

Opening Statement for Sarah Laurie, BMBS

Proceeding number 1955, Alberta

Thank you for the opportunity to share my first hand knowledge of the experiences of people living with the environmental noise emissions from large wind turbines and other sources of environmental noise; people who are predominantly rural residents living and working in quiet rural environments.

This first hand knowledge has primarily been obtained by carefully listening in person or via telephone to the experiences of predominantly rural residents, mostly in Australia, who have contacted me directly in my role first as Medical Director, and then Chief Executive Officer of the Waubra Foundation. Some contact has also been via email exchange with residents in Canada, USA, New Zealand, the United Kingdom and Europe.

Contrary to assertions made publicly by others closely associated with the wind industry, we do not go into communities and tell people they are going to get sick. We wait to be contacted, and will only initiate contact if we have been specifically invited to do so by the person concerned. I have then maintained contact with these people, many of whom have shared what happened to them and their family members over the following period of time, so I have gained valuable insights into what happens with longitudinal exposure to environmental noise.

There is currently no longitudinal prospective data in the peer reviewed published literature, which investigates, describes and quantifies the health impacts from exposure to operating wind turbine noise, especially with respect to larger wind turbines which emit proportionately more low frequency noise.

Given the residents' consistent reports of deterioration in mental and physical health with ongoing exposure to operating wind turbines, and in particular their cumulative sleep deprivation, this gap in knowledge is of great concern, especially for members of planning tribunals making decisions on wind turbine projects which are likely to have a lifetime of at least 25 years.

The intention of the Waubra Foundation has always been to better understand the complexities of the reported health problems, in order to assist acoustic and clinical researchers who are independent of the Foundation with design of their research projects. The Foundation does not have the resources or the personnel to conduct formal structured research ourselves. However in its broadest sense "research" is defined as "seeking answers to questions" and that is precisely why the Foundation exists, and what motivates us.

Careful clinical history taking skills honed during my medical training and through working as a rural general practitioner, together with a growing knowledge of the known science with respect to the impact of sound and vibration energy on humans

and animals, has helped me focus attention on specific parts of these residents histories which were most relevant to understanding which of their symptoms and sensations were new, which of the symptoms and sensations correlated with exposure to operating wind turbines (or other sources of environmental noise), and what happened to those symptoms over time with ongoing exposure.

Some residents have kept personal health journals which they have then shared extracts of with me, which has been invaluable. Some of these detailed records are starting to form the basis for witness statements in legal proceedings, and given their contemporaneous nature they provide very useful information for health researchers and acousticians, even more so if there is concurrent acoustic information being collected.

I have also had the great benefit of learning directly from a number of acousticians, both in Australia and internationally, who have willingly shared their knowledge and answered my questions. In turn, sharing observations from the residents, together with relevant clinical insights with these acousticians and other researchers has helped us all progress our understanding of the health problems being reported by the residents, and what might be causing them.

Psychoacoustician Dr Bob Thorne is one of the Australian acousticians I have worked with. Dr Thorne has additional expertise in evaluating the human perception of exposure to sound energy, and his case series presented to the Australian Federal Senate was the first data internationally which contained both results of acoustic measurements at some affected people's homes, and systematically collected health data from residents living at two Victorian wind developments. The turbines at these developments were less than 2MW in size, and the distances away from the nearest turbine were out to 3.5km, with an average distance of 1.4km.

Dr Thorne's data confirmed serious adverse effects on sleep and mental health from exposure to operating wind turbines. When compared to norms from other studies (table 3.1.2 on the bottom of page 8) his quality of life data (using the standardised survey instrument WHOQUOL-BREF) found that in every domain of physical, psychological, social and environmental quality of life, wind turbine residents in his study scored the worst, lower even than hospital inpatients from other studies. The Thorne study participants' sleep quality was significantly adversely affected, and their low mental health scores were extremely concerning.

