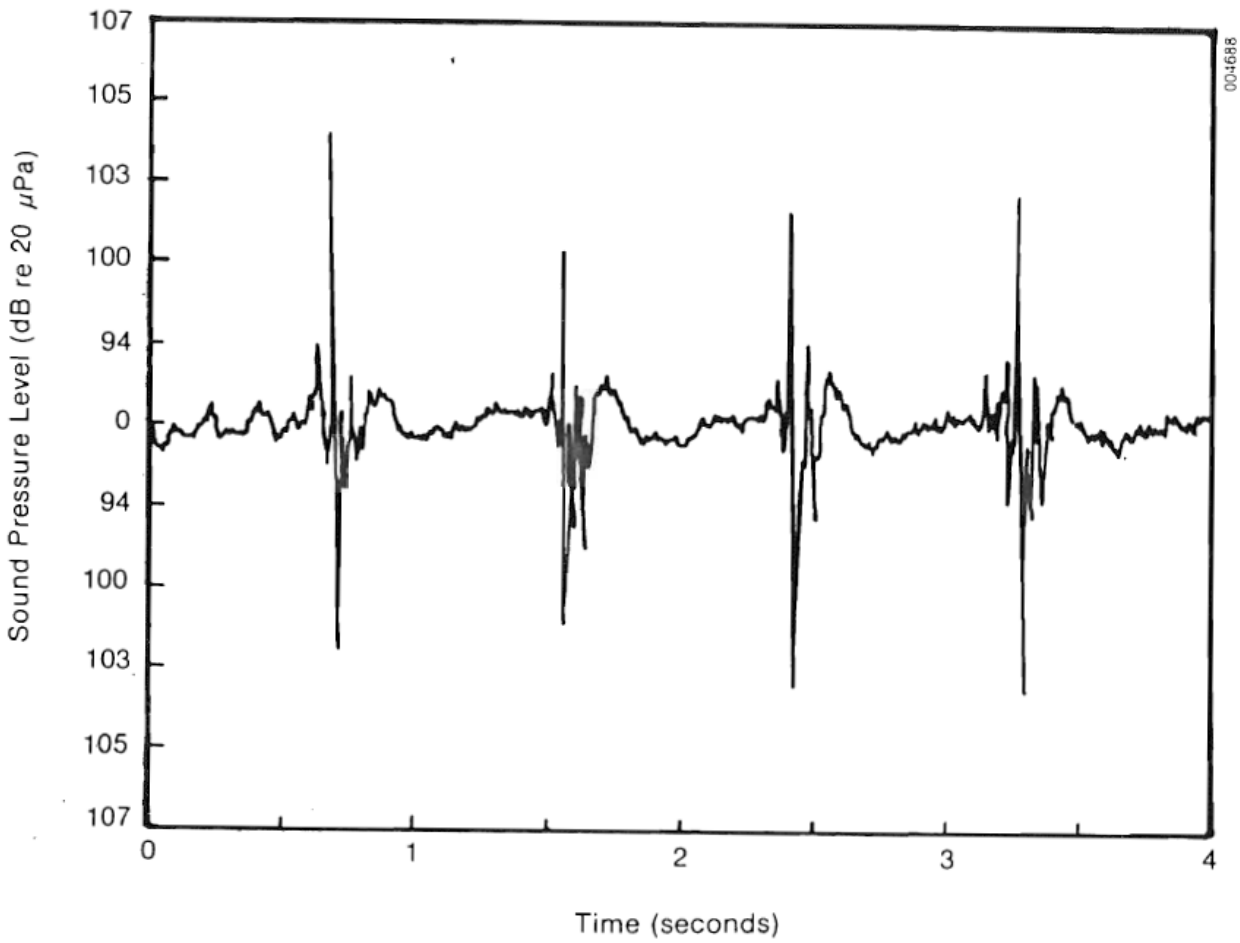
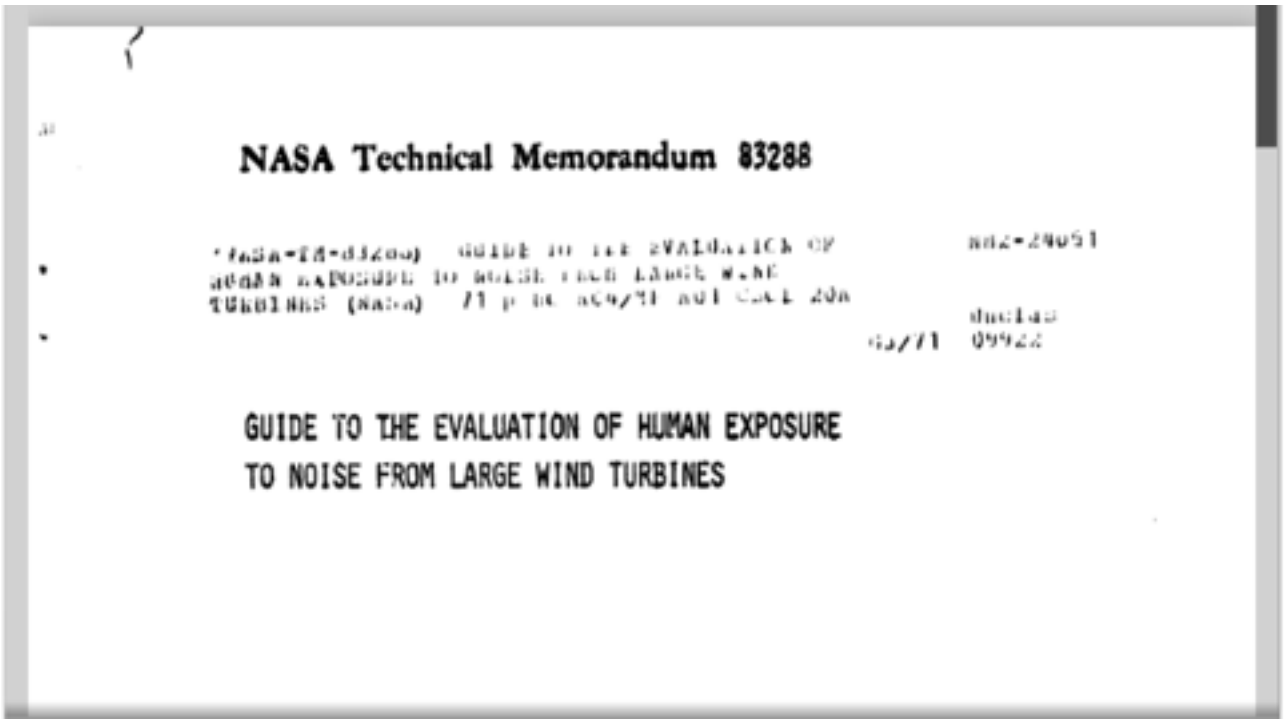


Figure 3-3. Typical Pressure-Time Plot of MOD-1 Acoustic Emissions Containing Strong Period Impulses. (Two complete rotor revolutions and four blade passages)

March 1, 1982

Householders are exposed to Low Frequency Noise (LFN) from wind turbines while indoors.

NASA's Guide to the evaluation of human exposure to noise from large turbines - 'Receiver exposure' includes noise evaluation inside homes.



NASA Technical Memorandum 83288

GUIDE TO THE EVALUATION OF HUMAN EXPOSURE
TO NOISE FROM LARGE WIND TURBINES

March 2, 1982

Closed windows and doors do not protect occupants from LFN

Further NASA research showed that even with windows shut, houses do not stop LFN sound energy. Measured levels inside the home are significantly higher than predicted within the LFN range. The house acts like a drum for LFN.

There are very few data available at the low frequencies (below 50 Hz). In this range the wavelengths are comparable to the dimensions of the rooms and there is no longer a diffuse sound field on the inside (ref. 29). Other complicating factors are the role of stiffness at these lower frequencies and 45

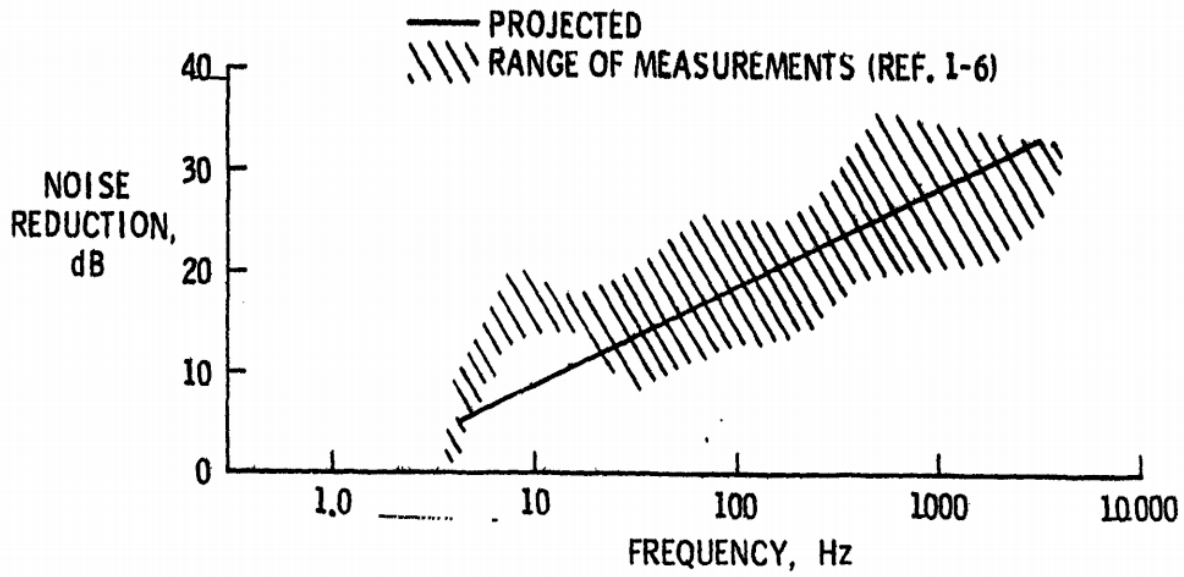


Figure C-10.- House noise reduction as a function of frequency for the windows closed condition.

the existence of pressure leaks. The inside distribution of pressure can be non-uniform because of standing wave patterns, organ pipe modes and cavity resonances due to room, closet and hall way configurations. The anticipated large variation of sound pressure levels from one location to another at very low excitation frequencies has not been documented for houses. Thus, it is difficult to characterize the low frequency noise environment inside a house structure based on a knowledge of the outside noise environment.

March 3, 1982

Turbine redesign from downwind to upwind does not fix LFN problem

The position of the turbine was thought to contribute to the problem. The MOD-1 wind turbine was a downwind turbine. The acoustics of upwind turbines were investigated. A change in configuration of the turbine did change the noise profile, however, as the blades still must pass a tower, LFN sound pressure emissions remain high.

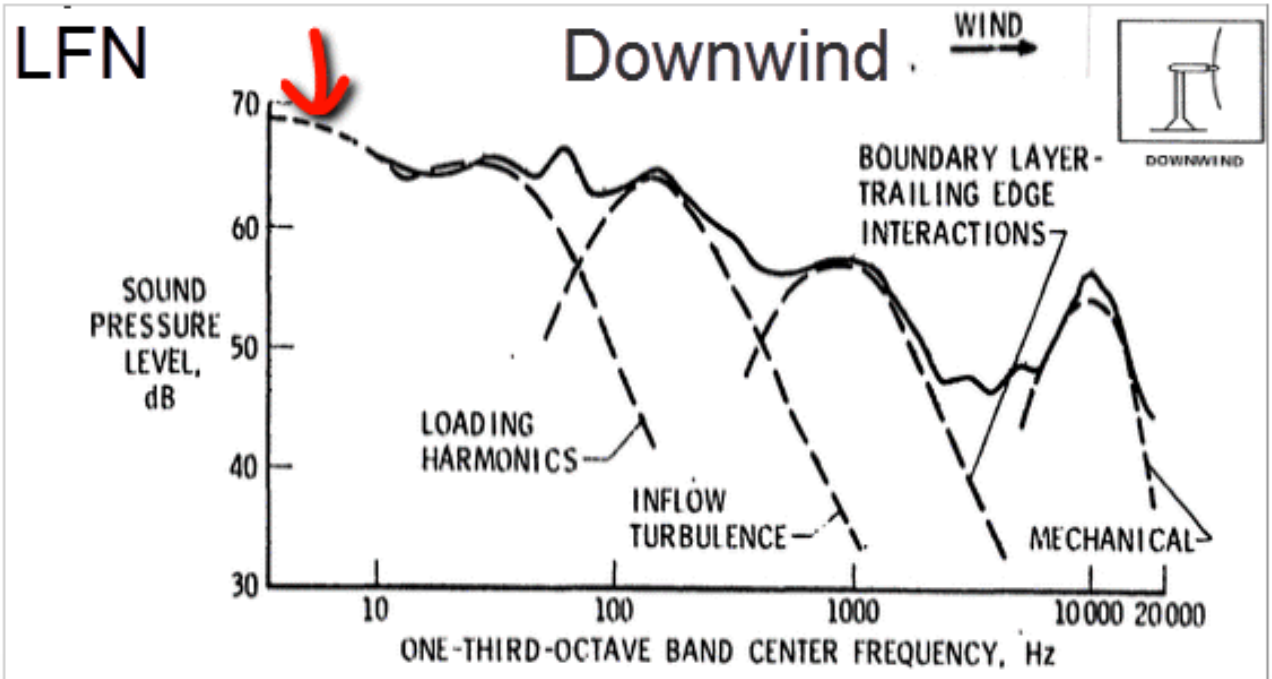


Figure A-2.- Acoustic sources for a downwind horizontal axis wind turbine generator

September 1, 1982

NASA research on human impacts provided to wind industry

Wind industry is provided with research through this summary article in the Noise Control Engineering Journal. It describes noise-induced house responses, including frequencies, mode shapes, acceleration levels and outside-to-inside noise reductions. The role of house vibrations in reactions to environmental noise is defined and some human perception criteria are reviewed.

