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Professor Warwick Anderson
Professor John McCallum
Professor Bruce Armstrong
NHMRC

Sent via email

11th April, 2014

Open Letter

Dear Professors Anderson, McCallum and Armstrong,

This letter is the formal response of the Waubra Foundation to the NHMRC commissioned Systematic Review and the NHMRC's Draft Information Statement concerning wind turbines and adverse health effects. I note that the public has not been invited to comment on the Systematic Review, however in light of the serious issues which have arisen about that document and because the draft information statement relies heavily upon the Systematic Review, this has been sent directly to you, and is a public document.

As you know, the Chairman of the Waubra Foundation, Mr Peter Mitchell, is an observer on the NHMRC Literature Review Panel, and is bound by a strict confidentiality agreement. Accordingly no discussion with Mr Mitchell about the Panel's deliberations has taken place with any Board member, including any discussion about either the Systematic Review or the Draft Information Statement. Mr Mitchell has had no involvement in the preparation of this document, and the contents of it have not been discussed with him. The comments relate solely to the wind turbine noise evidence.

We are pleased the NHMRC has acknowledged the lack of concurrent full spectrum acoustic measurements together with objective physiological monitoring of sleep (EEG), blood pressure, heart rate and biochemical markers of physiological stress such as cortisol. We hope that identification of this important gap in knowledge (which we identified to the first Federal Senate Inquiry three years ago) is immediately addressed with thorough independent multidisciplinary research, conducted by researchers with no conflict of interest, and that the sole motivation of the research is the prevention of harm to human health from environmental noise.

We would like to see such multidisciplinary research extended to include other environmental noise sources.

Yours sincerely

Sarah Laurie, CEO Waubra Foundation
Bachelor Medicine, Bachelor Surgery, Flinders University, 1995

SYSTEMATIC LITERATURE REVIEW

The NHMRC have not invited public comments on the Systematic Literature Review, however as this document forms the basis for the NHMRC Draft Information Statement, the Foundation has looked at the Systematic Literature Review document closely and found serious cause for concern. Those concerns are outlined below.

We note that the document has been peer reviewed, however no details have been provided about the identity or qualifications of the Canadian Peer Reviewers, in particular their expertise and knowledge in the field of environmental noise, clinical medicine, acoustics, or research in related areas, and possible conflicts of interest, both disclosed and undisclosed.

That may explain why these issues were not detected earlier.

General Comments re Exclusions

A systematic review should indeed provide *“a scientific analysis of all of the highest quality evidence available on a topic”* (p 9 last sentence under “Review Questions” in the systematic review document) **however if some of the scientific evidence has deliberately been excluded from consideration at the beginning, or the literature search focus is too narrow, or there are conflicts of interest which introduce bias into the information provided, it will not achieve that aim.**

The Systematic Literature Review document states the protocol was “developed jointly” (p 27) although the decision to deliberately exclude the 3 “case series” was the sole decision of the NHMRC Literature Review Panel Members.

It is the view of the Waubra Foundation that the very narrow approach to the literature search for this subject area, as well as exclusions of known relevant research and misclassifications of specific studies resulting in their exclusion has resulted in a dangerously misleading document. Any subsequent Draft information statement based on this Systematic Literature Review will be similarly dangerously incomplete, and misleading. As a consequence it will fail to assist governments to adopt a truly precautionary approach, to protect its citizens from predictable and known harm to human health.

Excessive Environmental & Night Time Noise, & Sleep disturbance

Residents living near industrial noise emitting developments such as coal mines, CSG field compressors, gas fired power stations as well as wind turbines, are consistently reporting repetitive sleep disturbance and symptoms of physiological stress as well as deteriorating health.

There is a large body of relevant research relating to the adverse health consequences of chronic sleep disturbance and chronic stress, regardless of the cause. One important recent meta analysis by Capuccio et al was provided to the Systematic Literature Team but was excluded (p 266) because “the population was unsuitable”.

Whilst the population in this meta analysis was not exclusively wind turbine sleep deprived residents, clearly the findings that cardiovascular disease was associated with insufficient sleep is of great relevance to a population group whose main reported adverse health effect, acknowledged in the limited research literature, is sleep disturbance. The cause of the sleep disturbance is immaterial to the downstream health effects, but the consequences are clear. The Capuccio meta analysis is available here:

<http://waubrafoundation.org.au/resources/sleep-duration-predicts-cardiovascular-outcomes/>

Professor Alun Evans has recently written about the folly of ignoring the cardiovascular consequences from sleep deprivation here: <http://waubrafoundation.org.au/resources/evans-prof-emeritus-review-wind-farms->

[and-health/](#) . Another very recent review article dealing with the cardiac consequences of environmental noise exposure is equally relevant and should be included:

<http://waubrafoundation.org.au/resources/munzel-t-et-al-cardiovascular-effects-environmental-noise-exposure/>

Increasingly sleep deprivation, physiological stress and cardiovascular disease are recognised to result from exposure to excessive environmental noise at night. This important body of research is contained in documents such as the WHO guidelines on night noise, environmental noise and international community noise literature reviews from as far back as 1995. None of that information appears to have been accessed.

Is Excessive noise an issue for residents?

Unlike the Sydney airport noise emissions monitored online at WEBTRAK, there is no transparent objective full spectrum acoustic data at any of these residential locations, either outside or inside the residents' homes, so their true exposures to sound energy at different frequencies are not known unless they have the financial means to pay for the acoustic research and survey work themselves. Few people have those resources.

However, there is limited acoustic evidence which supports the view that noise guidelines may be regularly exceeded in some locations. There is the additional issue that those noise pollution guidelines are themselves inadequate to protect sleep and health, particularly because they do not include measurement of the full acoustic spectrum, and are not continuously and transparently monitored. Dr Neil Kelley et al established nearly thirty years ago that infrasound and low frequency noise impulsive emissions (not currently measured) could cause sleep disturbance and other symptoms the researchers called "annoyance".

