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Expert Witness Statement of Sarah Elisabeth Laurie, CEO, Waubra Foundation

Requested by Stockyard Hill Landscape Guardians, provided pro bono

Re: Stockyard Hill Wind Farm Application to Amend Planning Permit PL-SP/05/0548

Name and Address of Expert

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Qualifications

Bachelor Medicine, Bachelor Surgery, Flinders University, awarded 1995
Fellowship Royal Australian College of General Practitioners (RACGP), awarded 1998
Fellowship Australian College of Remote and Rural Medicine (ACRRM), awarded 2000

Professional Affiliations

Nil currently

Former Fellow and Examiner for RACGP
Former Fellow of ACRRM
Former member of Australian Medical Association State Council, South Australia

Experience

January 1995 - April 2002 Post graduate hospital and rural General Practice training with rotations in Emergency Medicine, Intensive Care, Cardiology, General Medicine, General Surgery, Orthopaedics, Anaesthetics, Obstetrics, Paediatrics, Psychiatry, and employment as a full time Rural General Practitioner in Rural and Remote South Australia, with one in two or one in three rotation for after hours emergency care for the local hospital / health service in addition to full time clinical workload during the day.

April 2002 – August 2010 unplanned recovery from sudden onset of ill health requiring urgent surgery, and extended family caring responsibilities

From August 2010 to present – Medical Director and then CEO of Waubra Foundation (voluntary).

I have used my previous clinical experience as a rural General Practitioner to interview individuals reporting adverse health effects from a range of industrial noise sources, and then used the information obtained together with my clinical insights and experience, to collaborate with trained health and acoustics professionals in Australia and internationally to plan and implement new multidisciplinary research methodologies and develop new acoustic instrumentation, to facilitate accurate measurement and recording of acoustic exposures, and concurrent physiological data (sleep and heart rate), where people are reporting adverse impacts with exposure to industrial noise sources.

The aim of this work is to identify the precise acoustic triggers for the reported symptoms, including particularly the triggering of the acoustic startle reflex that underpins much of the reported illness, especially when the acoustic startle reflex is repeatedly triggered during sleep, resulting in chronic sleep deprivation which worsens with progressive low frequency noise sensitization.

The acoustic exposures have been in residential as well as occupational settings, at open cut and underground coal mines, coal, gas and wind power generators, and other noise sources such as CSG field compressors and urban data storage centres.

International collaboration has occurred with experts such as Dr Paul Schomer, immediate past Director of Acoustical Standards in the USA. At Dr Schomer's invitation, I was asked to join the international working group on Wind Turbine Noise in May 2015 in Pittsburgh, USA, and to present at the American Society of Acoustics conference.¹ I work closely with independent Acousticians, Psychoacousticians and others both in Australia and internationally who are leading the world in investigation of industrial noise inside impacted residents homes, together with the collection of concurrent physiological data.

I have collaborated with others in the development of affordable dual channel broad spectrum acoustic soundscape recording units, in order to capture scientifically important data which is being missed if averaging and sampling techniques are used, or if infrasound and low frequency noise inside and outside homes is excluded from measurement and analysis as is the case with many existing sound level meters and regulatory requirements and standards.

¹ <http://waubrafoundation.org.au/resources/acoustical-society-america-conference-2015-waubra-foundation-presentation-notes/>

Medically trained researchers and collaborators have included (but are by no means limited to) Professor Robert McMurtry from Ontario, Emeritus Professor Alun Evans (Cardiac Epidemiologist) from Ireland, Dr Chris Hanning (Sleep Physician from the United Kingdom), Dr Michael Nissenbaum (Radiologist practicing in the USA & Canada) as well as the early medical research pioneers in the specific area of wind turbine noise including Dr Amanda Harry (Rural General Practitioner from the United Kingdom), Dr David Iser (Rural General Practitioner from Toora, Victoria), and Dr Nina Pierpont (Population Biologist and Specialist Paediatrician from the USA). Others include Professor Mariana Alves Pereira, and Professor Arline Bronzaft from the USA.