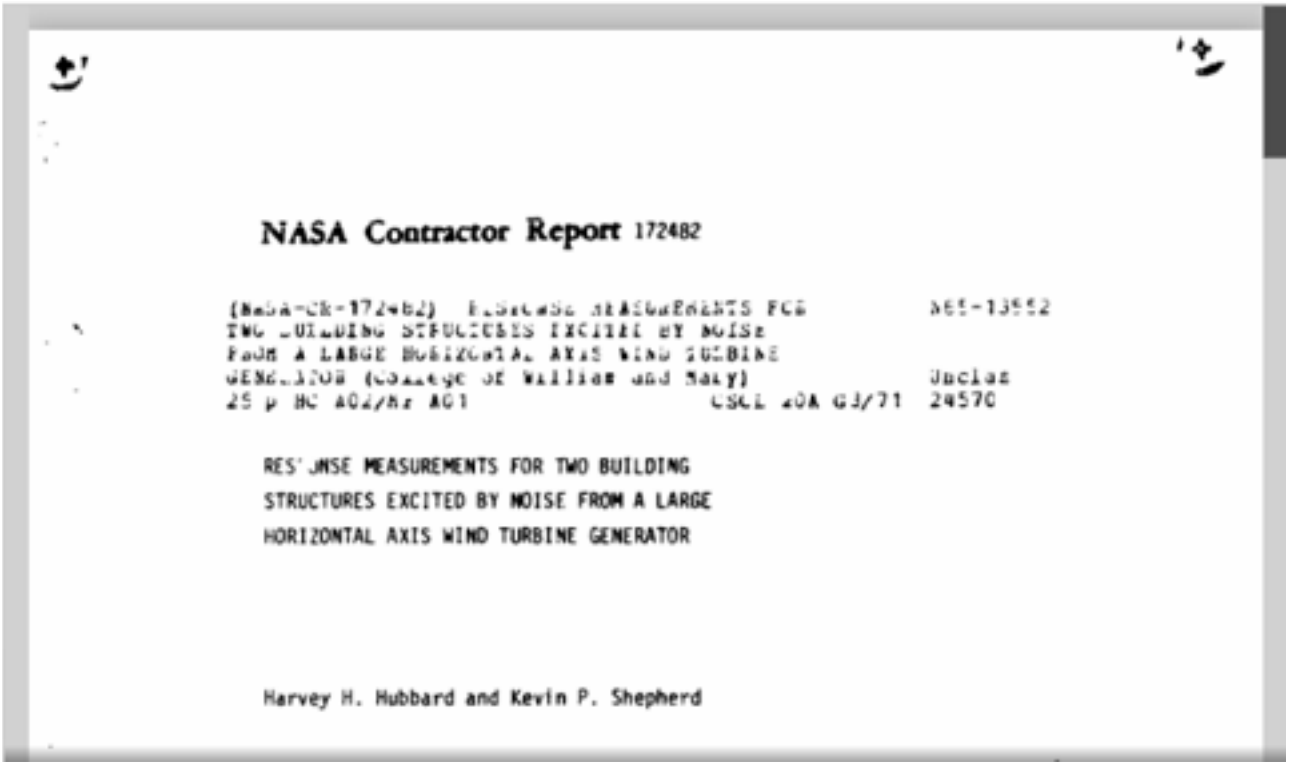
Noise Induced House Vibrations and Human Perception*

Harvey H. Hubbard, member INCE,† summarizes noise induced house responses including frequencies, mode shapes, acceleration levels and outside-to-inside noise reductions. The role of house vibrations in reactions to environmental noise is defined and some human perception criteria are reviewed.

November 1, 1984

Noise inside homes worse than outside

More NASA research shows that house structure excitation from wind turbine operation is similar to the sonic boom created by jet aircraft passing overhead. Interior noise can be greater than outside noise. Many people complain that wind turbines sound like a jet that never lands - this is why. There is an overlap between the peak acceleration level (vibration measure) and peak sound pressure levels within two structures that had been excited by commercial jets, helicopters and wind turbines.



NASA Contractor Report 172482

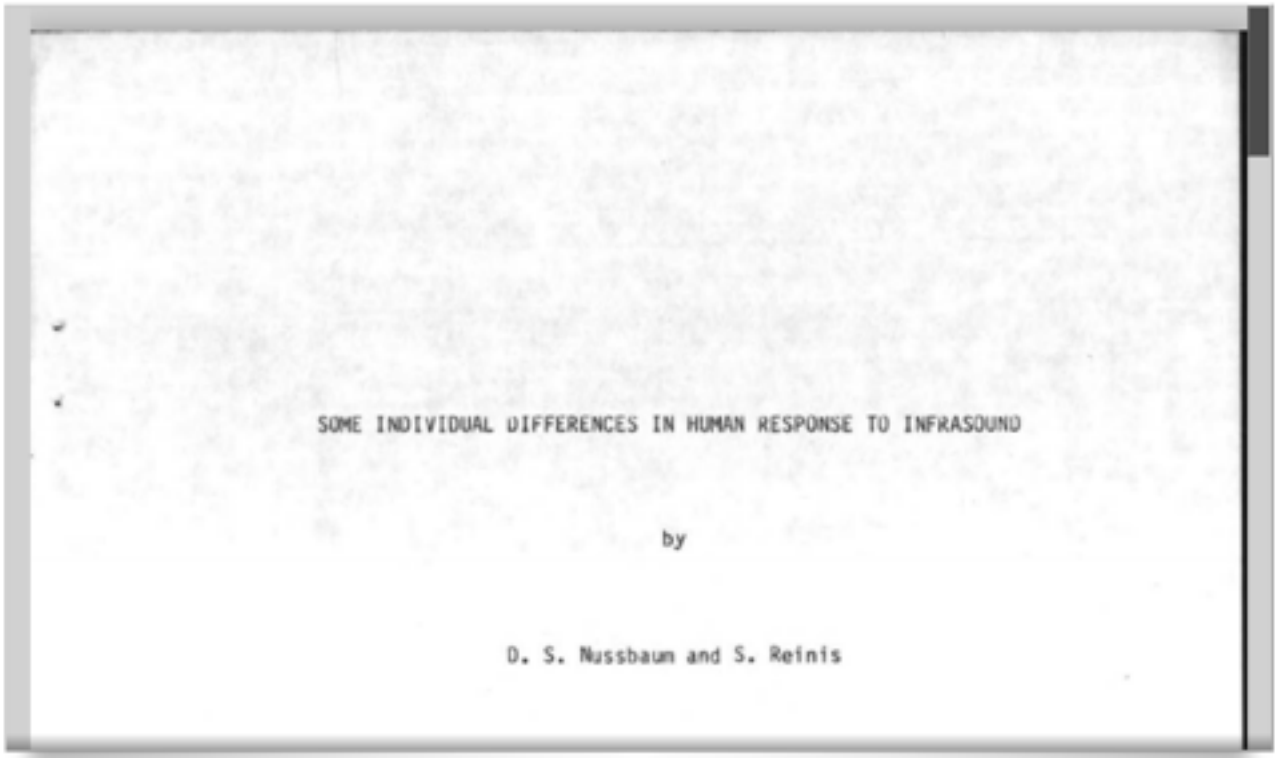
RES'JNSE MEASUREMENTS FOR TWO BUILDING
STRUCTURES EXCITED BY NOISE FROM A LARGE
HORIZONTAL AXIS WIND TURBINE GENERATOR

Harvey H. Hubbard and Kevin P. Shepherd

January 3, 1985

Hypothesis for infrasound-induced motion sickness

It was known that not every one responded to infrasound in the same way and studies were commenced to determine the possible 'transducers' for infrasound in the human body and explore how they might differ between individuals. People who suffer from infrasound were found to be measurably different to people who did not. The resulting hypothesis proposes the differences are related to anatomical differences (diameter of inner ear), neural responsiveness as well as processing of information in the brain (central nervous system). Clear parallels to motion sickness was made.



SOME INDIVIDUAL DIFFERENCES IN HUMAN RESPONSE TO INFRASOUND

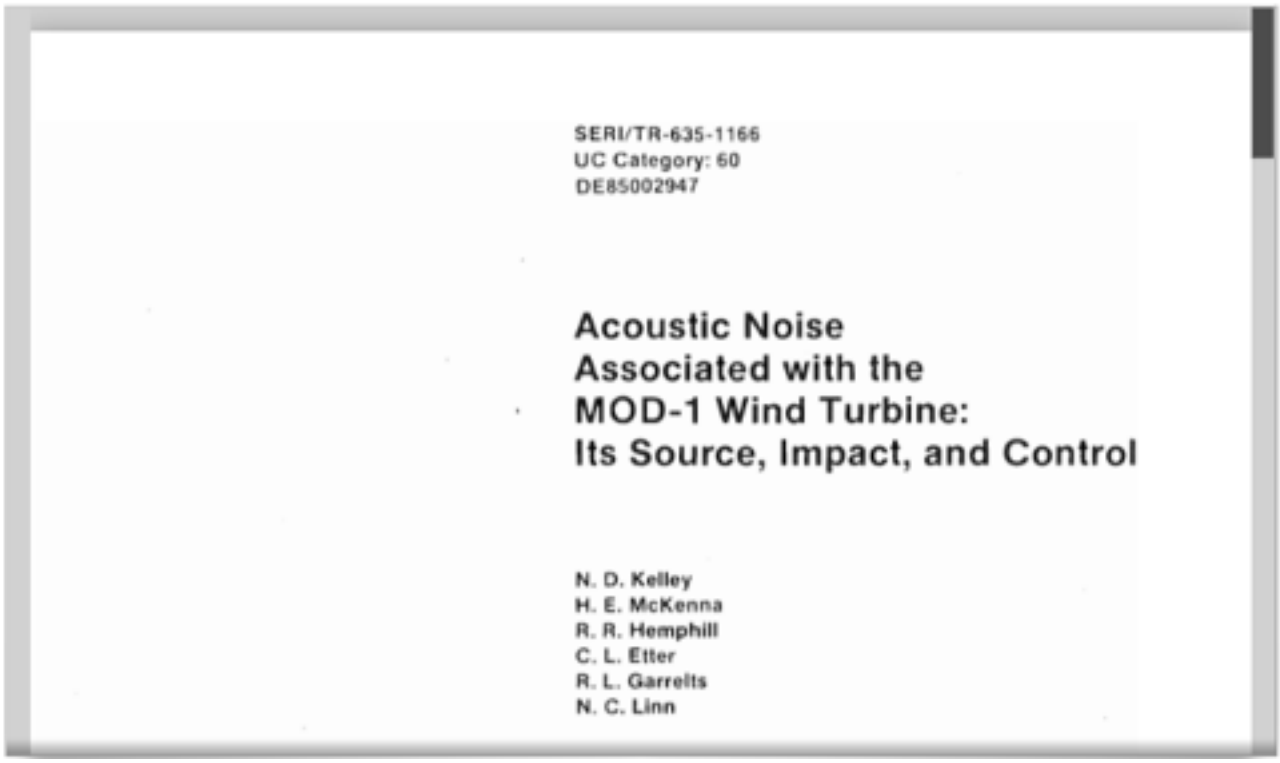
by

D. S. Nussbaum and S. Reinis

February 1, 1985

Major research on community annoyance from wind turbine released

Extensive NASA research established the origin and possible amelioration of acoustic disturbances associated with the operation of the MOD-1 wind turbine. Results show that the source of this acoustic annoyance was the transient, unsteady aerodynamic lift imparted to the turbine blades as they passed through the lee wakes of the large, cylindrical tower supports. Nearby residents were annoyed by the LFN impulses propagated into the structures of the homes in which the complainants lived. The situation was aggravated further by a complex sound propagation process controlled by terrain and atmospheric focusing.