Dr Thorne stated (p 27) *"Based on the results of the study it can be argued that, when exposed to wind farm noise and wind turbine generated air pressure variations, some will more likely than not be so affected that there is serious harm (also termed significant adverse effect) to health."* He goes on to specify precisely what his criteria for a significant adverse effect includes, and on page 28 lists acoustical criteria which on the basis of his study results are markers for serious harm to health. Of note is his criteria of an LAeq sound level of 32 dBA or above over any ten minute interval outside, and 22 dBA inside a home.

This particular case series study data confirmed my own impression that these people who report adverse health effects from living near wind turbines are very unwell, especially with cumulative exposure.

In summary, it is my experience that everyone is affected *differently* by exposure to operating wind turbines. Not everyone is adversely impacted, however over time, more and more residents describe sleep disturbance, which not surprisingly is the commonest reported problem. This is particularly illustrated in the most recent noise impact surveys and case series data from three Australian wind developments, being Cullerin in NSW, Waterloo in South Australia and Macarthur in Victoria. This data was collected for the Cherry Tree case in Victoria, as the Tribunal members had specifically asked for population impact data and information about the distances over which adverse effects were being reported, especially from similar sized wind turbines to those proposed at Cherry Tree.

The recent Cullerin survey is probably of most relevant to this Alberta hearing, because the turbines have been operating for four years, so they give an idea of the population impact after 3 – 4 years exposure to operating wind turbines. The 15 wind turbines at Cullerin are 2MW in size, are located along ridges in gently rolling hills, with tower heights of 80 metres, and blade lengths of 46 metres. Comparison with this proposed Alberta project with its 46 2.5MW turbines, with tower hub heights of 85 metres and blade lengths of 46 metres.

The 2013 household survey of all homes within 10km of the Cullerin wind turbines had a 68.5% response rate, and found that 91% of those responding out to 8km reported being impacted by noise and vibration that was affecting their sleep and health. The twenty households contained 50 occupants, 49 of whom reported being affected by sleep deprivation and other health impacts. All had complained to a variety of authorities, but nothing had been done to reduce or cease the negative health impacts.

The Waterloo case series report from September 2013 by Mary Morris clearly illustrates the direct and consistent correlation between people's symptoms, sleep disturbance, and exposure to operating wind turbines. The week the Waterloo wind turbines were all off because of a cabling fault resulted in a perfect "natural experiment" with the opportunity for the residents to collect rare cross over exposure data, which is detailed at the end of that document.

Reports of symptoms other than sleep disturbance and deprivation vary, and are generally either the range of specific symptoms described by Dr Nina Pierpont and given the name "wind turbine syndrome", or they relate to exacerbations of each individual's existing chronic health conditions, often known to be adversely impacted by either sleep deprivation, physiological and psychological stress, or both.

It is becoming clearer from the work of researchers in the disciplines of physiology, acoustics, and clinical medicine that stimulation of the vestibular system is directly

involved in the human and animal physiological response to sound energy. One of those responses can be the stimulation of a fight flight / anxiety response, which generates a physiological stress response via the sympathetic nervous system.

The characteristic descriptions of residents of “waking up at night in a panicked state” on a regular basis, sometimes many times a night, yet being unable to hear the wind turbine noise at the time, is suggestive that inaudible sound frequencies are also involved in these episodes of sleep disturbance, possibly via stimulation of the vestibular system, when people are sleeping.

These characteristic episodes are being reported by residents out to 10km from wind turbines which the residents often cannot see from their homes, certainly cannot see when they are fast asleep, and the episodes correlate with turbine activity, specific wind directions, and are noticeably worse in certain weather conditions.

This characteristic sleep disturbance is in addition to the residents reported or documented observations that on occasions audible wind turbine noise, including the more disturbing low frequency noise, either prevents them from going to sleep, or wakes them up from sleep.

As yet, despite the Waubra Foundation specifically advocating for nearly three years for concurrent full spectrum acoustic monitoring and physiological sleep monitoring in the field, this research has not yet been conducted. This precise research is required in order to establish precisely which sound frequencies are involved, at what “doses” of sound energy.

We have very little knowledge of the “dose” of actual sound frequencies residents are exposed to whilst inside their homes, awake or asleep, as most acoustic monitoring is conducted by the wind developers, is limited in duration, occurs outside homes, and does not involve accurate measurement of the full acoustic spectrum. The noise data, together with the power output and wind mast data, is not ever made publicly available by the wind developers for external independent scrutiny, even for verification of compliance external to the wind developer.