Other contributors to this report: None

Report

1. I have been asked by the Stockyard Hill Community Guardians to comment on the planned amendments to the original permit issued for the Stockyard Hill Wind Power Development.
2. I understand that the instructions from the Chair of the Planning Panel at the Directions Hearing were to focus on changes from the existing approved project, rather than undertaking a first principles review. The existing permit allowed for a total of 157 wind turbines to be constructed, with a maximum tower height of 80 metres, and a maximum blade length of 52 metres.
3. I note that the proposed changes to the permit include an increase in tower height and blade length, and altered wind turbine location layout, but that no specific choice of wind turbine has yet been made.
4. I also note that it is now over six years since the Planning Hearing for the Original Stockyard Hill Wind Power Development Application (since approved but not yet constructed), and that there has been considerable advancement since 2010 both in scientific and clinical knowledge, particularly with respect to the effects of longterm exposure to wind turbine noise upon individuals who experience adverse health effects, which including sleep disturbance and physiological stress, known to acousticians as “annoyance”. I have therefore included key aspects of this new research and new insights in my comments, as this information was previously unavailable to the original planning panel, but is publicly available now, and is relevant to the matter being considered by the Panel.
5. For example, and of direct relevance to this application to amend the original planning permit, I note that experienced Danish Professor of Acoustics Henrik Moller and his colleague Christian Pedersen coauthored a peer reviewed paper published in May 2011 which demonstrated (using wind industry data) that as power generation capacity increased (which can be achieved via increased tower height and blade length), so too did the proportion of low frequency

noise emitted also increase. They noted that therefore it was predictable that “annoyance” for the neighbours would also increase.²

6. This increase in “annoyance” including sleep disturbance is precisely what has happened to rural residents in Victoria living near the Macarthur Wind Power Development, documented in a preliminary Community Noise Impact Survey at Macarthur Wind Power Development in 2013 by Mrs Anne Schafer,³ and also in numerous public submissions and oral Testimony to Federal Senate Inquiries⁴ and legal proceedings.⁵
7. This research paper by Moller and Pedersen was provided by the Waubra Foundation, to Victorian Department of Planning Staff and the Minister for Planning, soon after it was published. Despite its obvious relevance, especially to this application to amend the existing permit, this research by Moller and Pedersen has been ignored by all Victorian Planning Ministers, and Planning officials, since it was provided in 2011.
8. In addition, the very real consequences for human health of increasing the size and power generation capacity of wind turbines but failing to also increase buffer distances to rural residences, and failing to increase inter turbine separation distances, have also become clearer at newer wind power developments such as Waterloo Wind Power Development in South Australia,⁶ and Macarthur Wind Power Development in Western Victoria.⁷ I am advised by numerous acousticians that this leads directly to increased wake turbulence, and increased lower frequency noise,⁸ and therefore will lead to increased adverse health effects including sleep disturbance and physiological stress (annoyance).
9. The reported noise related adverse effects including particularly sleep disturbance have extended out to even greater distances where more powerful wind turbines are sited close together. Reports of regular sleep disturbance and other symptoms (clearly and repeatedly related to wind turbine operation and specific wind direction and weather conditions eg temperature inversions) have been documented in community noise impact surveys as well as first hand

² <http://waubrafoundation.org.au/resources/moller-pedersen-low-frequency-noise-from-large-wind-turbines/>

³ <http://waubrafoundation.org.au/resources/moller-pedersen-low-frequency-noise-from-large-wind-turbines/>

⁴ For example Hetherington, Gardner and Jelbart submissions and oral testimony to the 2015 Federal Senate Inquiry into Wind Turbine regulation in Portland on 30th March, 2015:

http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Wind_Turbines/Wind_Turbines/Public_Hearings

⁵ Gardner <http://waubrafoundation.org.au/resources/gardner-statement-vcac-cherry-tree-hearing/>, Hetherington <http://waubrafoundation.org.au/resources/hetherington-j-witness-statement-vcac-cherry-tree-tribunal/> and Linke <http://waubrafoundation.org.au/resources/linke-m-witness-statement-vcac-cherry-tree-hearing/> written evidence to the Cherry Tree VCAC hearing

⁶ <http://waubrafoundation.org.au/resources/hansen-zajamsek-hansen-noise-monitoring-waterloo-wind-farm/>

⁷ see the appendix of the Waubra Foundation’s submission to the RET Review, for the exchange between Dr Malcolm Swinbanks, UK Acoustician, and Mr Les Huson, about the inter turbine separation distances at Macarthur Wind Power Facility, and the inevitable consequences of increased wake turbulence

<http://waubrafoundation.org.au/resources/renewable-energy-target-review-waubra-foundation-submission-2014/>

⁸ <http://waubrafoundation.org.au/resources/hansen-zajamsek-hansen-noise-monitoring-waterloo-wind-farm/>

reports from noise nuisanced residents out to at least 10km from 3 MW turbines (VESTAS V 90 at Waterloo, and VESTAS V112 at Macarthur).