SERI/TR-635-1166
UC Category: 60
DE85002947

Acoustic Noise Associated with the MOD-1 Wind Turbine: Its Source, Impact, and Control

N. D. Kelley
H. E. McKenna
R. R. Hemphill
C. L. Etter
R. L. Garrelts
N. C. Linn

November 1, 1987

Laboratory simulation of wind turbine annoyance conducted

Kelley continued researching the annoyance from wind turbines in a 'laboratory situation'. A testing facility was constructed and furnished with a control room, listening room and speaker room. Subjects were exposed to LFN emission profiles similar to that detected in the MOD-1 turbine and asked to rate their annoyance.

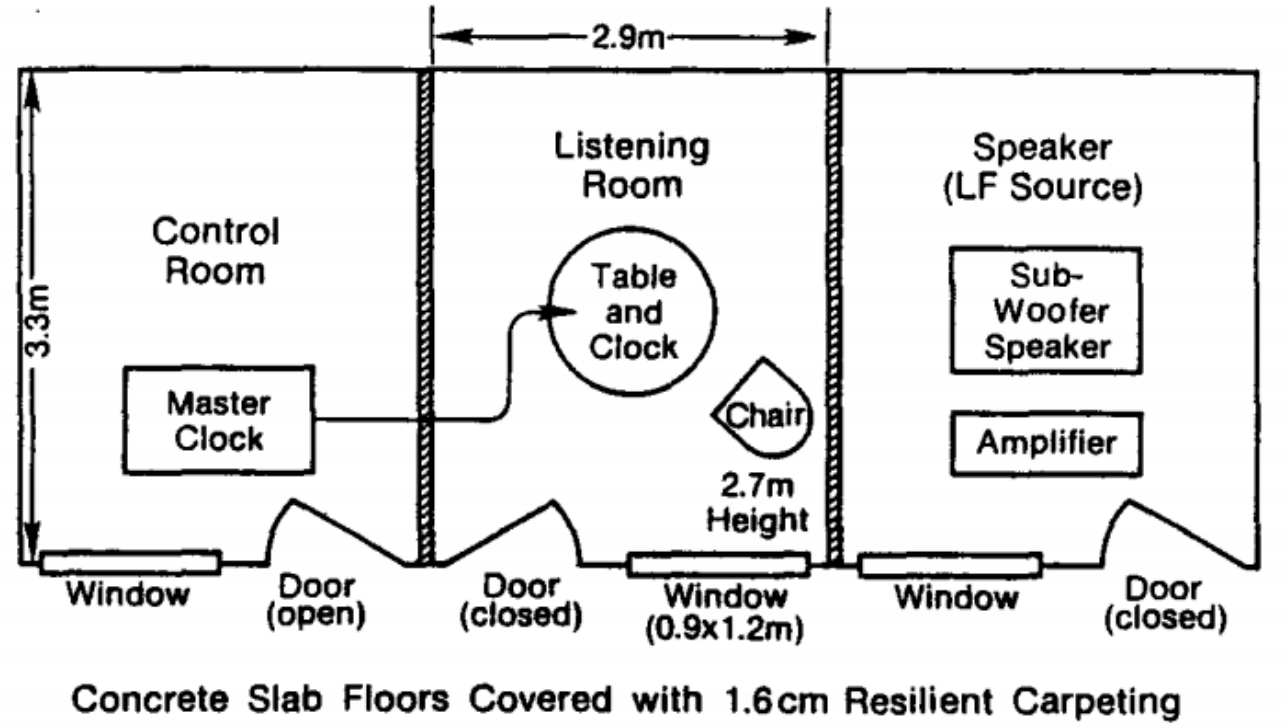


Figure 5. PLAN VIEW SCHEMATIC OF PHYSICAL ARRANGEMENT OF TESTING FACILITIES

November 2, 1987

Wind turbine annoyance measured

Participants rated their perceptions in various LFN environments using this scale, recording noise, annoyance, vibration and pulsations.

Table 2. SUBJECTIVE RANKING CRITERIA FOR LOW-FREQUENCY (LF) NOISE ENVIRONMENTS

Rank	Stimuli Response Rating 0	1	2	3	4	5
	Perception					
Noise level (loudness)	Can't hear	Barely can here	Weak, but definitely audible	Moderate loudness	High noise level, loud	Very high noise level, very loud
Annoyance/ displeasure	None	Barely aware of presence	Definitely aware of presence	Moderate distraction/ some irritation	Very annoying, irritating	Extremely annoying, uncomfortable
Vibration/ pressure	None	Feel presence	Definitely feel vibration/ pressure	Moderate vibration/ pressure feeling	Very noticeable	Severe vibration
Pulsations	None	Barely feel pulses	Definite pulses or bumping	Moderate booming or thumping	Heavy booming or thumps	Very heavy pulses, booms, thumps
	Acceptable		???????		Clearly unacceptable	

November 3, 1987

Lab studies confirm dB(A) worst noise measure for predicting annoyance

Of all the noise filters tested, dB(A) was shown to be the worst of all at predicting annoyance from LFN.

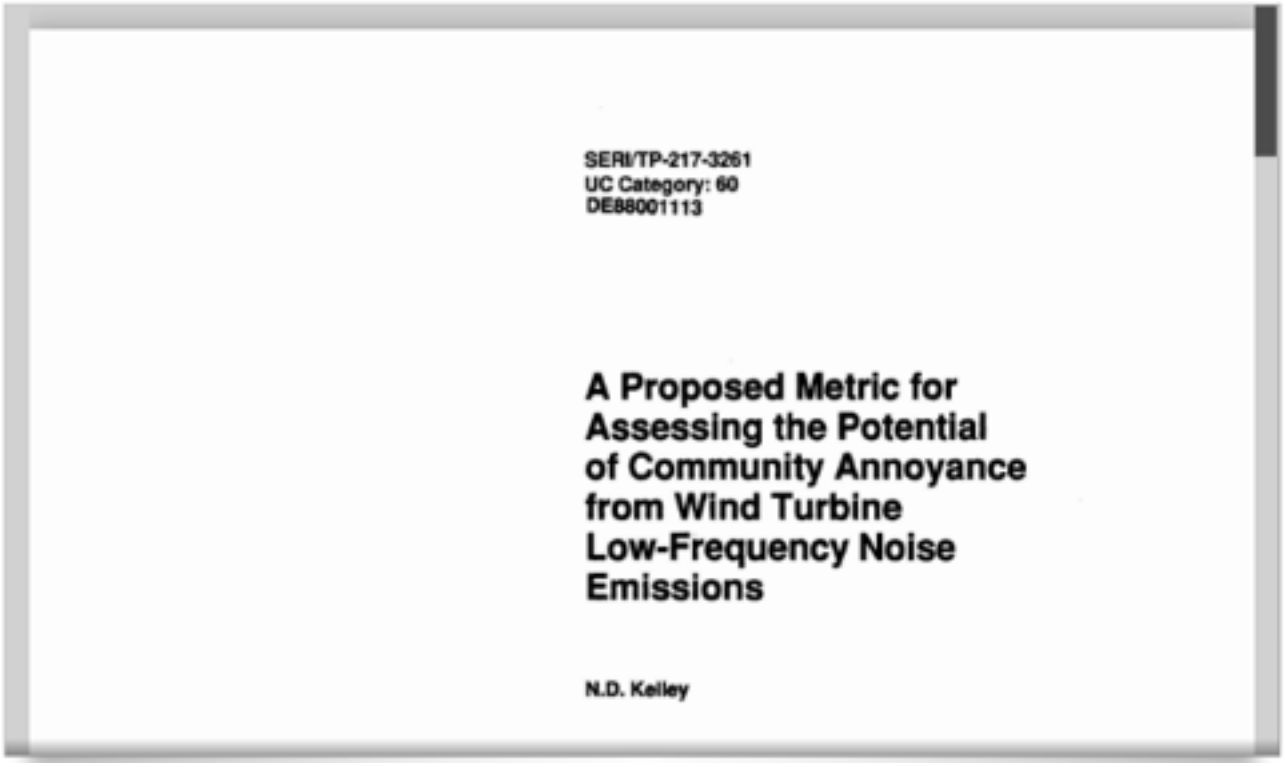
Table 3. CORRELATION COEFFICIENTS OF EVALUATOR ANNOYANCE RATINGS OF LF NOISE STIMULI VERSUS SIX NOISE METRICS

Metric	Noise Level	Annoyance/ Displeasure	Vibration/ Pressure	Pulsations	Mean
G_1	0.898 (0.033)	0.933 (0.018)	0.709 (0.170)	0.819 (0.115)	0.840 (0.084)
G_2	0.873 (0.071)	0.879 (0.053)	0.701 (0.157)	0.769 (0.148)	0.806 (0.107)
LSPL	0.898 (0.035)	0.924 (0.034)	0.711 (0.155)	0.831 (0.107)	0.841 (0.083)
LSL	0.935 (0.021)	0.958 (0.014)	0.732 (0.174)	0.860 (0.097)	0.871 (0.077)
C	0.940 (0.030)	0.947 (0.008)	0.725 (0.167)	0.841 (0.098)	0.863 (0.076)
A	0.384 (0.464)	0.269 (0.413)	0.413 (0.137)	-0.077 (0.719)	0.247 (0.433)

November 4, 1987

Wind industry told that dB(A) unsuitable to measure LFN emissions from wind turbines

Wind industry informed of how to predict annoyance from LFN emissions from wind turbines at Windpower '87 Conference. Kelley explains how to measure LFN emissions that annoy neighbours of wind farms. LFN can be intensified inside homes. The dB(A) filter cuts out all the LFN and is therefore unsuitable. G-weighted scales were better correlated with noise, annoyance, vibration and pulsations.



SERI/TP-217-3261
UC Category: 60
DE88001113

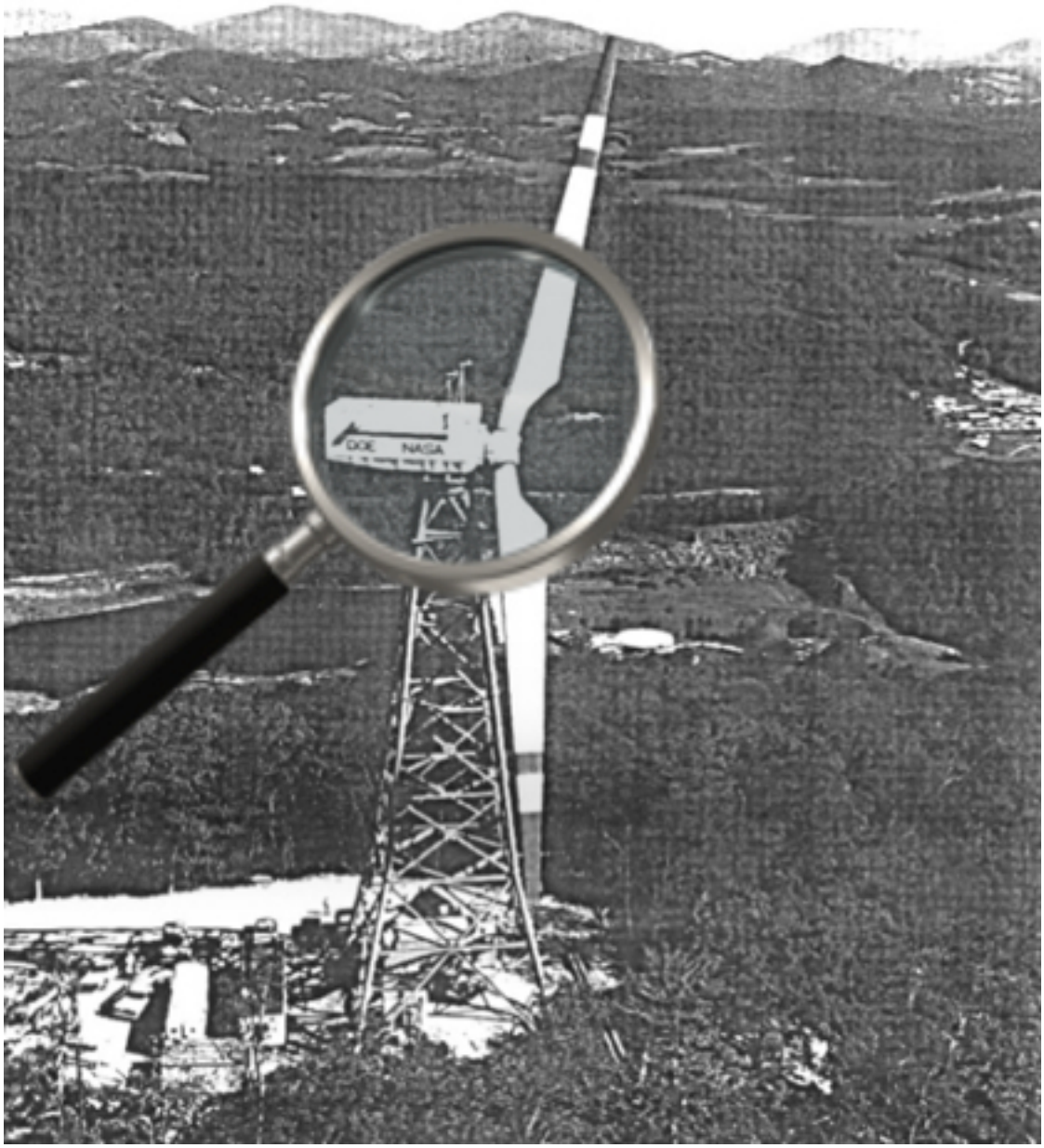
A Proposed Metric for Assessing the Potential of Community Annoyance from Wind Turbine Low-Frequency Noise Emissions

N.D. Kelley

January 2, 1988

End of NASA research

This was essentially the end of almost a decade of NASA research into the unexpected annoyance of wind turbine operation on neighbours. It revealed the fundamental flaw - the turbines blades passing the tower, which generates huge pressure waves - LFN emissions. Depending on topography, weather and the location of houses and turbines, some LFN emissions were focussed and reacted with homes. The sensation from LFN emission generated many complaints. The levels were higher inside the homes than outside. LFN can not be detected when dB(A) filters are applied. Susceptible people experience a range of symptoms including motion-sickness-like symptoms.



