

Wind Turbine Noise and Adverse Health Effects

What Was Known in the 1980's About Wind Turbine IFLN and Turbulence

Constructively addressing the current conundrum about precisely what is causing the reported symptoms, sensations, sleep disruption and deteriorating mental and physical health of residents living near industrial wind turbines around the world, and trying to prevent such damage to health in future, has not been helped by ignoring important research findings of the past, particularly those of Dr Neil Kelley and his co researchers, and other NASA researchers during the 1980's. ^{1,2,3}

For those who are not aware, Dr Kelley and his co researchers at the Solar Energy Research Institute ("SERI") identified in 1985 that the cause of the symptoms euphemistically called "annoyance" for the residents living near a single downwind-bladed turbine was impulsive infrasound and low frequency noise (ILFN) from that wind turbine, which then resonated within some building structures. ⁴ The effects were consistently reported to be worst in small rooms facing the noise source. ⁵ Sensitisation or "conditioning" was also acknowledged ⁶ – in simple terms people **did not habituate to the sound energy** but became sensitised to it. What was also clearly established was that perception of the sound energy was well **below the audibility thresholds** for hearing in the infrasound range. ⁷

Subsequent laboratory experiments using volunteers working for SERI (rather than wind turbine noise sensitised residents) reproduced the sound energy and the variable effects on those exposed. ⁸ In other words, **direct causation** of the reported "annoyance" effects from the impulsive reproduced sound energy identical to "wind turbine noise" **was clearly established**. This research was presented to the international wind industry at the American Wind Energy Association Windpower conference in 1987, sponsored by the US Department of Energy. ⁹

Subsequent NASA research in Hawaii by Shepherd and Hubbard in 1989 showed that **modern upwind-bladed wind turbines could also generate higher than expected infrasound and low frequency noise, especially when the inflow air was turbulent**. ¹⁰ This occurs when wind developers site wind turbines too close together. More recent work by Laratro et al ¹¹ has confirmed that tip vortices have only just broken down at 7 rotor diameters (using free stream speed of 10m/s), providing empirical support for a **minimum** of 7 rotor diameter separation distance.

Despite the scientific acoustic knowledge from the 1980's that infrasound and low frequency noise could be generated by both downwind-bladed **and** upwind-bladed wind turbines, and that these frequencies could directly cause symptoms including sleep disturbance, the global wind industry, and noise pollution regulatory authorities have not measured the full acoustic spectrum, and in particular have ensured that accurate measurement of both infrasound and low frequency noise inside homes is not included in wind turbine noise pollution regulations. It is clear

that these regulations, developed with wind industry assistance, have favoured the expansion of the wind industry, at the expense of public health. ¹²

The following photo shows the wake turbulence generated by wind turbines, from a maritime wind development in the Atlantic called Horns Rev. ¹³ The turbulence extends to a significant distance many kilometres away, and increases significantly when subsequent turbines are downwind and receive the turbulent inflow of air. These are the precise conditions which Shepherd and Hubbard ¹⁴ demonstrated in 1989 markedly increase the generation of ILFN from upwind-bladed wind turbines.



Acousticians

Acousticians as a profession are far more knowledgeable about the range of symptoms and sensations directly caused by exposure to infrasound, low frequency noise, audible noise, and vibration than most health professionals, with the exception of some occupational physicians ^{15,16} and some ear nose and throat specialists. ^{17,18,19,20} These symptoms are commonly called “annoyance”.

Rural Health Practitioners

Rural health practitioners ^{21,22,23,24,25,26,27,28,29} have been at the forefront of trying to raise the alarm with health authorities and their colleagues about the severity of the

impacts and clinical consequences they are seeing, particularly over the last ten years. So far, those concerns have not resulted in any multidisciplinary concurrent acoustic and health research, despite the Australian Federal Senate Inquiry's recommendation for research "as a priority" in June 2011.³⁰

Flawed Literature Reviews, Studies, Research Proposals and Reports

Some of these and their critiques are available on our website,³¹ and include:

- AWEA CANWEA 2009 Literature Review by Colby et al³²
- Australia's National Health and Medical Research Council's 2010 "Rapid Review"³³
- Health Canada Study, proposed 2012, and currently underway³⁴
- the Victorian Department of Health, April 2013.³⁵
- the South Australian Environmental Protection Agency's Waterloo Wind Development acoustic survey³⁶,
- the Australian National Health and Medical Research Council's commissioned Systematic Literature Review released in 2014³⁷
- the Australian Medical Association position paper, March 2014³⁸

The only explanation for these flawed studies/reports/position statements is that the issuers/authors wished to promote and protect the wind industry, at the expense of the health of the rural neighbours to these wind projects. These rural residents are sometimes openly referred to as "**collateral damage**" or "**policy roadkill**" by wind developers and some of the public servants who promote the business interests of the wind industry.