10. I have first hand knowledge of multiple home abandonments or forced property sales out to 5km which have occurred at Waterloo and Macarthur Wind Power Developments because the adverse health effects and chronic sleep deprivation were intolerable to those residents, who had become progressively low frequency noise sensitized with ongoing exposure.
11. I note that the Victorian Health Department issued a Technical Note entitled “Wind Farms, Sound and Health” in April 2013 ⁹ (author(s) unnamed) which acknowledges that noise can cause sleep disturbance and physiological stress, and states the following about **low frequency noise sensitivity** on page 16 (section 7.5.3):

“Some individuals have a particularly sensitive response to low frequency noise. It is unclear what causes this response, but it is likely to be due to a combination of biological, psychological and social factors....”

Annoyance increases more rapidly for low frequency sounds, and there is greater variation in how individuals perceive them, because of their narrow audible range (Section 5.2). This means that some people’s annoyance in response to low frequency noise may not be shared by others. This lack of understanding may make them more frustrated and potentially more sensitized to the sound. Furthermore, once a person has become sensitized to any noise, the slightest elevation over the hearing threshold can be perceived and may become unbearable.”

It is therefore clear that the Victorian Department of Health are well aware that low frequency noise sensitivity and sensitization can happen with exposure to low frequency noise (which wind turbines are known to emit) and that predictable adverse health effects such as “annoyance” (physiological stress effects), will follow.

12. New biological acoustics research in mammals published in 2012, authored by Scottish University biologists Gotz and Janik, (who were developing methodologies to deter seals from fishing nets using sound) has shed light on the biological mechanisms in mammals of low frequency noise sensitization, and highlighted the important role played by the acoustic startle reflex in progressive sensitisation.¹⁰
13. This basic biological research is equally relevant for humans, (who are also mammals), and helps explain the increasing numbers of people presenting with symptoms consistent with low frequency noise sensitization after industrial

⁹ <http://waubrafoundation.org.au/resources/wind-farms-sound-health-victorian-dept-health-report/>

¹⁰ <http://waubrafoundation.org.au/resources/bmc-neuroscience-repeated-elicitation-acoustic-startle-reflex/>

noise exposure, who also being diagnosed with post traumatic stress disorder from repeated prolonged exposure to industrial noise with a pulsing / impulsive quality, including as wind turbine noise, especially where there is amplitude modulation present.

14. The risk of this low frequency noise sensitization and its sequelae occurring in even higher numbers of the nearby population with the proposed permit amendment to increase the power generation capacity of the turbines at Stockyard Hill is obvious, even to those without the benefit of acoustic or medical training.
15. The acoustic startle reflex is epitomized by the description given by residents living near various sources of industrial noise, including particularly wind turbines, of **“waking up at night suddenly in an anxious frightened panicked state”**. These episodes correlate directly with wind direction and weather conditions, with the worst experiences being when they are downwind, with either heavy cloud cover or temperature inversion conditions.
16. The acoustic startle reflex is a simple neural reflex, which is extremely rapid. The neural pathway does not travel to the cortex or thinking part of the brain, but rather goes from the peripheral sensory receptors directly to the primitive part of the brain in the brainstem, and then straight to the heart where one of the effects of the sympathetic nervous system activation is to increase heart rate. In layman’s terms, this is known as the “fight flight” response, and is the core of the physiological stress response.
17. By its very nature (simple and very rapid neural reflex), the acoustic startle reflex cannot be induced by “suggestion” so the assertion by wind industry advocates and some acousticians that a “nocebo” effect is responsible for the annoyance / physiological stress reactions or sleep disturbance episodes is not supported by the scientific evidence in animal studies.
18. Nor is the “nocebo effect” excuse supported by detailed clinical history taking directly from noise affected people by experienced medical practitioners. When such medical histories are gathered, clinical diagnoses of Environmental Sleep Disorder¹¹ and other conditions including Wind Turbine Syndrome¹² become clear, as do the serious adverse health consequences of the diagnosis of Environmental Sleep Disorder if the excessive noise exposure and sleep deprivation continue.