January 1, 1995

Wind developers regroup and respond to NASA research, creating the Noise Working Group

Seven years have passed. In an attempt kick start the wind industry again, a group of mostly wind farm developers, calling themselves the Noise Working Group was established in the UK by the Department of Trade and Industry and through the Energy Technology Support Unit (ETSU - now called Future Energy Solutions). They met and created a set of procedures for measuring wind farm noise. Their aim was to promote the development of the wind industry, without the burden of dealing with community annoyance.

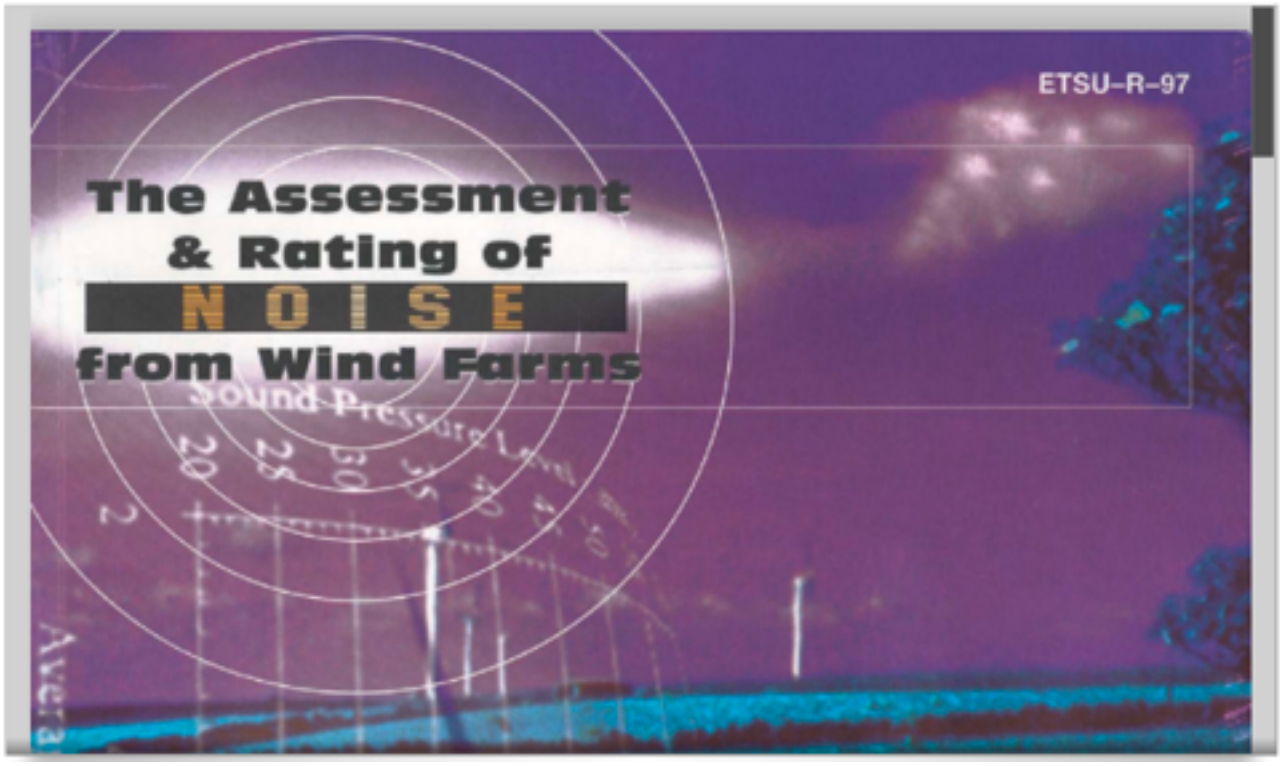
Members of the Noise Working Group:

Mr R Meir, Chairman	DTI
Dr M L Legerton, Secretary	ETSU
Dr M B Anderson	Renewable Energy Systems
Mr B Berry	National Physical Laboratory
Dr A Bullmore	Hoare Lea and Partners
Mr M Hayes	The Hayes McKenzie Partnership
Mr M Jiggins	Carrick District Council
Mr E Leeming	The Natural Power Company Ltd
Dr P Musgrove	National Wind Power Ltd
Mr D J Spode	North Cornwall District Council
Mr H A Thomas	Isle of Anglesey County Council
Ms E Tomalin	EcoGen Ltd
Mr M Trinick	Bond Pearce Solicitors
Dr J Warren	National Wind Power Ltd

September 1, 1996

Noise Working Group produce ETSU-R-97 guidelines for assessing wind turbine noise

Noise standard document produced by the Noise Working Group makes it plain that its purpose is to create guidelines that will promote the development of the wind industry by not placing "unreasonable restrictions on wind farm development or adding unduly to the costs and administrative burdens on wind farm developers or local authorities."



September 2, 1996

ETSU deliberately excludes testing inside homes

Without any supportive evidence, a 10 dB(A) buffer is assumed to occur inside homes compared to outside. No need to take measurements inside just deduct this 10 dB(A) from outside noise level readings and say that this is equivalent to the inside noise level.

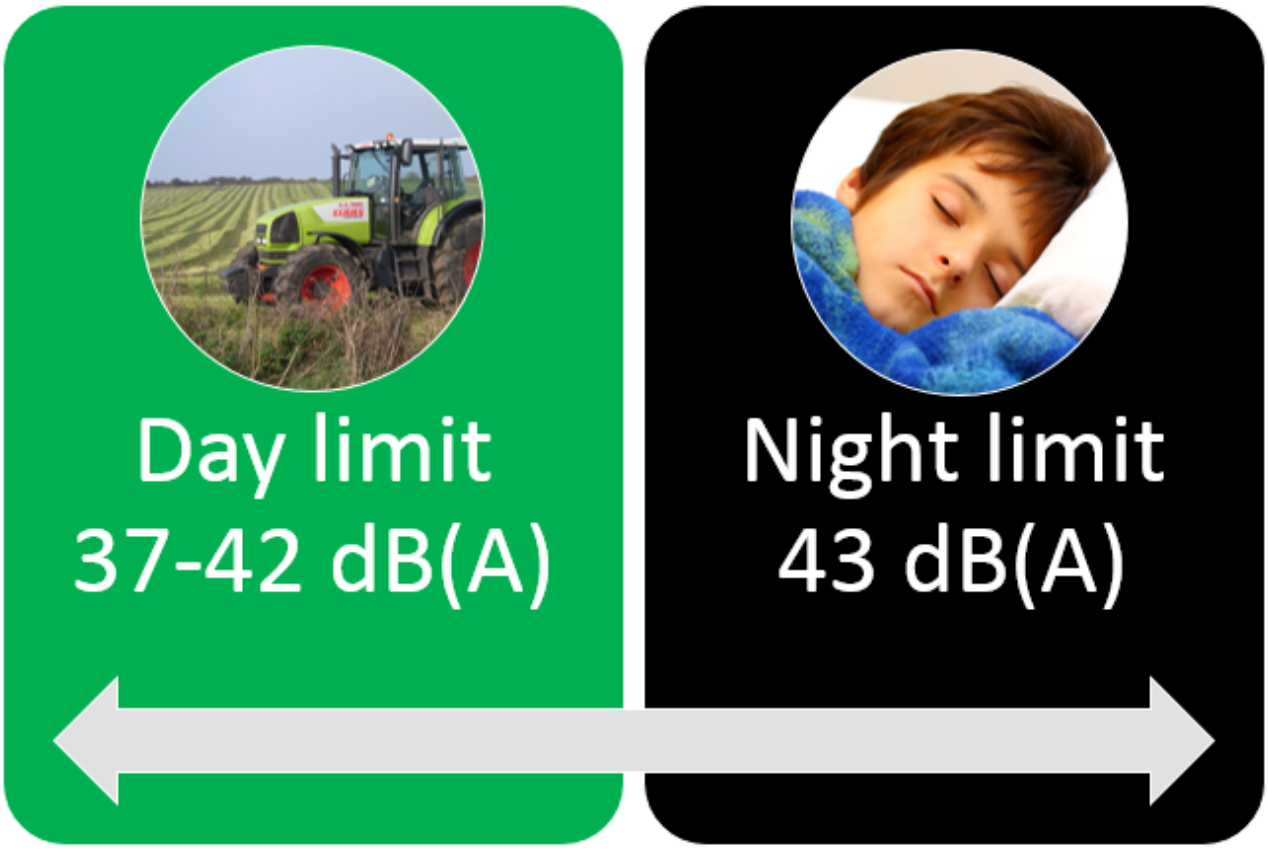
3.11 Further down page 60 it says that *On balance it is considered that a margin of 5dB(A)* (by which it means 7dB in BS4142 terms) *will offer a reasonable degree of protection to both the internal and external environment without unduly restricting the development of wind energy which itself has other environmental benefits.* There is no foundation whatsoever for this assertion. No evidence is brought forward or referred to.

3.12 So the position in the argument so far is this. The NWG has decided, without any foundation, that the 5dB "marginal significance" in BS4142 could be 7dB. It has decided, against all normal practice, that the background noise level for assessment purposes ought to be the average of background levels in any particular condition rather than the lowest level. In wind controlled background noise the average is likely to be at least 4dB more than a realistic background level. So the NWG consider that 11dB over background is appropriate for wind farms as against normal practice for industrial noise of 5dB over background noise. Of course I have to bear in mind that ETSU-R-97 does not purport to offer a method of assessment of impact. So the NWG is proposing that, for wind farms, a level of noise that is likely to give rise to complaints is appropriate because of the particular public benefits of wind farms. I cannot agree with this. As I exemplify elsewhere other projects of public benefit have to meet the stricter standard of 5dB above background.

September 3, 1996

ETSU sets night time noise limit higher than day time limit

ETSU sets night time noise limit high of 43dB(A), while day time limit is 37-42 dB(A). Critics write "The conclusions of ETSU-R-97 are so badly argued as to be laughable in parts (the daytime standard is based on the principle that it does not matter if people cannot get to sleep on their patio so long as they can get to sleep in their bedrooms). It is the only standard where the permissible night time level is higher than the permissible day time level."



September 6, 1996

ETSU avoids measuring LFN from wind turbines

The sampling and filtering protocols in ETSU remove the dominant LFN component of the noise emissions from wind turbines

Noise measurement

ETSU requires noise levels to be measured using the '$L_{A90\ 10min}$' measurement. In this case the 'A' indicates the A weighting measurement that most closely accords with the sensitivity of the human ear. However, given the significant low frequency content of wind turbine noise, the use of the C weighting measurement has been suggested by some acousticians and audiologists [Ref 38] to better indicate the true noise impact.

The '90' indicates the measurement of the noise level exceeded for 90% of the time. This measurement is effective for broadband noise such as traffic noise but not when measuring intermittent noise as produced by wind turbines. Some acousticians have proposed using the L_{A50} measurement [ETSU Ref 1 page 16] that indicates the noise level exceeded for 50% of the time or the L_{AEQ} the measurement indicating the equivalent continuous sound pressure level.

The '10 min' indicates the measurement is averaged over a 10 min period. This may work effectively when measuring broadband noises such as traffic noise but not when measuring intermittent noise as produced by wind turbines. It has already been proposed that the $L_{Aeq\ 125\ milliseconds}$ measurement be used to monitor for excess amplitude modulation.