However there is a crucially important body of work by US scientist Dr Neil Kelley and colleagues from NASA and a number of American Universities, relating to human perception of infrasound and low frequency noise from wind turbines. This research included both acoustic field survey data, and followup laboratory research, reproducing the sound energy and documenting the existence of a direct causal link and dose response relationship between the frequencies and the human response.

The comprehensive acoustic field research was carried out nearly 30 years ago by Dr Neil Kelley, as part of a US Department of Energy funded research project to investigate why some residents living within 3 km of a single downwind bladed wind turbine had unexpectedly developed “annoyance” symptoms including night time sleep disturbance.

Dr Kelley and his co researchers found that the annoyance symptoms reported by the residents were **caused directly** by infrasound and low frequency noise emissions from the single downwind bladed wind turbine, which resonated within the building structure of the residents' homes.

Crucially, Kelley found that ***the sound energy levels at which this was occurring were well below the threshold of hearing, and that the sound was perceived rather than heard.*** This evidence from nearly 30 years ago does not support Dr Leventhall's assertions in his evidence that it is "well established" that "you cannot feel inaudible infrasound" (from Volume 4 p 1176). ***Indeed Dr Neil Kelley's research clearly established the precise opposite in the case of wind turbine generated infrasound and low frequency noise almost 30 years ago.***

It is unfortunate that Dr Kelley's evidence-based recommended limits for exposure to wind turbine generated infrasound and low frequency noise (p 225 of his report) have not ever been adopted, and in many jurisdictions these frequencies are not even measured by noise pollution regulatory authorities.

Kelley also mentioned the problem of "sensitisation" or what he called "conditioning" (p190 of the 1985 report). This refers to the observation that people appear to become more sensitive to the noise over time. In other words, people do not "get used to" this sound energy.

Dr Leventhall also referred to this sensitisation concept in his 2003 Literature Review for DEFRA in the conclusions, and UK Ear Nose and Throat Specialist Dr Amir Farboud also refers to the related problem of what he calls "enhanced perception" from "long term unwanted sound" in the recent review article in the Journal of Otolaryngology entitled "Wind Turbine Syndrome: fact or fiction" (p225)

Whilst the precise pathophysiological and clinical reasons for this consistent observation of increasing sensitisation and sensitivity to wind turbine noise over time are not yet clear, its existence is in no doubt. It is very important for planning considerations with respect to wind turbine noise, because once sensitised, as Dr Leventhall pointed out in 2003, only removal from the source of the noise and cessation of exposure will result in recovery.

In the case of wind turbine noise, that currently means the residents have to move, or the turbines are shut down, if they are severely affected, because to date no solutions for reducing these infrasound and low frequency noise emissions from the blade pass frequencies are available, as they are an inevitable component of the forces and sound energy generated by horizontal axis upwind bladed wind turbines.

As wind turbine size and power generating capacity increases, this issue will become even more important to consider, which is difficult for planning tribunals to do where so little is known about low frequency noise and infrasound propagation from specific sized wind turbines in specific terrain and configurations. Current noise models used by the wind industry do not include these low frequencies.

Subsequent laboratory experiments by Dr Kelley conducted with employees as subjects, and reported in 1987 ***confirmed the direct causation of symptoms*** of annoyance from this infrasound and low frequency sound energy reproduced in a laboratory setting. This information was made widely available to the wind industry at the 1987 American Wind Energy Association conference in California, and I have been told that it was this research which triggered the change from downwind bladed design wind turbines to modern upwind blades.

Dr Kelley has recently publicly specifically confirmed that this old research documenting the human dose response to infrasound and low frequency noise generated by a single downwind bladed wind turbine is equally applicable to acoustic emissions from upwind bladed turbines, contrary to recent wind industry assertions to the contrary. This makes sense, because whilst the wind turbine designs may have changed, human beings have not, and it is the human perception of the sound frequencies which was measured in those studies.