¹¹ The diagnostic criteria for Environmental Sleep Disorder are summarized in the World Health Organisation’s document Night Noise Guidelines for Europe, 2009 in section 2.1.2, and 2.1.2.3, pages 18-19 <http://waubrafoundation.org.au/resources/who-night-noise-guidelines-for-europe/> and can be sourced in full from the original document International Classification of Sleep Disorders, Revised, published by the American Academy of Sleep Medicine, <http://www.esst.org/adds/ICSD.pdf>

¹² Diagnostic criteria for adverse health effects in the environs of wind turbines which followed the 2009 study by Dr Nina Pieront which described Wind Turbine Syndrome (<http://waubrafoundation.org.au/resources/dr-nina-pieront-submission-australian-senate-inquiry/>) have been developed by Professor Robert McMurtry and Carmen Krogh, and have been published in a peer reviewed journal: <http://journals.sagepub.com/doi/full/10.1177/2054270414554048>

19. The effects of chronic sleep deprivation have been summarized in the 2009 World Health Organisation's Night Noise Guidelines for Europe,¹³ and include serious physical and mental health consequences. Subsequent published research is consistently confirming the deleterious effects of chronic sleep deprivation, regardless of the cause.
20. The importance of good sleep for good health is uncontested, even by medical experts who give paid evidence for wind power developers, as the clinical and research evidence about the importance of sufficient good quality sleep for maintaining good mental and physical health is so compelling.
21. The existence of reported sleep disturbance from wind turbine noise affected residents in the scientific literature has been accepted by the NHMRC, who have since funded specific research to investigate sleep disturbance by a multidisciplinary team led by a Sleep Physiologist, Dr Peter Catchside.¹⁴
22. There is currently no empirical or field research evidence that the old (1998) or current (2010) NZ standard adequately protects residents against sleep disturbance, chronic sleep deprivation, or the development of low frequency noise sensitization from wind turbine noise, which means that they can then perceive and be disturbed by sound in their environment which previously they could not detect.
23. I have been advised that one of the then members of the NZ Standards Committee expressed his concern about the potential for harm from adopting the NZ Standard and resigned from the committee. A summary of the history of this episode and details of conflicts of interest can be found in Dr Bruce Rapley's submission and evidence to the 2015 Senate Inquiry into Wind Turbine Regulation, chaired by Senator John Madigan.¹⁵ Professor Philip Dickinson, Dr Rapley's PhD supervisor, was the member of the NZ Standards Committee who resigned, and was the former head of the Noise Control Unit under the Minister for Health in New Zealand. Responsibilities with that unit included the protection of public health from noise nuisance in New Zealand.
24. Evidence from Victorian residents to three successive Federal Senate Inquiries in 2011, 2012 and 2015 makes it clear that noise complaints are very rarely investigated with noise investigations of any sort, let alone including objective noise measurements of the full spectrum of noise including infrasound and low frequency noise, including outside and inside home measurements and recordings (rather than averaging or sampling the sound), and the noise nuisance complaints relating to wind turbine noise are rarely acted upon by regulatory authorities to prevent further harm.
25. I note that neither the Victorian Health department, the Victorian Planning Department, nor the Victorian EPA have ever conducted multidisciplinary

¹³ <http://waubrafoundation.org.au/resources/who-night-noise-guidelines-for-europe/>

¹⁴ <https://www.nhmrc.gov.au/media/releases/2016/nhmrc-awards-funding-wind-farms-and-human-health>

¹⁵ submission no 409, Rapley and Atkinson

http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Wind_Turbines/Wind_Turbines/Submissions

research at any wind power development in Victoria, despite numerous specific requests from noise nuisanced Victorian residents for them to do so. I also note that the Pyrenees Shire council's specific request for the then Victorian Chief Health Officer to investigate the noise complaints from the Waubra Wind Power Development was ignored, and no Health Impact Assessment was ever subsequently conducted.