September 7, 1996

ETSU does not measure aerodynamic modulation

Wind turbines emit highly intrusive LFN thumping noises (excess amplitude modulation) that are essentially filtered out and ignored by the measurement protocols recommended in the ETSU, thereby failing to protect residents from this annoyance. The noise is comparable to that of helicopters. Because of its LFN nature, the annoyance can be experienced at significant distances from turbines.

1. There is a phenomenon called aerodynamic modulation (AM) that causes wind turbine noise to take on a loud, "thumping" character and to become audible at a considerable distance from the wind turbines.

2. The fluctuating (amplitude modulated) noise caused by aerodynamic modulation is more noticeable and annoying than broadband noise of the same sound level.

3. The Government is aware of the existence of aerodynamic modulation and has acknowledged that it can be an issue in the case of planning applications for wind farms close to residences in low background noise areas. The Government has, however, refused to take action to update the noise guidelines embodied in ETSU-R-97.

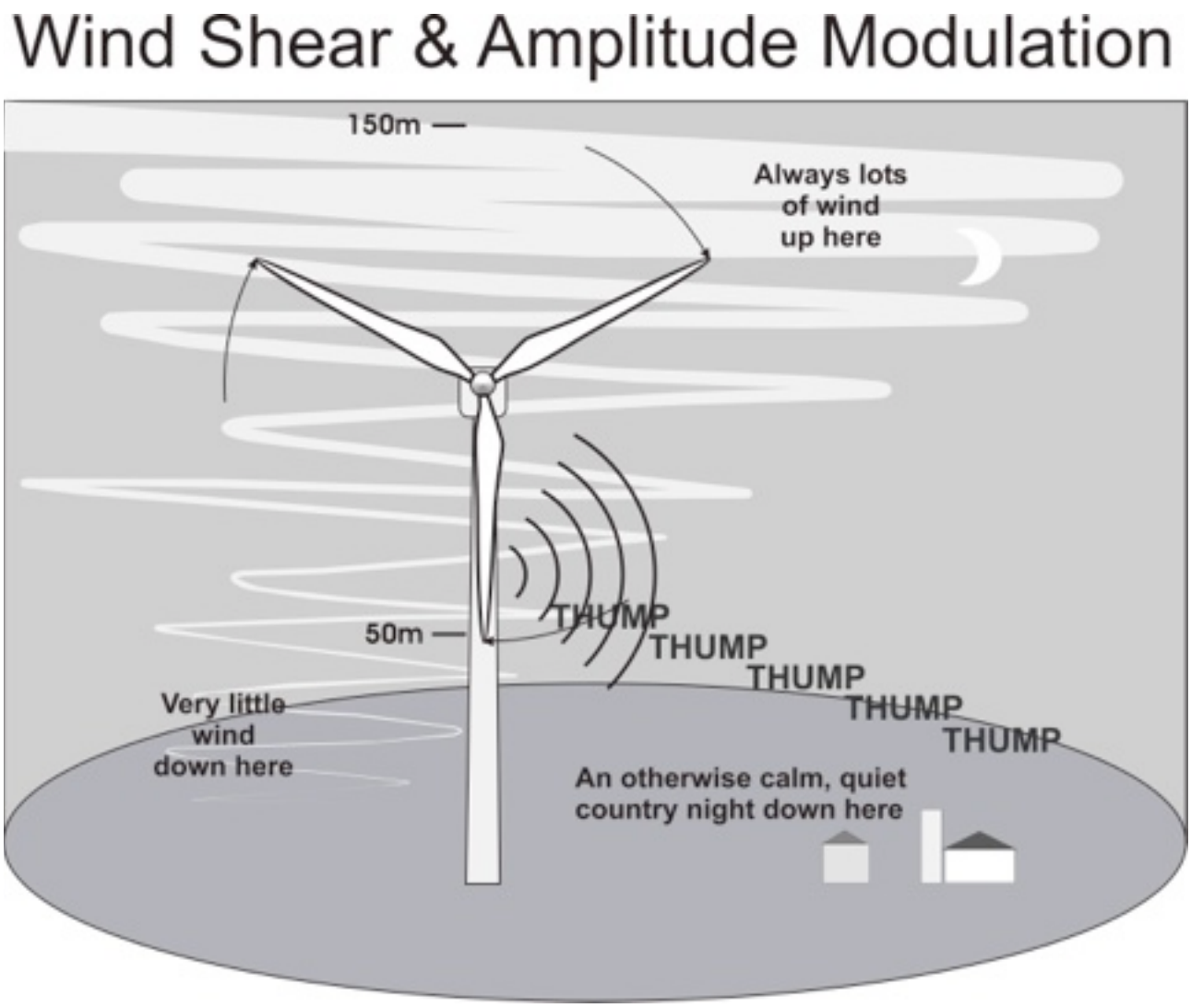
4. The noise monitoring recommended in ETSU-R-97 is totally ineffective in protecting residents from aerodynamic modulation noise, because the specified noise descriptor (LA90, 10min) ignores the noisiest 90% of each ten-minute measurement period and gives a result based on the loudest noise during the quietest 10% of the period.

5. ETSU-R-97's recommendation that noise monitoring is carried out at the nearest noise sensitive properties fails to take account of the fact that aerodynamic modulation noise can be heard at considerable distances from a wind farm and can be difficult to detect closer to the wind farm.

September 8, 1996

ETSU silent on wind shear and LFN propagation

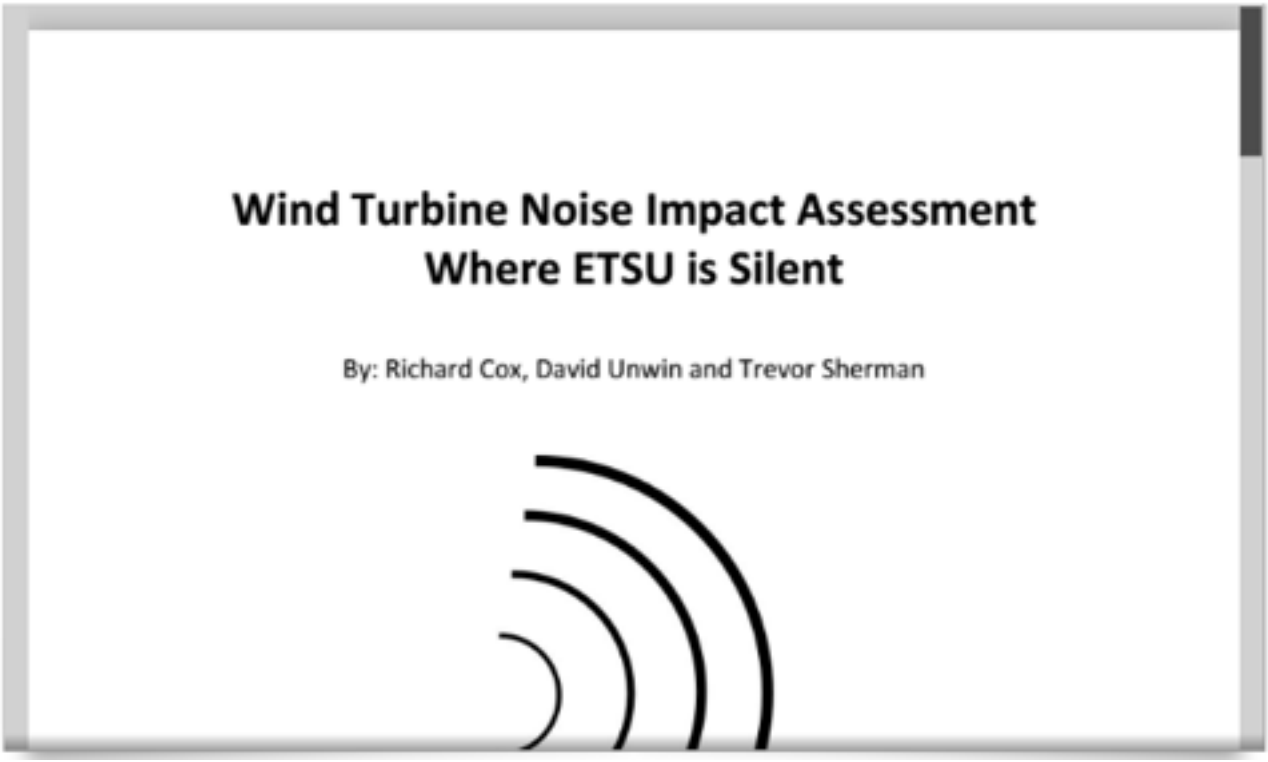
Wind shear occurs when wind speed at upper levels is higher than at lower elevations, which is common at night. This means there is more noise emitted and less masking of the noise at homes. Instead, the ETSU assumes as wind turbine noise increases, there will be a proportional increase in background noise due to increased wind speed.



October 1, 1996

ETSU falsely elevates background noise readings to hide noise produced by wind turbines

Under ETSU, background noise levels set the benchmark for turbine noise criteria. ETSU artificially elevated background levels by using techniques such as poor microphone shielding, limiting monitoring locations, sample size, sample time of day, sample duration, survey period, sample processing.



February 1, 2003 — March 1, 2003

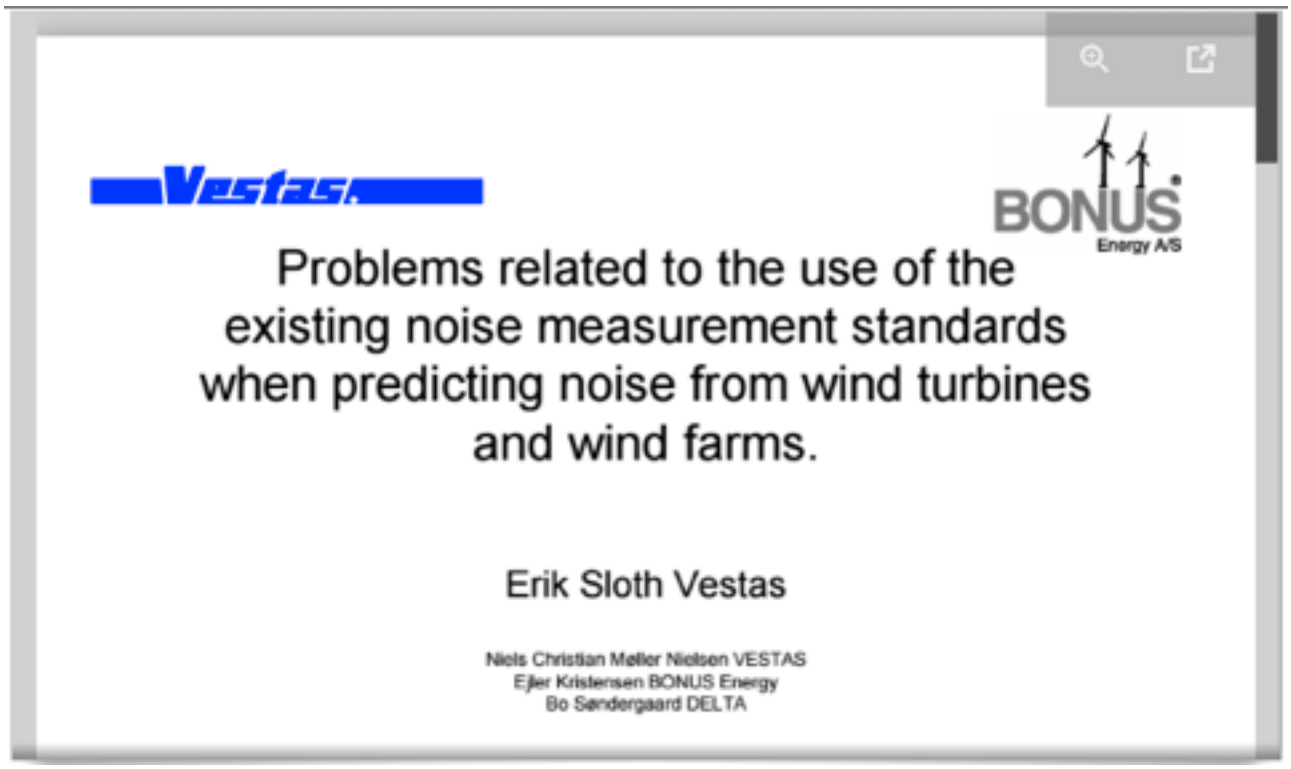
Australian 1st wind farm noise guidelines follow ETSU

South Australian EPA release Environmental Noise Guidelines: Wind Farms. The allowable noise limit is set at 35 dB(A). Section 2.2 specifies that the noise criteria for a new wind farm development should not exceed 35 dB(A). The guidelines follow ETSU: use of dB(A) as the exclusive noise measure; deliberating excluding LFN and testing inside homes. In relation to LFN and infrasound it writes: "The EPA has consulted the working group and completed an extensive literature search but is not aware of infrasound being present at any modern wind farm site". The EPA had never carried out any field research to support that assertion.