Dr Leventhall in his comments during cross examination (Vol 4 p 1176) made reference to some very recent acoustic data collection from Australia, as did Dr Phillips. They were both referring to information just publicised, which was presented at the Cherry Tree Tribunal hearing late last month by independent acoustician Les Huson, and a resident from Macarthur describing “pressure bolt” sensations. I was involved in ensuring this evidence was presented to the Cherry Tree Tribunal members, and its subsequent circulation but was not involved in any way in the data collection. Mr Les Huson is an independent acoustic consultant who has worked for wind developers and for community members impacted by noise, and his recent infrasound data collection at Macarthur was entirely self funded. Dr Leventhall has stated otherwise, (Vol 4 p 1176) and in particular has said that I was involved, so I would just like to correct the tribunal record on that point.

With respect to the findings: Mr Huson found there was a direct correlation 86% of the time between the pressure bolt sensations reported in a diary by the resident and pressure pulses of infrasound measured and recorded by Mr Huson, to which the resident was “blinded”, which Mr Huson described as “pressure transients”. These pressure transients were 10 times the magnitude of similar pressure transients found in a case study from the UK, which had also resulted in complaints of symptoms and noise nuisance. Noise control measures in the UK case study resolved the issues.

Mr Huson also found that at the Macarthur wind development, there was no attenuation (reduction) of infrasound between 1.8km and 6.4km away from the turbines.

I have listened carefully to this Macarthur resident’s description of his sudden onset symptoms of “pressure bolts” and they are remarkably similar in many respects to a number of other reports from farmers at Macarthur and other wind developments who describe experiencing sudden pressure sensations, generally in their head,

chest or abdomen, and particularly in the latter two examples have made it difficult or impossible for these fit burly farmers to stay on their feet.

Dr Leventhall referred to this report of the burly farmers being knocked off their feet in his evidence and said *“there should be no complaints about inaudible noise because if you can’t hear it, I believe it does not affect you. So the complaints are actually about audible noise”* (Vol 4 p 1176). But what is interesting when you listen directly to the farmers concerned is that in almost all circumstances **they do not hear the noise at the time they perceive these “pressure bolts”**. They are just going about their business, or even resting inside their homes in the case of Mr Gardner, and they suddenly experience this pressure bolt symptoms.

Dr Leventhall in his evidence also stated that *“people are being told that infrasound from wind turbines is dangerous and will make them ill”* (Vol 4, p 1176). Dr Leventhall has also supported the “nocebo effect” explanation for these and other symptoms. However the evidence does not support these assertions.

In 2009, one such farmer quietly and privately reported sudden “pressure bolt sensations” to his local doctor. The “pressure bolt sensations” were immediately followed by symptoms consistent with unusual adrenaline surge pathology, which results in dangerously high blood pressure, as indeed this farmer experienced. These episodes are known as “acute hypertensive crises” and have also been documented in Ontario residents near wind developments. They usually only occur in the presence of a very rare tumour of the adrenal gland, called a pheochromocytoma.

The episode in Australia in 2009 was documented at the time by his local doctor, who was at a complete loss to explain these concerning symptoms, which occurred well before any publicity about possible connections with wind turbine emissions, which did not occur until late 2010, almost a year later. The presence of an adrenal tumour was subsequently excluded by his local doctor.

In that 2009 case, there was no concurrent acoustic monitoring at the time the symptoms were experienced, but in the recent case of the Macarthur resident, Mr Andrew “Gus” Gardner, the concurrent acoustic monitoring was occurring, and for 86% of these episodes documented by the resident, a transient pressure pulse spike was seen.

Mr Huson’s expert opinion stated the following at #4: *“I find it entirely plausible that infrasound can cause nuisance and disturbed sleep in communities surrounding wind farm developments similar to the Macarthur and Leonards Hill developments”*.

To place Mr Huson’s comments in a comparative physical context, Leonards Hill is a community owned wind development, with only two wind turbines (each 2MW), and Macarthur is a large wind development owned by a large Australian company, with 140 wind turbines, each V112 Vestas (3MW) approximately 150 metres high (tower height plus blade tip length).