26. In contrast, the Waubra Foundation gained important clinical insights with both direct investigation and ongoing longterm contact with noise affected residents and has facilitated independent acoustic and psychoacoustic data collection at numerous industrial noise facilities, including multiple locations in Victoria.
27. Two important Victorian wind turbine noise investigations since 2010 are the acoustic and health study conducted by Dr Bob Thorne at the Waubra and Cape Bridgewater Wind Power Developments,¹⁶ and the Pacific Hydro initiated and partly funded Cape Bridgewater Acoustic Investigation by Steven Cooper.¹⁷ The existence of repeated sleep disturbance was confirmed in both.
28. Both these wind power developments have been deemed to be compliant with their permit conditions and the NZ Standard. If they are in fact compliant, then it is clear that the NZ standard is allowing people to become chronically sleep deprived, and progressively sensitized to low frequency noise, both of which have serious adverse health sequelae for both physical and mental health.
29. Those who find the noise becomes *unbearable*, (as stated in the Victorian Health Department Technical report quoted from earlier), can become a serious suicide risk. The Waubra Foundation Administrator and Directors have direct experience and knowledge of the desperation of low frequency noise sensitized people, and I have personally prevented a number of suicides by responding rapidly, and locating local health providers in a timely fashion. My own experiences are supported by the data contained in Dr Bob Thorne's study report referred to above, and by independent psychological assessment in some instances – these people are very unwell, physically and often mentally, and exhausted. Their psychological distress is further compounded by the lack of any action to alleviate their situation by responsible authorities at every level of government, and sometimes ignorance of their treating health professionals.
30. This lack of timely action to prevent further harm may become the subject of consideration for punitive damages in noise nuisance cases in Australian courts, as is currently being considered in a noise nuisance case before the Irish High Court, in which the Wind Power Operator has conceded liability for Noise Nuisance for seven Irish families, a number of whom had to abandon their homes.¹⁸
31. In view of the serious nature of the health problems being reported to the Foundation from residents living in the vicinity of wind power developments in

¹⁶ <http://waubrafoundation.org.au/resources/thorne-r-victorian-wind-farm-review-updated-june-2014/>

¹⁷ <http://waubrafoundation.org.au/resources/cooper-s-acoustic-group-results-cape-bridgewater-acoustic-investigation/>

¹⁸ <http://www.farmersjournal.ie/wind-company-admits-nuisance-damage-to-neighbours-246465>

Australia, and the distance of impact from the larger more powerful wind turbines at Waterloo Wind Power Development which were then the largest in Australia, the Waubra Foundation issued an Explicit Cautionary Notice on 29th June, 2011¹⁹ which was widely distributed, including to Victorian Planning Authorities.

32. Our concerns about the seriousness of the adverse health effects have only increased since that date, if there is ongoing exposure to wind turbine noise, or any other source of pulsing, amplitude modulated industrial noise, to which low frequency noise sensitized people react.
33. **In my opinion, because of the existing failure of the NZ Standard *and* the failure of the regulatory authorities in Victoria, to protect the health, and related human rights of Victorian residents at existing wind power developments “to enjoy the highest standard of physical health”, which is enshrined in six of the seven Human rights Covenants and Conventions to which Australia is a signatory,²⁰ the amendments proposed to the original planning permit for Stockyard Hill Wind Power Development will directly result in even more serious and widespread harm to the health of the surrounding population of Stockyard Hill residents over the lifetime of this project, including wind turbine hosts and their families, than will inevitably occur if the original permit stands and the already approved wind turbines are constructed.**

I declare no personal conflict of interest in this matter, nor does the Waubra Foundation have a conflict of interest. I have not been, nor will I be, remunerated for preparing this report.

Steven Mitchell is the son of Peter Mitchell, (the Founder of the Waubra Foundation and former Chairman, Director and Patron, and a Life Member of the Waubra Foundation). Steven owns property in the Stockyard Hill area.

I have made the enquiries I believe are relevant and appropriate, given my specific expertise and knowledge in this area, and in my view no matters of significance or relevance have been withheld from the Panel. I am happy to provide further detail with respect to any of the information provided above.



Sarah Laurie,
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¹⁹ <http://waubrafoundation.org.au/about/explicit-cautionary-notice/>

²⁰ <https://www.humanrights.gov.au/chart-related-rights-and-articles-human-rights-instruments-human-rights-your-fingertips-human-rights>