July 28, 2004

Wind industry knows noise models inadequate

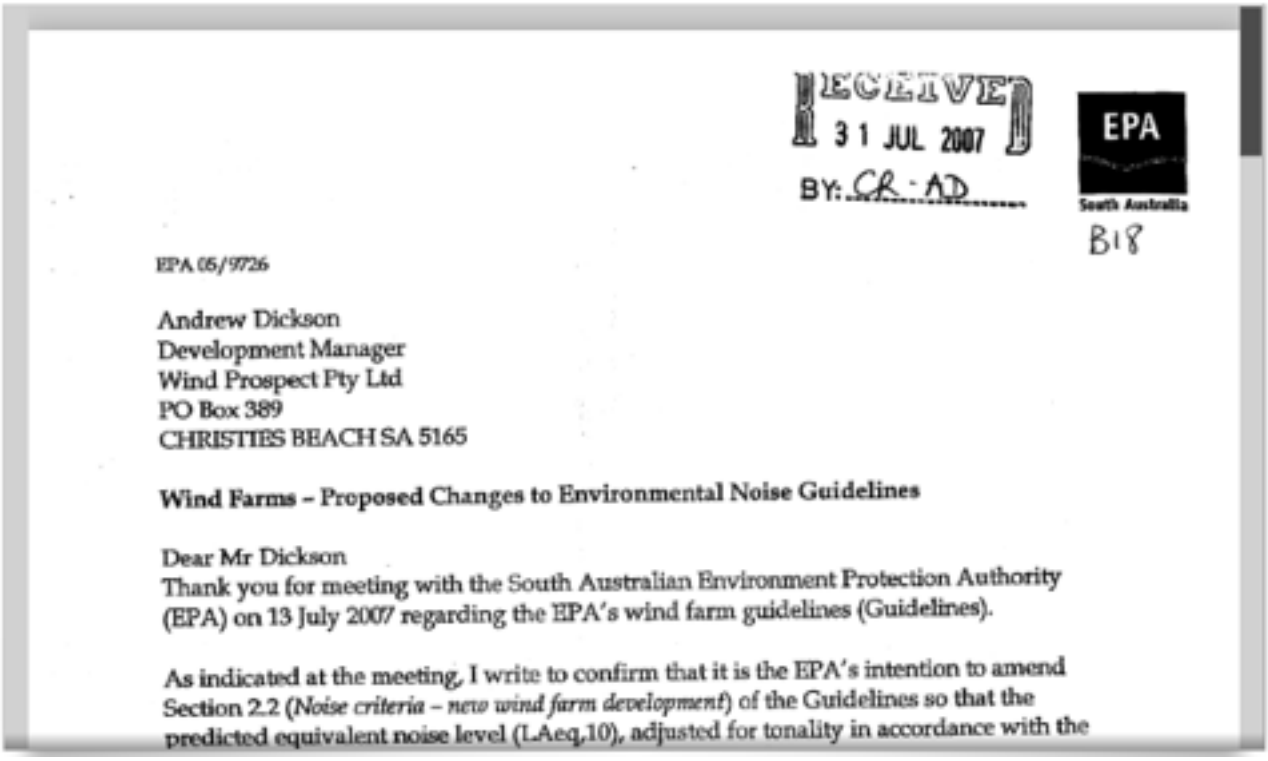
At a Australian Wind industry conference, AUSWEA, Eric Sloth from Vestas presented collaborative research findings (Vestas, Bonus, Delta - later named as Siemens) that confessed that their noise prediction models were inadequate and further research was required.



July 27, 2007

Australian wind industry increases turbine noise limit from 35 dB(A) to 40 dB(A)

This letter from the EPA confirms that the development manager from Wind Prospect was able to convince the SA EPA to up the allowable turbine noise limit from 35 dB(A) to 40 dB(A).



RECEIVED
31 JUL 2007
BY: CR - AD

EPA
South Australia

B18

EPA 05/9726

Andrew Dickson
Development Manager
Wind Prospect Pty Ltd
PO Box 389
CHRISTIES BEACH SA 5165

Wind Farms – Proposed Changes to Environmental Noise Guidelines

Dear Mr Dickson
Thank you for meeting with the South Australian Environment Protection Authority (EPA) on 13 July 2007 regarding the EPA's wind farm guidelines (Guidelines).

As indicated at the meeting, I write to confirm that it is the EPA's intention to amend Section 2.2 (*Noise criteria – new wind farm development*) of the Guidelines so that the predicted equivalent noise level (LAeq,10), adjusted for tonality in accordance with the

July 1, 2009

Sixty years of WHO research shows sleep deprivation, caused by noise, is a serious adverse health effect

The WHO reviews the available evidence and concludes sleep deprivation can lead to consequences for health and well-being. They write: "Sleep is a biological necessity and disturbed sleep is associated with a number of adverse impacts on health.... (and) is viewed as a health problem in itself (environmental insomnia), (as) it also leads to further consequences for health and well-being"

July 1, 2009

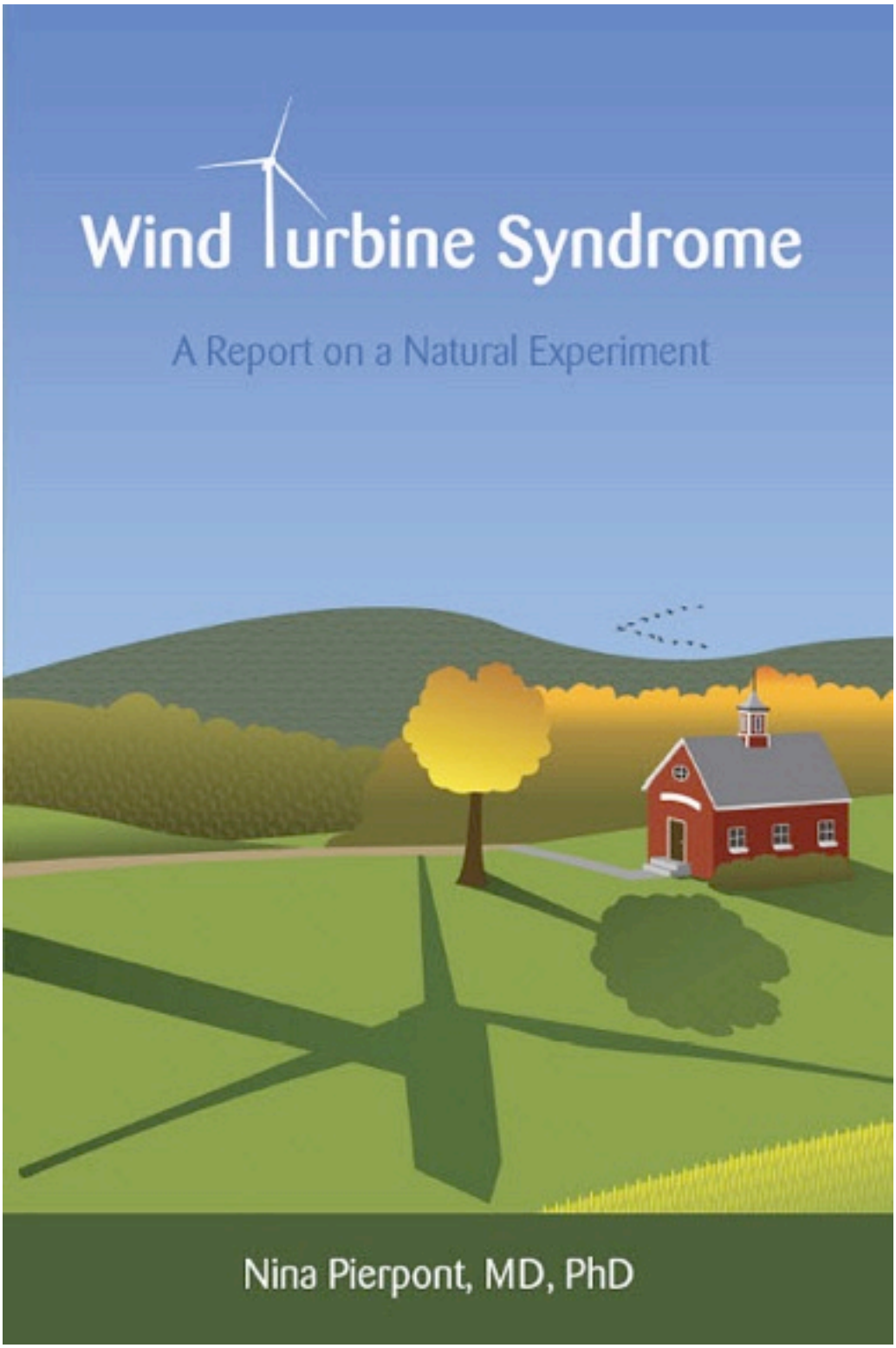
New version of EPA guidelines - limit up to 40 dB(A)

New version of SA EPA Environmental Noise Guidelines: Wind Farms. For no other reason than wind industry lobbying, the allowable noise limit is increased from 35 dB(A) to 40 dB(A). The guidelines continue to follow ETSU: use of dB(A) as the exclusive noise measure; deliberating excluding LFN and testing inside homes. In relation to LFN and infrasound it continues to assert: "The EPA has consulted the working group and completed an extensive literature search but is not aware of infrasound being present at any modern wind farm site". The EPA had never carried out any field research to support that assertion.

July 3, 2009

Wind turbine syndrome described

Dr. Nina Pierpont explains how turbine infrasound and LFN create the range of symptoms associated with Wind Turbine Syndrome. Case histories provided as supporting data.



January 1, 2011

Infrasound also generated by movement of the turbine tower

In a study to investigate and mitigate LFN and infrasound from wind turbines that interfere with seismic monitoring to detect nuclear detonations, it was shown that the wind turbine tower itself moves and this is another source of infrasound

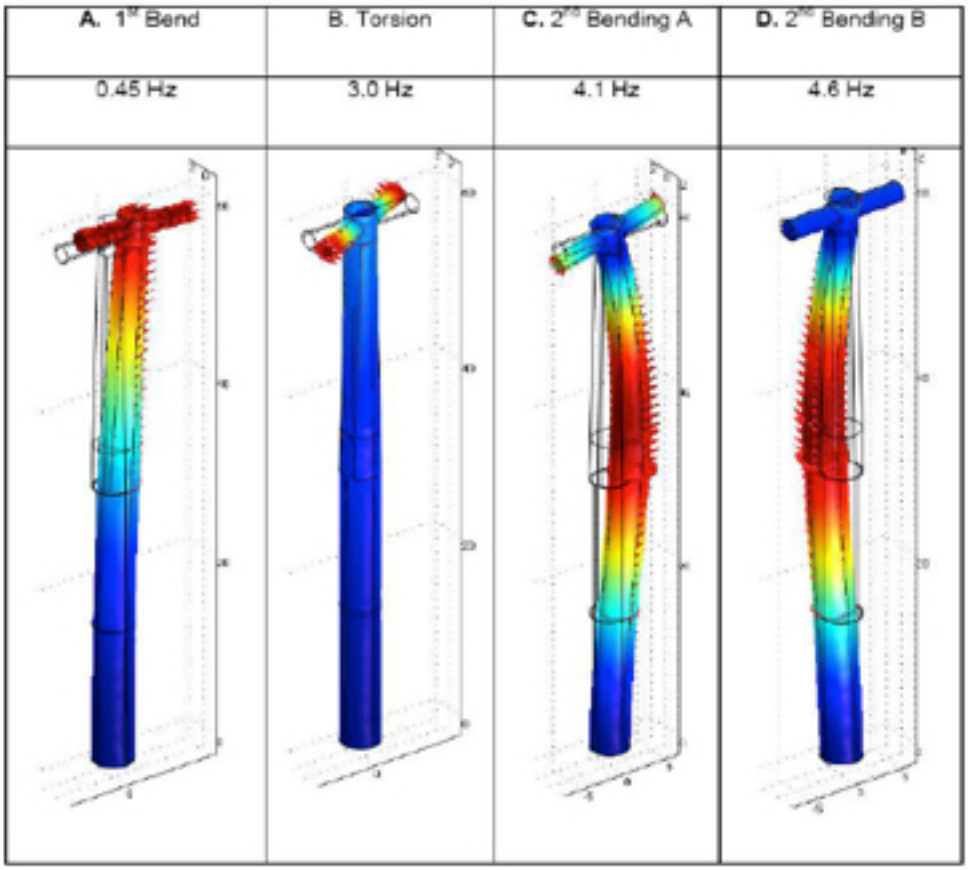


Figure 4. Frequency response based on FFT and eigenfrequency analysis of vibrations measured at the base of Tower 5 at Crystal Rig on a Nordex N80 wind turbine.

June 29, 2011

Vestas knew that low frequency noise from larger turbines needed greater setbacks

This is a letter from the CEO of Vestas, lobbying the Danish government not to bring in significant noise regulations, admitting that low frequency noise from larger turbines will increase setback distances needed for neighbours.