There appears to be an inherent assumption in this Systematic literature review that residents are not exposed to excessive environmental wind turbine noise, especially at night, and that wind turbine noise regulations will always be adhered to and limits will never be exceeded. Reports from the residents and results from some limited acoustic monitoring independently conducted at arms length from the wind developers and noise pollution regulatory authorities would suggest otherwise.

Publicly available real time continuous full spectrum noise monitoring will soon establish what the actual exposures to different frequencies are. The sooner that happens the better.

"Annoyance" – what is it?

A subset of these people also report symptoms which UK Acoustician Professor Geoffrey Leventhall has identified as known to him for years to be "***symptoms of annoyance from environmental noise***", but which others especially those trained in the diagnosis of human diseases are increasingly calling "wind turbine syndrome" (WTS) or "infrasound and low frequency noise syndrome" (ILFNS). Academic socioacoustic researchers use the term "annoyance" to mean something else again.

Use of the term "highly annoyed" to refer to someone who is acutely suicidal, who medical practitioners would refer to as a "psychiatric emergency" is but one example of the misunderstanding caused between the different professional groups by the use of this word. Medical practitioners do not generally understand what others such as researchers and acousticians mean when they use the word "annoyance" as it is not a clinical diagnostic descriptor, and usage hides the range and severity of the specific adverse health impacts.

The sound frequencies below 200 Hz which directly cause these "annoyance" symptoms from wind turbine sound emissions were identified nearly 30 years ago by Dr Neil Kelley and a large team from 15 Research institutions including two branches of NASA, and funded by the US Government Department of Energy.

Kelley et al (SERI / NASA) Research – excluded

Assertions that there is no evidence of “direct causation” of symptoms from impulsive wind turbine generated infrasound and low frequency noise (ILFN) have been untrue since Kelley et al’s acoustic field research in 1985 Mod 1 Acoustic Survey <http://waubrafoundation.org.au/resources/kelley-et-al-1985-acoustic-noise-associated-with-mod-1-wind-turbine/>

Dr Neil Kelley led a large team of researchers from 15 different research institutions to investigate why a small number of people living within a couple of kilometers of a single downwind bladed Mod 1 wind turbine were experiencing a range of characteristic symptoms long called “annoyance” by acoustic engineers.

Kelley and his team established that impulsive infrasound and low frequency noise from the wind turbine was directly causing the annoyance symptoms, including repetitive sleep disturbance. The sound energy was resonating within some homes more than others, and therefore amplifying those frequencies.

Direct causation was subsequently confirmed in volunteers by the 1987 Kelley laboratory study, which confirmed the direct causation of annoyance symptoms from exposure to impulsive infrasound and low frequency noise (ILFN) frequencies, generated in a specially constructed laboratory. <http://waubrafoundation.org.au/resources/1987-problem-with-low-frequency-noise-from-wind-turbines-scientifically-identified/>

This Kelley research has been known to the wind industry since 1987, when it was presented at the American Wind Energy Association Conference in California. Its importance was acknowledged, because it resulted in a dramatic change in design of wind turbines (downwind bladed to upwind bladed on a single tower) in order to try and reduce the generation of ILFN frequencies.

The Kelley research papers were sent to the NHMRC in July 2013, and receipt was acknowledged.

No reason has been given in the Systematic Literature Review for exclusion of this crucially important research which established direct causation of annoyance symptoms from wind turbine generated impulsive infrasound and low frequency noise in 1985.

I note that whilst there was a cut off date of September 2012 for material being considered by the Systematic Literature Review Team, it is clear that some acoustic field research was provided to the Systematic Literature Review team which was completed *after* that date – namely the SA EPA Resonate Acoustics Report of their acoustic survey, which is quoted at length in the Systematic Literature Review. The date of that report was January 2013, some four months after the cut off date of September 28th 2012. I also note that the date of publication of the Systematic Literature Review was December, 2013, some 5 months after the Kelley research was provided by me to the NHMRC.

The wind industry’s predictable excuse that “the Kelley research is only applicable to downwind bladed wind turbines” is not based on scientific evidence or principles. Harvey Hubbard’s work shows that similar doses of sound energy resulted in identical symptoms from a different noise source – in other words the human impact is dependent on the dose and sound energy characteristics rather than the source of the sound energy. <http://waubrafoundation.org.au/resources/hubbard-h-1982-noise-induced-house-vibrations-human-perception/>

Animal studies - excluded

There is no scientific justification for the decision to exclude research data from properly conducted peer reviewed animal studies.

No reasons were given for this decision.

Animal studies have long been used in toxicology studies, and this is precisely how the National Institutes of Environmental Health Sciences (NIEHS) approached their 2001 Literature review of infrasound, which included studies in languages other than English. <http://waubrafoundation.org.au/resources/infrasound-brief-review-toxicological-literature/>

There is useful information relating to animal studies, which for example showed a direct causal relationship between infrasound stimulus and responses such as adrenaline release (Nishimura), evidence of a physiological stress mechanism. One of the few studies of chronic exposure showed evidence of organ damage caused by prolonged chronic infrasound exposure for 2 months in rats (Dadali et al). The resulting organ damage was not noted in the intervention group who were given anti oxidants, and the mechanism was therefore concluded to involve oxidative stress. Other animal studies reported ischaemic damage to heart muscle resulting from lack of blood flow.

These animal studies all suggest that at high enough doses of infrasound for prolonged exposures, physiological changes and even organ damage can indeed occur so this is relevant mechanistic evidence, deliberately excluded from consideration. The possibility that these physiological and pathological responses could be occurring in humans who are exposed chronically to wind turbine infrasound and low frequency noise is clear, because the animal studies have established some of the mechanisms with exposure to ILFN. What is not yet clear is what the exposure doses are, and what the consequences of chronic exposure at lower doses might be for prolonged periods of time.