Others Who Deny the Existence and Severity of the Adverse Health Effects

There are others who continue to deny or ignore the existing peer reviewed published evidence of consistent distress and harm to health from wind turbine noise, recently catalogued by Drs Lynn and Dr Arra from the Grey Bruce Health Unit in Ontario, whose literature review has now been peer reviewed and published.³⁹

In Australia, the most outspoken "denier" of harm to health from exposure to wind turbine noise is a sociologist and public health Professor⁴⁰ at Sydney University, whose PhD examined aspects of cigarette advertising. Professor Simon Chapman recently assisted VESTAS with the launch of their "Act on Facts" campaign.⁴¹

Professor Chapman has been invoking the "nocebo" hypothesis for some time prior to conducting his own research,^{42,43} but more recently he has cited new research from New Zealand by PhD candidate, Fiona Crichton⁴⁴ to support his frequent assertions that scaremongering is itself **causing** the symptoms.

Crichton et al's research used unrepresentative frequencies, exposure levels and durations unrelated to the varying impulsive characteristics of wind turbine noise. Exposure duration was only 10 minutes during the day, with subjects who were fit young adults. Crichton's research has been strongly criticised by experts in audiology⁴⁵ and acoustics.⁴⁶

In contrast, rural residents are exposed to wind turbine noise day **and night** when the wind is blowing, for up to 25 years, and are reporting their sleep is regularly and repeatedly disturbed in addition to a range of other effects which directly correlate with exposure to operating wind turbines. Rural residents are often not young, and may have chronic pre-existing physical and mental illnesses, which make them more vulnerable to the adverse consequences of chronic sleep disturbance and stress.

No Research Evidence for Nocebo Effect in Wind Turbine Neighbours

Inconveniently for Crichton and Chapman, whilst there is no doubt that a nocebo effect exists in the general research literature, there is no such evidence of a "nocebo effect" collected **directly** from wind turbine affected residents in the peer reviewed research, nor is it consistent with the clinical, acoustic and psychoacoustic findings of health practitioners and researchers from the UK,⁴⁷ Australia,⁴⁸ Scandinavia,⁴⁹ the United States,⁵⁰ Canada,⁵¹ & New Zealand.⁵² Interestingly, the "nocebo effect" is never used by Chapman with respect to identical symptoms occurring in residents exposed to and affected by ILFN from coal mining or gas fired power stations.

The final word on the nocebo nonsense currently being peddled by some is from Dr Michael Nissenbaum, who had this to say about non physicians invoking the use of a diagnosis of "the nocebo effect" in his final response to the Australian Federal Senate Inquiry in November, 2012.⁵³

*"... suggesting a diagnosis of 'nocebo' without investigating, 'boots on the ground', for more plausible, better understood, or more logical causes of a medical condition **would normally constitute medical malpractice** in most Western-based medical systems, including Australia. Individuals who are not physicians are not limited by this professional mandate or even necessarily this conceptual framework.*

Sleep Deprivation and Physiological and Psychological Stress

There is extensive clinical experience and a body of peer reviewed research evidence, which supports clinical concerns about the adverse health consequences of both chronic sleep deprivation, and chronic stress, regardless of the specific cause of that sleep deprivation or stress.^{54,55,56,57} Dr William Hallstein, a psychiatrist from Falmouth, USA stated the following in a recent letter to the Falmouth Board of Health⁵⁸:

"In the world of medicine illnesses of all varieties are destabilized by fatigue secondary to inadequate sleep. Diabetic blood sugars become labile, cardiac

rhythms become irregular, migraines erupt and increase in intensity, tissue healing is retarded, and so forth, across the entire field of physical medicine. Psychiatric problems intensify and people decompensate. Mood disorders become more extreme and psychotic disorders more severe.”

Those who are young and fit report taking longer to be adversely impacted by exposure to wind turbine noise, unless they have underlying physical and mental health conditions or acknowledged risk factors such as a history of migraines, inner ear pathology or motion sickness, which make them more vulnerable or susceptible.

Dr Hallstein goes on to state the following ⁵⁹:

“People with no previously identified psychiatric illness are destabilized by sleep deprivation. Sleep deprivation experiments have repeatedly been terminated because test subjects become psychotic; they begin to hallucinate auditory and visual phenomena. They develop paranoid delusions. This all happens in the “normal” brain. Sleep deprivation has been used as an effective means of torture and a technique for extracting confessions.”

There are many clinical clues and some animal and human research which strongly suggest that disturbance of the vestibular sensory system, and the consequent sleep disturbance and physiological stress are integrally related and that the direct causal link is sound and vibration energy, whether it is frequencies above 200 Hz, or frequencies in the infrasound or low frequency noise spectra below 200 Hz. This research, ^{60,61,62,63} together with the clinical and research evidence of Vibro Acoustic Disease ^{64,65} resulting from chronic exposure to infrasound and low frequency noise, can no longer be ignored.