TRANSLATIONZ

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Vestas

Karen Ellemann, Minister of Environment
Department of Environment
Højbro Plads 4
1200 Copenhagen K

[StampcRECEIVED
BY THE DEPARTMENT
30 JUNE 2011]

Date
Randers, 29 June 2011/erkjs

Dear Karen Ellemann,

Following previous correspondence, I am writing this letter to express my concern regarding the limits for low frequency noise from wind turbines now being proposed.

Back in January 2011 we applauded your announcement of the new regulations regarding low frequency noise and the fact that you also then emphasised that those regulations would not be tightened and that it was a question of improving the security in connection with the installation of wind turbines. Accordingly, the reaction

December 1, 2011

Draft NSW guidelines for wind farms released for discussion

New guidelines for wind farm operation are drafted. Some LFN testing proposed and C-weighting used. Lower noise limits (drop from 40 to 35 dB(A) are proposed. 2km setback. No in home testing performed.

March 1, 2012

Vestas attempt to avoid LFN measurement

Wind turbine manufacturer Vestas implores NSW government to remove any reference to LFN and exclude any testing, Also ask for noise limits to stay at 40 dB(A).

Vestas

Vestas Australian Wind Technology Pty Ltd

14 March 2012

Policy, Planning Systems and Reform
NSW Department of Planning and Infrastructure
GPO Box 39
SYDNEY NSW 2001

By email: innovation@planning.nsw.gov.au

Dear Sir/Madam

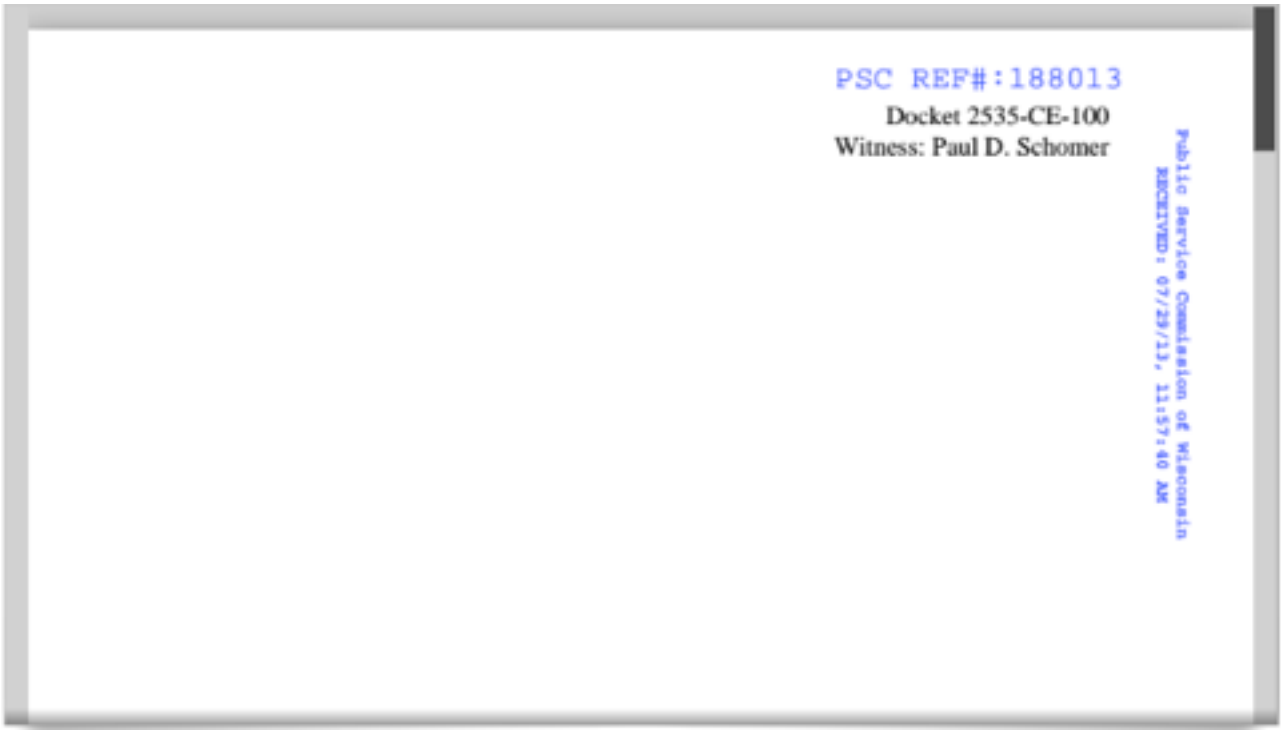
DRAFT NSW PLANNING GUIDELINES: WIND FARMS

Thanks you for the opportunity to make a submission on the *Draft NSW Planning Guidelines: Wind Farms* (**the Draft Guidelines**).

August 1, 2013

Wind developers refuse to cooperate with noise impact studies

Paul Schomer, George Hessler and Rob Rand investigates the Shirley Wisconsin wind farm acoustic annoyance and concludes "Most residents do not hear the wind-turbine sound; noise annoyance is not an issue. The issue is physiological responses that result from the very low-frequency infrasound and which appears to be triggering motion sickness in those who are susceptible to it." Schomer laments the difficulty of studying wind turbine annoyance when developers refuse to cooperate by allowing on-off testing.

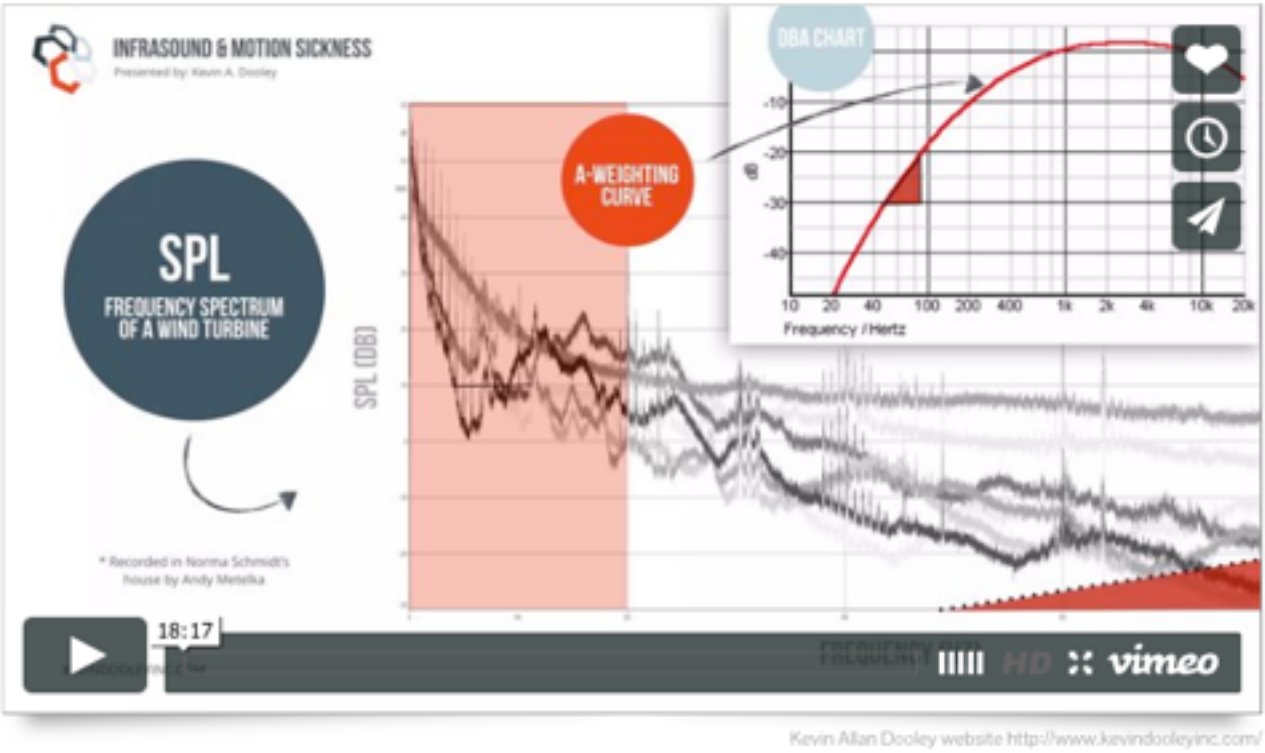

PSC REF#:188013
Docket 2535-CE-100
Witness: Paul D. Schomer

Public Service Commission of Wisconsin
RECEIVED: 07/29/13, 11:57:40 AM

September 1, 2014

Cones of wind turbine infrasound hypothesis and motion sickness

Kevin Dooley proposes that 'cones' of infrasound exposure from wind turbines is related to motion sickness symptoms.



October 1, 2014

Ontario Council enacts new by-law including infrasound from wind farms

Under the bylaw, if a resident complains about infrasound, the municipality would hire an engineer qualified to take the measurements before laying a charge. If a company is found guilty – can range from $500 to $10,000 per offense and could exceed $100,000 if the offense continues. The municipality recoups the cost of the specialized testing under the bylaw.

CORPORATION OF THE TOWN OF PLYMPTON-WYOMING

BY-LAW Number 62 of 2014

Being a by-law to provide for the regulation of wind turbine noise within the Town of Plympton-Wyoming

WHEREAS section 9 of the Municipal Act, 2001, S.O. 2001, c. 25, as amended, provides that a municipality has the capacity, rights, powers and privileges of a natural person for the purpose of exercising its authority under this or any other Act;

AND WHEREAS subsections 11(2) and 11(3) of the *Municipal Act, 2001* provides that a municipality may pass by-laws respecting: in paragraph 5 of s.11(2), Economic, social and environmental well-being of the municipality; in paragraph 6 of s.11(2), Health, safety and well-being of persons; in paragraph 7 of s.11(2), Services and things that the municipality is authorized to provide under subsection (1); in paragraph 8 of s.11(2), Protection of persons and property; in paragraph 9 of s.11(3), Animals; in paragraph 7 of s.11(3), Structures including fences and signs;

AND WHEREAS subsection 14(1) of the *Municipal Act, 2001* provides that a by-law is

October 1, 2014

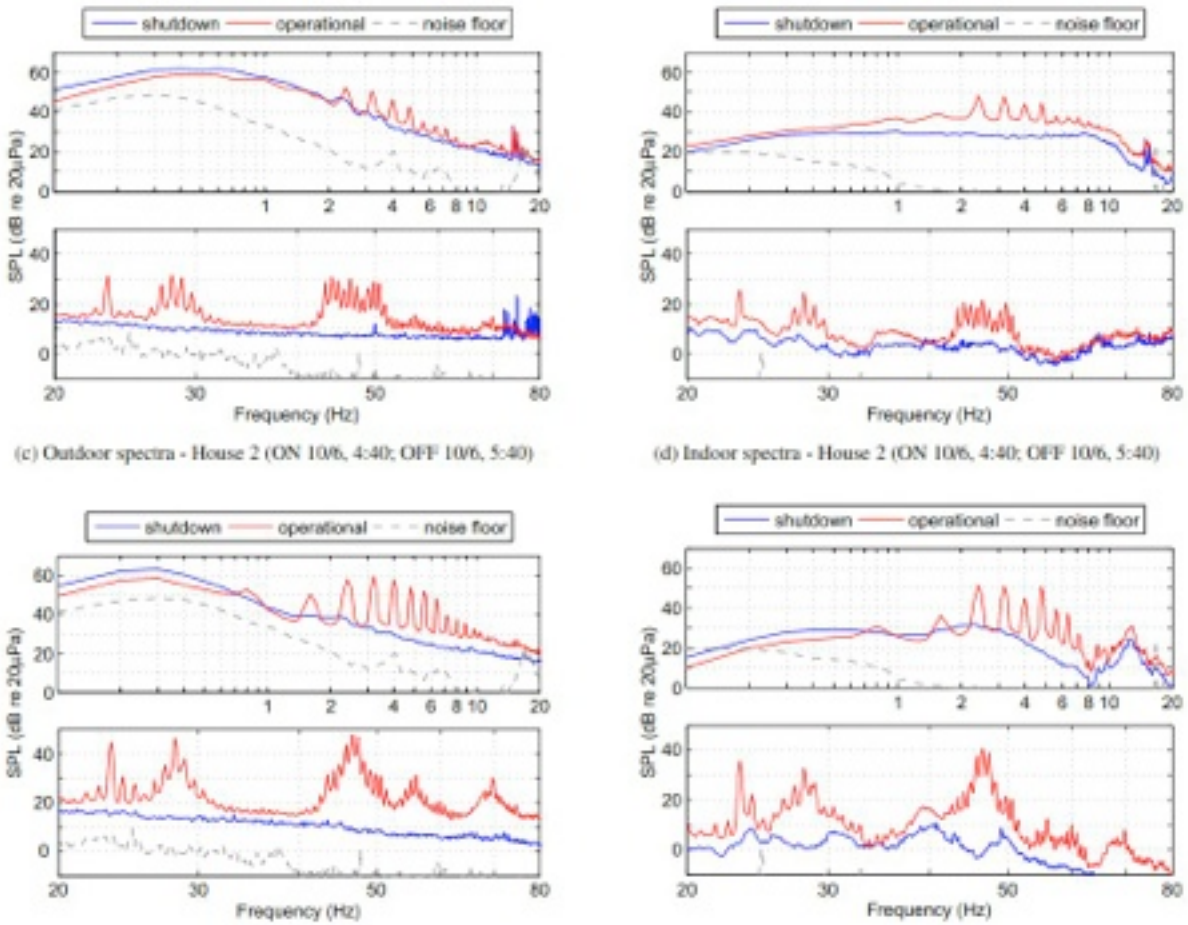
US Wind farm declared 'Hazard to Human Health'

The Brown County Board of Health declared the Shirley-Wisconsin wind farm a " … Human Health Hazard for all people (residents, workers, visitors, and sensitive passersby) who are exposed to Infrasound/Low Frequency Noise and other emissions potentially harmful to human health."