The effect of this joint decision by both the NHMRC Literature Review Panel and the Systematic Literature Review team members to exclude all the animal research data, means that vital information about known pathophysiological mechanisms and direct causation was not included in the literature review.

Two bodies of work including highly relevant animal laboratory research which have been excluded from consideration by this literature review include the following:

- nearly 3 decades of animal and human research, initially inspired by unusual serious human pathological findings in a group of aviation workers exposed to high levels of occupational infrasound and low frequency noise, led by Pathologist Dr Nuno Castelo Branco and Biomechanical Engineer Professor Mariana Alves Pereira. The following comprehensive review article details some of their more important research <http://waubrafoundation.org.au/resources/vibroacoustic-disease-biological-effects-infrasound-alves-periera-castelo-branco/>
- the physiological mechanisms of damage from infrasound exposure, including all of Professor Alec Salt's team's work establishing the numerous ways infrasound can physiologically affect the inner ear in guinea pigs, by inducing a condition called "endolymphatic hydrops" which produces the symptoms similar to Meniere's disease in susceptible people (identical to the "wind turbine syndrome" (WTS) symptoms of nausea, tinnitus and vertigo, with a sensation of fullness in the middle ear); and by inducing an "alerting response" resulting in a physiological stress response. The following review article summarises the key research and its implications for those who continue to deny or ignore the established scientific evidence <http://waubrafoundation.org.au/resources/salt-n-lichtenhan-j-t-how-does-wind-turbine-noise-affect-people/>

Human Case Studies - excluded

Professor Warwick Anderson made it plain in his evidence to the first Federal Senate Inquiry on March 31, 2011 that anecdotal evidence is useful, and it forms the basis for developing subsequent research hypotheses. <http://waubrafoundation.org.au/resources/social-and-economic-impact-rural-wind-farms-prof-warwick-anderson-nhmrc/>

Astute and careful clinical observations are the genesis of clinically relevant research. Therefore the information gleaned from case studies conducted by knowledgeable professionals working at the front line

and seeing the pathology and measuring the noise, is a starting point and should have been included. Such data with both clinical findings and full spectrum acoustic data is rare and therefore of high value.

Valuable case studies fitting these criteria excluded from this systematic literature review include the following, which I have described in some detail so there is an understanding of why they should have been included for consideration in this NHMRC systematic review.

- **the Alves Pereira 2007 case study documenting the clinical findings of VAD in residents and animals near a Portuguese wind development**, and the measurement of the actual full spectrum wind turbine noise acoustic spectrum. There is now subsequent followup information available about that case, which should be considered in its entirety, the most recent update being a letter published in the Australian and New Zealand Journal of Public Health by the two lead investigators. <http://waubrafoundation.org.au/resources/alves-pereria-m-castelo-branco-n-ltr-australian-new-zealand-journal-public-health/> That data provides a rare glimpse at the progression of documented and investigated VAD over time – such longitudinal data with ongoing exposure is almost nonexistent.
- **The Bruce McPherson Infrasound and Low frequency noise Acoustic study from Falmouth, USA**, December 2011. This was initially written up as a detailed acoustic survey report, and was subsequently edited and published in a peer reviewed journal article. Robert Rand and Stephen Ambrose unexpectedly experienced acute WTS symptoms while conducting the acoustic survey, which were relieved by leaving the premises. These two acoustic engineers had not experienced those symptoms before despite plenty of previous work measuring wind turbine noise for wind developers, and a longstanding professional career working to solve noise control problems. It took both acoustic consultants some time to recover (days – weeks). Both are now “sensitized” to ILFN and experience identical symptoms when they conduct this sort of acoustic monitoring and are re exposed. <http://waubrafoundation.org.au/resources/bruce-mcpherson-infrasound-low-frequency-noise-study/>

These case studies are the “canaries in the coal mine”, with evidence of damage to health or physiological and psychological symptoms caused directly by ILFN from wind turbine emissions. They are of special importance to the residents and the health practitioners at the front line of trying to look after and understand the new pathologies and some unfamiliar conditions they are seeing.

It is of note that litigation has subsequently occurred in both Portugal, and in Falmouth USA, and the turbines have been either pulled down (Portugal) or ordered to cease operating overnight (Falmouth) because of the harm to human health caused by the wind turbines established in those two cases to the satisfaction of the respective presiding judges.

<http://waubrafoundation.org.au/2014/portugese-supreme-court-orders-four-wind-turbines-removed/>
<http://waubrafoundation.org.au/resources/us-judge-rules-wind-turbine-neighbours-suffer-irreparable-harm/>

“Case Series” studies – misclassified and excluded

Three studies conducted by the first three rural medical practitioners to collect any data in this field and identified by the reviewers as “case series” were deliberately excluded from consideration, because of a decision taken by the NHMRC Literature review Panel.

I note that according to the usual NHMRC inclusion criteria for a systematic literature review, case series studies would usually be included, albeit as the lowest grade of evidence at Level 4. This can be seen from Table 4 on page 38 of the Systematic Review, entitled “*NHMRC Evidence Hierarchy: designations of levels of evidence (excerpt) – aetiology research questions only*”.

No reasons were given to justify this decision to exclude case series data from this particular systematic literature review apart from a “lack of comparative data”. **Given the widely acknowledged general lack of data and research in this area, this decision seems highly irregular.**

It is noteworthy that these three studies were each conducted by trained and experienced rural medical practitioners, all of whom had direct detailed and first hand knowledge of the clinical presentations of people reporting the symptoms, and were well aware of the severity of the impacts for some people. Indeed it was their direct knowledge of the severity of the reported symptoms, and the lack of information about this “new” disease to clinical medicine, which led Dr Harry, Dr Iser and Dr Pierpont to decide to conduct their studies.