Behaviour of Acousticians

It is long overdue for all acousticians to act according to their professional codes of ethics ^{66,67} and to put the interests of the health and safety of the community **first**, and to work collegiately with health professionals who are trained in accurate diagnosis of specific clinical conditions. To date, acousticians working as paid consultants with the noise polluting industries have unfortunately all too often chosen to ignore the reported adverse impacts and “shoot the messengers” namely the concerned health practitioners, fellow acousticians or other researchers. That approach will not solve the current problems with respect to wind turbine siting and noise pollution regulation, or the serious damage to health being caused by other sources of infrasound and low frequency noise.

The Kelley research from nearly 30 years ago established a baseline of operating parameters to help prevent annoyance and consequent deterioration in health from chronic exposure to infrasound and low frequency noise,⁶⁸ yet these parameters have never been implemented.

The ethical responsibilities of these members of the various acoustical societies who have assisted with writing the noise guidelines for government are clear – *it is a primary responsibility of acousticians to protect the health of the public.* ⁶⁹ The ethical responsibilities of the medical profession similarly would appear to have been neglected in the case of wind turbine noise.

The health of rural residents has clearly not been protected, and nor has this been the priority of public officials, both elected and public servants who are responsible for public health, noise pollution regulation, planning or siting of wind turbines.

Concerns are being raised internationally about breaches of human rights, resulting from both breaches of professional ethics and statutory duties of care. ⁷⁰

Abuses of Human Rights

Australia is a signatory to the UN Convention against Torture. ⁷¹

Sleep deprivation is acknowledged as a method of torture. ⁷² Sensory bombardment from noise and light have also been used as methods of torture, documented in the report by Physicians for Human Rights called “*Leave No Marks*”. ⁷³

Australia ratified the treaty of the Convention of the Rights of the Child in December 1990, which the UN adopted in 1989, and therefore Australian governments have a responsibility to ensure that all children in Australia have the rights set out in the Convention. ⁷⁴ In Australia some children and their families have been unable to continue to live in their homes because of serious adverse health impacts, which have affected children’s health, and affected their schooling. Others report their children’s sleep and health is regularly adversely affected.

It would therefore appear that serious breaches of human rights and breaches of a number of UN Conventions are occurring as a result of this systemic regulatory failure on the part of State and Federal responsible authorities, whose wind turbine noise guidelines and planning regulations and guidelines are clearly not protecting the health of the public, including WHO acknowledged vulnerable groups such as children and the elderly. ⁷⁵

The Victorian Government was first warned of serious adverse health effects resulting from exposure to wind turbine noise in 2004 by Dr David Iser. ⁷⁶

Justice Muse in Falmouth USA issued an injunction in December 2013 to prevent two wind turbines from operating overnight, in order to prevent “***irreparable harm to physical and psychological health***” of residents in Falmouth USA. ⁷⁷

The lack of effective action at all levels of government in Australia to prevent the ongoing irreparable harm to physical and psychological health to Australian rural residents is unacceptable, and must be urgently addressed.

There is no reason that similar injunctions to prevent wind turbines from operating overnight could not be immediately imposed and enforced at those wind developments where noise nuisance and adverse health effects are occurring. Daytime exposure limits to infrasound and low frequency noise according to the Kelley 1985 criteria could be immediately implemented.⁷⁸ Turbine separation distances could and should be immediately mandated at a minimum of 7 rotor diameters, in order to prevent future avoidable planning disasters.

The harm to human health is serious, and preventable.

We know enough now, to act immediately, to prevent further irreparable and serious harm to physical and psychological health at existing wind developments.

Waubra Foundation

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<http://waubrafoundation.org.au/resources/responses-nhmrc-draft-information-paper-systematic->

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 75. See for example the following WHO documents: Community Noise, 1999 <http://waubrafoundation.org.au/resources/who-guidelines-for-community-noise-2/> and 2009 WHO Night Noise Guidelines for Europe <http://waubrafoundation.org.au/resources/who-night-noise->

- [guidelines-for-europe/](#) and 2011 WHO Environmental Noise, Burden of Disease from Environmental Noise <http://waubrafoundation.org.au/resources/who-burden-disease-from-environmental-noise/>
76. Dr David Iser's letters to Victorian Premier and Ministers <http://waubrafoundation.org.au/resources/dr-david-iser-2004-conducts-first-survey-patients-living-near-wind-project/>
 77. Falmouth USA decision by Justice Muse 2013 <http://waubrafoundation.org.au/resources/us-judge-rules-wind-turbine-neighbours-suffer-irreparable-harm/>
 78. The Kelley parameters are at footnote 10 of the Waubra Foundation's Explicit Warning Notice <http://waubrafoundation.org.au/2013/explicit-warning-notice/>