November 1, 2014

Infrasonic wind turbine signature in homes

Private noise testing still was happening inside peoples homes because they were suffering. However this was happening without the co-operation of the wind turbine operators. They refuse to provide on-off testing to demonstrate that the turbines are causing the infrasonic pulses inside their homes or provide hub-height wind speed data to determine wind shear. One such study was underway at Waterloo South Australia when a cable fault allowed de facto on-off testing to be conducted. They demonstrate that the 'wind turbine signature' of the pulses created by the blades passing the tower is only evident when turbines are operational.



(c) Outdoor spectra - House 2 (ON 10/6, 4:40; OFF 10/6, 5:40)

(d) Indoor spectra - House 2 (ON 10/6, 4:40; OFF 10/6, 5:40)

(e) Outdoor spectra - House 3 (ON 29/7, 3:25; OFF 26/7, 1:55)

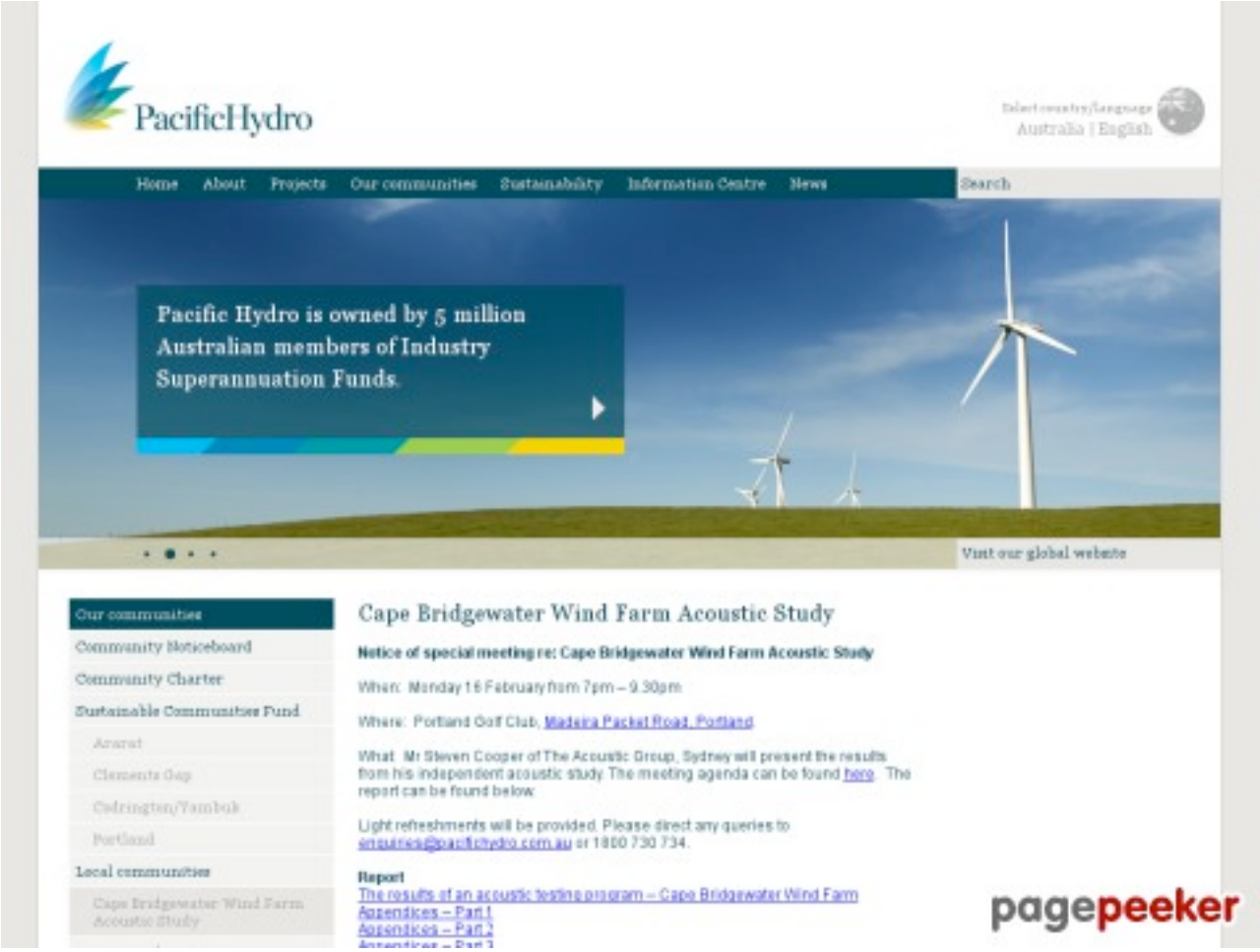
(f) Indoor spectra - House 3 (ON 29/7, 3:25; OFF 26/7, 1:55)

Figure 6 – Comparison of outdoor and indoor narrow-band spectra with local wind conditions similar to wind farm shutdown conditions

November 14, 2014

Cause and effect relationship established - Turbine LFN and human sensation of annoyance in homes

Commissioned by Pacific Hydro, and performed by Steven Cooper at Cape Bridgewater with 6 individuals who kept diaries of the sensations they were experiencing. Parallel in-home testing of turbine noise revealed wind turbine signature and its presence correlated with annoyance as recorded in participant diaries. A cause and effect relationship is undeniable.



December 1, 2014

Evidence mounts that wind turbines impact on health

21 peer reviewed papers on the adverse health effects of wind turbines

REVIEW / REVUE

Industrial wind turbines and adverse health effects

Roy D. Jeffery, MD, CCFP, FCFP
Manitoulin Island, Ont.

Carmen M.E. Krogh, BScPharm
Brett Horner, BA, CMA
Killaloe, Ont.

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This article has been peer reviewed.

Introduction: Some people living in the environs of industrial wind turbines (IWTs) report experiencing adverse health and socioeconomic effects. This review considers the hypothesis that annoyance from audible IWTs is the cause of these adverse health effects.
Methods: We searched PubMed and Google Scholar for articles published since 2000 that included the terms "wind turbine health," "wind turbine infrasound," "wind turbine annoyance," "noise annoyance" or "low frequency noise" in the title or abstract.
Results: Industrial wind turbines produce sound that is perceived to be more annoying than other sources of sound. Reported effects from exposure to IWTs are consistent with well-known stress effects from persistent unwanted sound.
Conclusion: If placed too close to residents, IWTs can negatively affect the physical, mental and social well-being of people. There is sufficient evidence to support the conclusion that noise from audible IWTs is a potential cause of health effects. Inaudible low-frequency noise and infrasound from IWTs cannot be ruled out as plausible causes of health effects.

December 1, 2014

Sleep deprivation by wind turbine noise: a dose-response relationship identified

Danish study concludes that noise from wind turbines increases the risk of annoyance and disturbed sleep in exposed subjects in a dose-dependent relationship. The higher the dose or exposure to LFN and infrasound, the worse the disruption to sleep.

PLOS | ONE

RESEARCH ARTICLE

Health Effects Related to Wind Turbine Noise Exposure: A Systematic Review

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Abstract

Background: Wind turbine noise exposure and suspected health-related effects thereof have attracted substantial attention. Various symptoms such as sleep-related problems, headache, tinnitus and vertigo have been described by subjects suspected of having been exposed to wind turbine noise.

Objective: This review was conducted systematically with the purpose of identifying any reported associations between wind turbine noise exposure and suspected health-related effects.

Data Sources: A search of the scientific literature concerning the health-related effects of wind turbine noise was conducted on PubMed, Web of Science, Google Scholar and various other Internet sources.

Study Eligibility Criteria: All studies investigating suspected health-related outcomes associated with wind turbine noise exposure were included.

Results: Wind turbines emit noise, including low-frequency noise, which decreases incrementally with increases in distance from the wind turbines. Likewise, evidence of a dose-response relationship between wind turbine noise linked to noise annoyance, sleep disturbance and possibly even psychological distress was present in the literature. Currently, there is no further existing statistically-significant evidence indicating any association between wind turbine noise exposure and tinnitus, hearing loss, vertigo or headache.

Limitations: Selection bias and information bias of differing magnitudes were found to be present in all current studies investigating wind turbine noise exposure and adverse health effects. Only articles published in English, German or Scandinavian languages were reviewed.

Conclusions: Exposure to wind turbines does seem to increase the risk of annoyance and self-reported sleep disturbance in a dose-response relationship.

OPEN ACCESS

Citation: Schmidt JH, Klokker M (2014) Health Effects Related to Wind Turbine Noise Exposure: A Systematic Review. PLoS ONE 9(12): e114183. doi:10.1371/journal.pone.0114183

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Data Availability: The authors confirm that all data underlying the findings are fully available without restriction. All relevant data are within the paper.

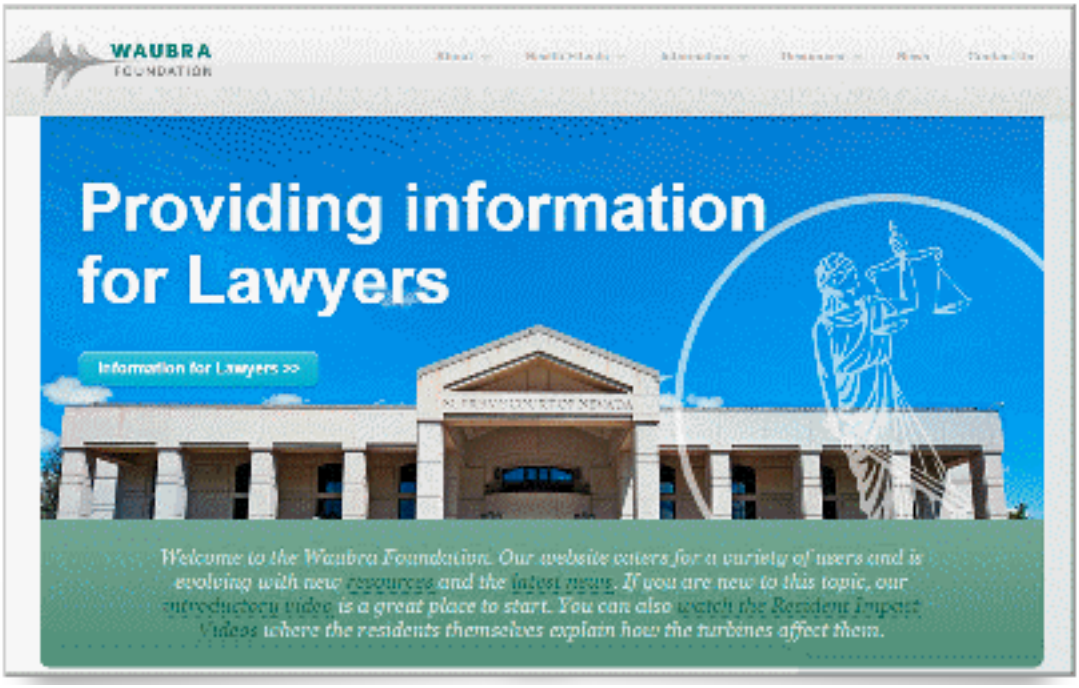
Funding: The authors have no support or funding to report.

Competing Interests: The authors have declared that no competing interests exist.

February 14, 2015

The story so far ...

We have now come full circle - just as was found 30 years ago - the dB(A) noise filter is totally irrelevant, infrasound LFN is the cause of adverse heath effects and as this is not attenuated, but is often amplified by structures, in-home testing must be used to protect neighbours. Find out more, as the story continues to develop through the Waubra Foundation, a not-for-profit organisation that represents the communities that have been adversely impacted by wind turbines.

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