The systematic literature review team pointed out on three different occasions that the decision to exclude the case series was not theirs, but was made solely by the NHMRC Literature Review Panel. On page 33 in Box 1 which lists the inclusion criteria for the study, note a) states “*case series were excluded on the advice of the reference group, given lack of comparison group*”. On page 42 the systematic literature review states that “*Harry (2007), Iser (2004) and Pierpont (2009) were case reports and case series, and so were excluded on the advice of the Reference Group (see page 30).*”

Why has there been “special treatment” on this occasion to exclude these three “case series” studies for this particular systematic literature review, especially given the lack of systematically collected data generally, and especially given the first hand knowledge of the treating medical practitioners of the seriousness of the reported health problems and the direct correlation of the reported symptoms with exposure to wind turbine noise?

Furthermore, and of even greater concern, the three studies excluded are not all “case series”.

Dr Amanda Harry’s study is certainly a case series, and was the first of its kind in the world. Dr Harry’s additional training in the discipline of Ear Nose and Throat medicine and her collaboration with UK Physicist Dr Manley gave her additional insights into the possible reasons for the pathology being reported by her patients and subsequently captured in her survey. <http://waubrafoundation.org.au/resources/dr-amanda-harry-groundbreaking-survey-sick-residents/>

The usual NHMRC protocol should have been followed, and this study should have been included as part of the material considered by the systematic literature review team.

Dr David Iser’s “case series” is really a Population Survey

Dr David Iser’s study was described in the exclusion table as a “case series” but in fact it was a small population survey, and was conducted at Toora in 2004. So the excuse that it was a “case series” and did not have comparative data is untrue. This study should therefore be included.

Dr Iser had comparative data – his study included the population within 2km. They reported variable effects - some were not affected, some were moderately affected and some were seriously affected. Prominent amongst Dr Iser’s conclusions from his data was that the symptoms and health problems were predominantly related to sleep deprivation and stress for those people who reported adverse health impacts. <http://waubrafoundation.org.au/resources/dr-david-iser-2004-conducts-first-survey-patients-living-near-wind-project/>

Many of these people in the survey were also Dr Iser’s longstanding patients, so he knew what their health had been like prior to the turbines, and what happened subsequently. Those residents seriously adversely impacted were bought out by the developer, silenced, and subsequently left their homes. Slater and Gordon have publicly confirmed that their clients were silenced as part of the property buy out agreements and inferred this was not an isolated incident. <http://waubrafoundation.org.au/resources/slater-gordon-acknowledge-confidentiality-clauses/>

Dr Nina Pierpont's "case series" is really a Case Series Crossover Study

Even more concerning is the omission of Dr Nina Pierpont's study from the systematic literature review, on the grounds that it was a "case series" and "did not have comparative data". Dr Pierpont's study was misclassified as a case series or series of case reports. Her study was made available to the first Federal Senate Inquiry along with the raw data, and is readily available from the senate website, and our own <http://waubrafoundation.org.au/resources/dr-nina-pierpont-submission-australian-senate-inquiry/>

Dr Pierpont's study is a "case series crossover" design of study, similar to those used in pharmacoepidemiology to study "*the association of transient drug exposures with acute outcomes*" and in such situations "*the case-crossover design is an efficient alternative to the case-control approach.*" <http://smm.sagepub.com/content/18/1/53.abstract>

In other words, **this particular study design is a particularly powerful design because people act as their own controls**, and this eliminates some confounders and sources of bias, which can be problematic with other study designs. The connection between exposure and symptoms becomes very obvious for each individual with their own unique susceptibility to whatever the toxic agent is. Repeated exposure at sufficient dose will predictably induce a response, whether it is a food or drug allergen causing an acute allergic reaction, or ILFN exposure causing characteristic symptoms.

This study design therefore gives useful dose response information in individuals who are susceptible and so is particularly suited to study exposure responses to ILFN. Important information about both direct causation and dose response relationships can be obtained if the "dose" is measured at the same time as the physiological responses and symptoms are being measured or recorded, and then subsequently replicated to obtain longitudinal data.

Exclusion of Dr Pierpont's case series cross over study has been achieved by both misclassification of the study type as a "case series", and then the exclusion of all "case series" studies by the NHMRC Literature Review Panel Members.

Case Series would normally be included in such a systematic literature review according to the NHMRC's own criteria (Table 4, p 38).

I note that on the NHMRC's own criteria, a case-control study design is considered to be a level III-3 study, (Table 4, p 38). Therefore as the case series cross over design is considered to be "*an efficient alternative to the case-control approach*" Dr Pierpont's study would appear to be well within the criteria listed for inclusion with the nominated study design criteria for this systematic review.

There therefore appears no justification for omitting Dr Nina Pierpont's study in this Systematic Literature Review.

The reason given in the table listing the reasons for non inclusion of the various studies including Dr Pierpont's study was the alleged "*lack of comparative data*" (p 270)

Dr Pierpont's study is *based* on comparative data.

There are in fact two different categories of comparative data.

Firstly, Dr Pierpont's study compared the individual symptoms and health status of people prior to exposure to operating wind turbines, and what happened during exposure to wind turbine noise, followed by what happened when they reduced their exposures. Reduction of exposure was because they were forced to abandon their home temporarily or permanently because of one or more family member's serious ill health.

Secondly, there was also comparative data between different family members with the same comparative exposures living in the same home (albeit with some differences in daytime exposure where people worked or

studied away from home), which helped Dr Pierpont identify individual susceptibility factors for developing symptoms of WTS, which were migraine, motion sickness and pre existing inner ear pathology including industrial deafness.

Professor Geoffrey Leventhall, an acoustic consultant who regularly works for the wind industry, has acknowledged Dr Pierpont's contribution in establishing these susceptibility factors whilst being cross examined in court in Ontario (personal communication, Eric Gillespie, Ontario lawyer).