The witness statements from Macarthur used in the recent Cherry Tree hearing including particularly that of Mr Les Huson and the resident experiencing the “pressure bolts” Mr Andrew “Gus” Gardner, are submitted for the benefit of this Tribunal, as this evidence has clearly caught the attention of some of the other expert witnesses, and is of great relevance to the deliberations of the Tribunal. I have also included Mrs Maria Linke’s witness statement also used in the Cherry Tree Tribunal, detailing impacts on one resident’s sleep out to 5km from Macarthur wind development. Mr Huson measured infrasound even further at 6.4 km. which had not reduced in intensity from a distance 1.8km from the turbines.

I would finally also just like to mention one Australian resident’ child’s experience with petit mal seizures. This information is not out in the public domain, because the family have signed a binding confidentiality agreement, which precludes them from talking publicly about any of the health problems they experienced whilst living at their former home.

The mother told me that her young adult child’s epilepsy had been well controlled, until the wind turbines started operating. After the turbines commenced operating, the petit mal seizures increased, but reportedly only when the young adult was home visiting parents. The mother said it became clear to everyone that there was something connected with exposure to operating wind turbines, which was triggering the seizures. It wasn’t long before their child stopped coming home. The precise “trigger” for the seizures was not ever identified.

In conclusion, whilst there is much we do not know about precise exposure doses, at different acoustic frequencies, we do know that residents living near existing wind turbine developments are reporting cumulative sleep deprivation, and symptoms of physiological and psychological stress, in addition to a range of other symptoms which have been given the term “wind turbine syndrome” by an increasing number of medical practitioners, and long called “annoyance” by engineers and other researchers.

There is no evidence, *collected directly from wind turbine residents*, that a “nocebo effect” rather than wind turbine acoustic emissions, is directly causing their sleep disturbance and other symptoms and sensations, or their deteriorating mental and physical health.

There is a wealth of clinical and peer reviewed published evidence which clearly establishes that both sleep deprivation and stress, (physiological and psychological), regardless of the cause, have a very damaging effect on long term health.

There is also peer reviewed published evidence, and many clinical and adverse health event reports that sleep deprivation and physiological and psychological stress are present in wind turbine exposed residents.

The limited but compelling old and recent acoustic field evidence we have is strongly suggestive that there is a direct causal relationship between sound energy frequencies and pressure pulses generated by wind turbines and the symptoms and

sensations being reported by residents living near operating wind turbines, including sleep disturbance and physiological stress, both of which we know are extremely damaging for long term health.

In the context of applying that knowledge to this particular proposed wind development, it is my opinion that serious adverse health effects will be inevitable and unavoidable for a significant number of the residents living within 5km of the wind turbines.

The Cullerin survey results from only 15 turbines, of a similar size proposed to this wind development, with turbines with only 2MW power generating capacity, suggest that the adverse impacts on sleep and therefore health over time could well extend further than 5km, and involve a major proportion of the population in the vicinity of this proposed wind development.

Sarah Laurie, BM BS

(Bachelor of Medicine, Bachelor of Surgery, Flinders University)

15th November, 2013

Links to the material presented at the Cherry Tree VCAT Tribunal in late October, 2013:

Mr Les Huson, acoustician

<http://waubrafoundation.org.au/resources/huson-l-expert-evidence-at-vcat-cherry-tree-hearing/>

Mr Andrew "Gus" Gardner (Pressure bolt perception)

<http://waubrafoundation.org.au/resources/gardner-statement-vcat-cherry-tree-hearing/>

Mrs Maria Linke (5km away from turbines she cannot see)

<http://waubrafoundation.org.au/resources/linke-m-witness-statement-vcat-cherry-tree-hearing/>

Links to the three recent population noise impact surveys/ case series prepared for the Cherry Tree Tribunal hearing

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

Macarthur survey 2013: <http://waubrafoundation.org.au/resources/macarthur-wind-energy-facility-preliminary-survey/>

Waterloo case series 2013: <http://waubrafoundation.org.au/resources/morris-m-waterloo-case-series-preliminary-report/>