Other researchers have independently confirmed each of these individual risk factors for developing either WTS symptoms or VAD, further confirming the replicability and therefore clinical validity of Dr Pierpont's work and research findings. Some examples follow, in addition to Otoneurologist Dr Owen Black, who provided confirmatory clinical agreement with Dr Pierpont's findings based on his work with US Naval divers and others impacted by ILFN from other sources. (see <http://waubrafoundation.org.au/resources/dr-owen-f-black-md-neuro-otologist-re-wind-turbine-syndrome/>, and further detail about Dr Black's expertise in this area of medicine is here: <http://waubrafoundation.org.au/resources/dr-f-owen-black-m-d-memorium/>)

Dr Hakan Enbom, Swedish Otoneurologist (specialist in vestibular disorders) conducted his PhD in the area of migraine. Dr Enbom considers that what occurs to people exposed to wind turbine infrasound and low frequency noise is that the impulses of sound energy is triggering migraine and vestibular symptoms which are part of a clinical condition recognized as part of a central hypersensitivity condition. <http://waubrafoundation.org.au/resources/enbom-h-infrasound-from-wind-turbines-can-trigger-migraine-and-related-symptoms/> So Dr Enbom, independently of Dr Pierpont, also recognized the role of impulsive ILFN as a migraine trigger, which could also result in other vestibular symptoms such as dizziness and nausea.

Drs Farboud and his ENT specialist colleagues from the UK have also recognized a connection between exposure to wind turbine generated infrasound and low frequency noise and symptoms being reported in their patients, which prompted Dr Farboud and his colleagues to conduct their own literature review. <http://waubrafoundation.org.au/resources/wind-turbine-syndrome-fact-or-fiction-farboud-et-al/>

Ms Clare Paller and Professor Phil Bigelow from the University of Waterloo in Ontario have reported on a cross sectional study they conducted in Ontario commissioned by the Ministry of the Environment, where they found a dose response relationship existed for symptoms of what they named as "wind turbine syndrome" which included sleep disturbance, tinnitus and vertigo. <https://www.wind-watch.org/documents/exploring-the-association-between-proximity-to-industrial-wind-turbines-and-self-reported-health-outcomes-in-ontario-canada/>

Dr Steve Rauch (ENT specialist , Harvard) has diagnosed a Falmouth resident with "wind turbine syndrome"(personal communication with the resident) as he can find no other cause for her symptoms. This was also reported by Professor Alec Salt (<http://waubrafoundation.org.au/resources/salt-n-lichtenhan-j-t-how-does-wind-turbine-noise-affect-people/>)

Dr Sandy Reider, Family Physican, Vermont USA has described "wind turbine syndrome" as a euphemism and prefers instead to call it vestibulo acoustic trauma syndrome, in order to emphasise the severity of the symptoms which can occur, and their impacts. (<http://waubrafoundation.org.au/resources/dr-sandy-reider-testimony-calls-for-moratorium-wind-farms/>)

Dr Paul Schomer, Director of Acoustics Standards in the USA has identified a history of motion sickness as one of the susceptibility factors for developing symptoms of severe nausea and vertigo in the vicinity of operating wind turbines, and referred to previous research involving pilots and motion sickness symptoms. He was unaware of the findings of Dr Nina Pierpont with respect to risk factors at the time he wrote his paper, and had not read her study. <http://waubrafoundation.org.au/resources/schomer-et-al-wind-turbine-noise-conference-denver-august-2013/>

Professor Mariana Alves Pereira has stated (personal communication, & NHMRC workshop in June 2011) that pre existing inner ear pathology including industrial deafness is a risk / susceptibility factor for developing

VAD. It is certainly a common observation by some farmers in Australia who have industrial hearing damage that they notice and are disturbed by the wind turbine noise when others around them with similar exposures do not notice the noise.

Dr Pierpont's study is therefore of very significant clinical importance – and her findings are increasingly being acknowledged and recognized by other clinicians and researchers from different disciplines of medicine and science, including acoustics, around the world. Most recently, Dr Colette Bonner, the Irish Deputy chief Health Officer has acknowledged the existence of “wind turbine syndrome” symptoms.
<http://waubrafoundation.org.au/2014/warning-over-wind-turbine-syndrome-irish-deputy-chief-health-officer/>

Exclusion of VAD research

I have already referred to the exclusion of animal studies, which established the existence and the pathophysiology of VAD and its direct causation of harm from ILFN exposure.

The VAD team's extensive work in both humans and animals to explore this disease over decades was dismissed with the following comment *“other biological damage resulting from heavy exposure to ILFN has been suggested, although it is an area of controversy (p 63).”* The person quoted as disputing the relevance and existence of VAD as a clinical entity was Professor Leventhall. Professor Leventhall is not a pathologist and has no clinical expertise. In addition, as an acoustic consultant who regularly appears in court proceedings to give evidence for wind developers denying the existence of adverse health effects from wind developers' products, or more recently asserting they are caused by the nocebo effect, he has an obvious conflict of interest in addition to a lack of relevant expertise.

It is unacceptable to completely ignore the findings of the VAD research, by ignoring the animal research, and ignoring important and relevant detailed case studies of VAD diagnosed in wind turbine neighbours as well as others impacted by different noise sources.

VAD is a clinical condition, which has been carefully researched by a team of Portuguese researchers from a range of disciplines, and it is increasingly being recognized in other countries, including in Taiwanese aviation workers <http://waubrafoundation.org.au/resources/effect-low-frequency-noise-echocardiographic-parameter-ea-ratio-chao-et-al-2/>

VAD is increasingly being recognized as a significant occupational health and safety issue in ILFN rich military environments, where ILFN itself can significantly affect cognition and therefore performance, and VAD may develop with chronic exposure, just as it does in aviation workers. With the increasing individual responsibility senior managers have to maintain a safe workplace under various OH&S legislation internationally, ILFN induced pathology such as VAD in ILFN rich environments such as the military will become increasingly important. (<http://waubrafoundation.org.au/resources/castelo-branco-n-low-frequency-noise-major-risk-factor-military-operations/>)

VAD has been identified in a Portuguese family living near wind turbines, and in a family living near a different source of ILFN. The existence of valvular heart tissue changes in a child of ten resulting from ILFN exposure in utero and in his first ten years of life is very concerning, as Dr Nuno Castelo Branco and Professor Mariana Alves Pereira have pointed out <http://waubrafoundation.org.au/resources/alves-pereria-m-castelo-branco-n-ltr-australian-new-zealand-journal-public-health/> .

The extensive body of VAD peer reviewed published research cannot be ignored.

Exclusion of other Key Studies

Qibai and Shi

This study was listed as excluded on page 267. The reasons given were that it was “background information on infrasound effects on humans” and it was excluded. The study is here:

<http://waubrafoundation.org.au/resources/an-investigation-physiological-and-psychological-effects-infrasound-persons/> .

This is not “background information” – it is a study which provides clear evidence of a direct causal link between infrasound and specific physiological and psychological responses in humans.

It is a carefully conducted study, which shows clear evidence that exposure to only an hour of infrasound at sound power levels which are not significantly above those recorded at some wind developments, directly induced elevation in systolic blood pressure, tachycardia, and symptoms of nausea, headache, and feeling fretful and tired. The impacts varied between individuals, just as people living near wind developments report.

Highly respected UK Acoustician Dr Malcolm Swinbanks is very well aware of the importance of this particular study – he based his conference paper in August 2012 on this study and others to show that these physiological impacts are real and could be expected from wind turbine infrasound emissions being measured at existing wind developments. Dr Swinbanks’ conference paper is here:

<http://waubrafoundation.org.au/resources/numerical-simulation-infrasound-perception-with-reference-reported-laboratory-effects/>

Moller & Pedersen 2011 “Size Matters”

This study was also excluded, with the reason given on p 266 – it too was described as “*background information on wind turbines*”.

In fact this is a vitally important study, which demonstrated using data obtained from the wind industry that the more powerful wind turbines were generating more low frequency noise as a proportion of their sound emissions, and the inevitable conclusion was that they would cause more “annoyance” symptoms in the neighbours. <http://waubrafoundation.org.au/resources/moller-pedersen-low-frequency-noise-from-large-wind-turbines/>

Indeed that is precisely what is being reported in Australia with Waterloo and Macarthur Wind Developments being two of the worst, both using 3 MW VESTAS wind turbines, V 90’s at Waterloo and V 112’s at Macarthur.

<http://waubrafoundation.org.au/resources/macarthur-wind-energy-facility-preliminary-survey/> and also a

follow up case series cross over study from Mary Morris at Waterloo

<http://waubrafoundation.org.au/resources/morris-m-waterloo-case-series-preliminary-report/>

Symptoms are being reported by residents living out to 10km from the nearest wind turbine – turbines which cannot be seen at that distance in the case of Waterloo particularly because of the Tothill Ranges in between the turbines and where the affected residents live. Both Steven Cooper and Professor Colin Hansen have collected acoustic data confirming that those wind turbine emissions are being detected and recorded out to those distances, and Steven Cooper has confirmed they are at levels above the thresholds of perception for those residents with attended measurements.

Other Confounders not mentioned

The silencing of sick people is a confounder and source of potential bias which has not been the subject of research (and may not ever be able to be studied by its very nature) and therefore does not yet appear in the literature. It is nevertheless a very real issue at a number of wind developments and will result in under reporting of health problems and bias in both wind turbine hosts and their families, and non participating former neighbours or those who have signed “good neighbour agreements” such as the one at Collgar in Western Australia, and at Palmer in South Australia where people receive a payment of cash in exchange for a contractual agreement not to report problems. (<http://waubrafoundation.org.au/resources/neighbour-deed-palmer-wind-farm-south-australia/>)

Other important issues - Sensitisation

Sensitisation refers to the commonly described pattern of increasing sensitivity with ongoing exposure described by people affected by ILFN, regardless of the source of that sound energy. In other words, people do not habituate or “get used to” the noise but rather become increasingly adversely impacted by it. It is for this reason that buffer distances are currently grossly inadequate given current planning and noise guidelines in Australia.

Sensitisation has been recognized by acousticians since at least the mid 1980’s when Dr Neil Kelley reported it in his 1985 major acoustic survey report (p 199 of that study <http://waubrafoundation.org.au/resources/kelley-et-al-1985-acoustic-noise-associated-with-mod-1-wind-turbine/>). Professor Leventhall is another who has mentioned sensitization as an issue unless people can be removed from the source of the ILFN (Leventhall 2003 <http://waubrafoundation.org.au/resources/review-published-research-low-frequency-noise-leventhall/>) and most recently it was mentioned by UK ENT surgeons Farboud et al in their literature review in 2013 <http://waubrafoundation.org.au/resources/wind-turbine-syndrome-fact-or-fiction-farboud-et-al/>

SA EPA & Resonate Acoustics study

I will not comment on the material contained in the Systematic Literature Review where the SA EPA Resonate Acoustics report by Cooper J, Evans and Lenchine is quoted frequently and at length, except to say that their opinions and conclusions about infrasound and low frequency noise from wind turbine noise are not shared by acoustic consultants who are not closely associated with the wind industry.

Both Cooper J and Evans work as acoustic consultants for Resonate Acoustics, which does a lot of work for wind developers.

To refer to their study as an “EPA study” is therefore misleading, as it was not solely the work of the EPA. The non disclosure of the involvement of RESONATE acoustics and lack of disclosure about conflicts of interest is concerning. So is the lack of alternative opinions or evidence, such as the Kelley research, or the Shirley Wisconsin Cooperative Acoustic survey (see below).

The SA EPA Resonate acoustics report was strongly criticized by NSW based Acoustic Consultant Steven Cooper, who wrote a detailed critique, which is available here: <https://www.wind-watch.org/documents/comments-on-sa-epa-and-resonate-acoustics-report-infrasound-levels-near-windfarms-and-in-other-environments/>.

In addition to the detailed critique, acoustic consultants internationally and in Australia who are independent of the wind industry were privately critical or voiced their concerns at an Australian Acoustical Society Meeting held at New South Wales University where the principal of Resonate Acoustics, Mr Stead, presented the results. The meeting was videoed by the AAS, however the footage has never been made publicly available, but a reasonably accurate transcript of the questions is available from one of the Wabra

foundation directors who attended and recorded what was said for his private use, and for the benefit of other interested parties who could not attend the meeting in person themselves. A number of acousticians at that meeting publicly expressed their concerns about some aspect of the way the work was conducted, and they included Dr Renzo Tonin, and Professor Bob Randall, in addition to Mr Steven Cooper.

One statement by some acoustic consultants working with wind developers which was also the subject of some discussion at the NSW AAS meeting is that *“if infrasound is not heard that it could not be perceived, and could therefore not affect people”*. Dr Tonin questioned the validity of this statement.

Dr Neil Kelley’s research showed that this statement was wrong nearly 30 years ago. The Qibai and Shi blood pressure study is confirmatory human laboratory research evidence that the statement is wrong. Professor Alec Salt’s recent neurophysiological research with animal models explains why it is wrong. The Kelley research, the Qibai and Shi research and the Salt research have been excluded from consideration in this systematic literature review.

The recent acoustic survey work of independent acousticians such as Emeritus Professor Colin Hansen, Dr Bob Thorne, Mr Steven Cooper and Mr Les Huson in Australia has significantly expanded the knowledge base amongst acousticians, and confirmed that wind turbine generated ILFN emissions are being measured at distances out to and beyond 10km where residents are reporting the characteristic impacts including repetitive sleep disturbance under certain wind and weather conditions.

Mr Les Huson has recorded infrasound pressure peaks on his pressure transducer which corresponded 86% of the time to a resident’s perception of distressing “pressure bolt sensations” whilst sitting quietly in his home near the Macarthur wind development. The resident was blinded to the acoustic monitoring at the time he recorded these events in his diary. <http://waubrafoundation.org.au/resources/gardner-statement-vcac-cherry-tree-hearing/> and <http://waubrafoundation.org.au/resources/huson-l-expert-evidence-at-vcac-cherry-tree-hearing/> for Mr Huson’s evidence to the Cherry Tree case describing what his acoustic data showed.

Similar sensations but with greatly increased severity were reported by a Waubra resident in 2009, who was subsequently diagnosed as having had an acute hypertensive crisis without an underlying adrenal tumour. His blood systolic blood pressure was dangerously high. There have been similar clinical reports in Ontario (personal communication Professor Bob McMurtry and Carmen Krogh). Tako Tsubo heart attacks with no obvious precipitant are also being diagnosed and reported by residents.

Research such as that being conducted by Mr Les Huson is precisely the sort of careful acoustic research now required, together with objective physiological measurement of sleep, blood pressure heart rate and biochemical markers of stress.

Dr Neil Kelley’s 1985 Acoustic Survey Field research established not only direct causation of annoyance symptoms from infrasound and low frequency noise, but also maximum tolerable exposure limits for these frequencies. Those evidence based limits were (p 225):

*“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 favourably with a summary of low-frequency annoyance situations by Hubbard.”***

Why was this information not included in the Systematic Literature Review?

Why was there no mention of the groundbreaking Shirley Wisconsin Acoustic Survey conducted by Dr Paul Schomer, George Hessler, Bruce Walker and Robert Rand, reported in December 2012 (before the SA EPA Resonate Acoustics Report was published) which stated:

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

<http://waubrafoundation.org.au/resources/co-operative-measurement-survey-analysis-low-frequency-infrasound-at-shirley-wind-farm/>

Again, why was this information not included as a counter to the views and contribution from wind industry acousticians from Resonate Acoustics? Dr Paul Schomer is the director of Acoustic standards in America. The four firms worked for both residents and wind developers. The words above are from a jointly issued report.

Concluding Remarks

What the 2014 NHMRC Systematic Review has clearly done is acknowledge that sleep disturbance, annoyance and reduced quality of life are confirmed by the data which was allowed to be included in the systematic literature review.

The Review has also highlighted the lack of objective evidence containing both full spectrum acoustic measurements and concurrent objective physiological data including sleep (EEG), blood pressure, heart rate and biochemical markers of physiological stress, such as cortisol conducted inside the homes of people reporting the new symptoms. No such studies have ever been conducted.

This sort of research in the homes of people reporting the new sleep and health problems, as well as in the laboratory was recommended “as a priority” in June 2011 by the Senate Inquiry chaired by Greens Senator Rachel Siewert. The research is long overdue, and it is pleasing that the current Federal Coalition government have committed to ensure it is conducted.

However, with respect to the Systematic Literature Review document, because of the serious issues raised above about the decisions made by NHMRC Literature Review Panel Members and the Systematic Literature Team members to

- exclude relevant studies,
- misclassify relevant studies, resulting in their exclusion,
- fail to properly disclose conflicts of interest with Resonate Acoustics, and
- fail to ensure balance and independence from the wind industry commercial interests in the acoustic data and opinion provided,

there are unfortunate consequences for the integrity of the document, and for the professional reputations of all those involved in its production.

Any Draft Information Statement prepared by the NHMRC on the basis of this dangerously incomplete Systematic Literature Review will be similarly dangerously incomplete and misleading, and governments who rely on it will not be getting the most accurate and up to date independent scientific advice they need to properly protect the health of their citizens, which they have an obligation to do.

There consequences for the residents who are suffering so greatly resulting from systemic regulatory failure of wind turbine and other environmental noise pollution are predictable serious adverse health effects, chronic exhaustion, and home abandonment.

The current situation is a national and international disgrace, and it brings considerable shame on those health and acoustics professionals who are involved in hiding the truth from government, from colleagues, and from fellow citizens.

Sarah Laurie, CEO, Waubra Foundation

“New” Studies since 28 September 2012

In addition to the material listed in this document previously, there are relevant studies cited in the following literature reviews on environmental and community noise, especially with respect to studies of the adverse health effects of night time noise, excessive noise, impulsive noise and infrasound and low frequency noise:

<http://waubrafoundation.org.au/resources/berglund-b-lindvall-t-community-noise/> from 1995

Other relevant literature reviews from WHO, and En Health in Australia, can be found here:

<http://waubrafoundation.org.au/information/acousticians-noise-regulators/literature-reviews/>

Mechanistic evidence (evidence of mechanisms)

Night time cortisol response to LFN

<http://waubrafoundation.org.au/resources/effects-nighttime-low-frequency-noise-cortisol-response/>

Details of Professor Salt’s studies (referenced in letter to Victorian Health Department)

<http://waubrafoundation.org.au/resources/prof-alex-salt-expresses-deepest-disappoint-victorian-dept-health-report/>

Ising & Braun Acute and Chronic Endocrine effects of noise

<http://waubrafoundation.org.au/resources/ising-h-braun-c-acute-chronic-endocrine-effects-noise/>

Polish Geese Study – physiological stress demonstrated via biochemical tests, together with poor weight gain

<http://waubrafoundation.org.au/resources/mikolajczak-j-et-al-preliminary-studies-growing-geese-proximity-wind-turbines/>

Schomer et al identified that motion sickness was highly likely to be related to similar symptoms resulting

from stimulation of the inner ear from infrasound <http://waubrafoundation.org.au/resources/schomer-et-al-wind-turbine-noise-conference-denver-august-2013/>

Direct Causation Evidence – wind turbine noise

Kelley et al, 1985 Mod 1 Acoustic Survey <http://waubrafoundation.org.au/resources/kelley-et-al-1985-acoustic-noise-associated-with-mod-1-wind-turbine/>

Kelley 1987 Laboratory study <http://waubrafoundation.org.au/resources/1987-problem-with-low-frequency-noise-from-wind-turbines-scientifically-identified/>

Dr Bob Thorne Case Series with comparative data from population norms, and acoustic exposure data

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

Paller & Bigelow, University of Waterloo, Ontario – cross sectional study which found a dose response

relationship for sleep deprivation and vestibular symptoms <https://www.wind-watch.org/documents/exploring-the-association-between-proximity-to-industrial-wind-turbines-and-self-reported-health-outcomes-in-ontario-canada/>

Rand & Ambrose

<http://waubrafoundation.org.au/resources/rand-ambrose-wind-turbine-acoustic-investigation-case-study/rand-ambrose-wind-turbine-acoustic-investigation-infrasound-Ifn-case-study-2/>

Mary Morris, Case Series Cross over, Waterloo

<http://waubrafoundation.org.au/resources/morris-m-waterloo-case-series-preliminary-report/>

Patina Schneider, Population Survey, Cullerin, 2012 and 2013

<http://waubrafoundation.org.au/resources/cullerin-range-wind-farm-survey-august-2012/>

<http://waubrafoundation.org.au/resources/schneider-p-cullerin-range-wind-farm-survey-follow-up-july-august-2013/>

Anne Schafer, Preliminary Population Survey at Macarthur in Western Victoria, 2013

<http://waubrafoundation.org.au/resources/macarthur-wind-energy-facility-preliminary-survey/>

<http://waubrafoundation.org.au/resources/kuwano-s-et-al-dose-response-relationships-for-wind-turbine-noise-japan/>

Polish Geese study – dose response (2 groups at different distances) and longitudinal data

<http://waubrafoundation.org.au/resources/mikolajczak-j-et-al-preliminary-studies-growing-geese-proximity-wind-turbines/>

Huson, Les Case Study in Amplitude Modulation at Leonards Hill, Victoria

<http://waubrafoundation.org.au/resources/huson-l-amplitude-modulation-case-study-at-leonards-hill-wind-farm-victoria-australia/>

Parallel evidence (other noise sources)

Hubbard, Harvey 1982 ILFN emissions from military aircraft caused identical annoyance symptoms at similar acoustic doses to those established by Kelley et al in the Mod 1 Acoustic Survey which reported in 1985

<http://waubrafoundation.org.au/resources/hubbard-h-1982-noise-induced-house-vibrations-human-perception/>

The relevant individual studies cited in the Literature Review by Leventhall et al (2003)

<http://waubrafoundation.org.au/resources/review-published-research-low-frequency-noise-leventhall/>

Dr Steve Robinson - Coal mining and transportation noise

<http://waubrafoundation.org.au/resources/mental-health-aspects-coal-seam-gas-mining/>

Dr Geralyn McCarron, health survey at Tara Gas Field, with some information about noise

<http://waubrafoundation.org.au/2013/report-tara-gas-field-health-survey-released/>

Sick Building Syndrome, Leventhall et al

<http://waubrafoundation.org.au/resources/effects-performance-due-Ifn-sick-building-syndrome-leventhall/>

Effects in train drivers exposed to ILFN (study by Bernie Willingale)

<http://www.windturbinesyndrome.com/2013/did-ilfn-syndrome-cause-spains-worst-train-wreck-nina-pierpont-md-phd/>

Effect of train LFN and vibration on heart physiology

<http://waubrafoundation.org.au/resources/smith-m-g-et-al-effect-vibration-sleep-and-heart/>

Low Frequency Noise interferes with performance and cognition

<http://waubrafoundation.org.au/resources/persson-waye-k-et-al-low-frequency-noise-pollution-interferes-with-performance/>

Studies cited in references in this Review Article by Rick James (ILFN from other sources)

<http://waubrafoundation.org.au/resources/james-r-warning-signs-that-were-not-heard/>

Case Study of Impulsive noise from a Factory Source

<http://waubrafoundation.org.au/resources/rushforth-et-al-case-study-low-frequency-noise-assessed-using-dinm-45680-criteria/>