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6<sup>th</sup> August, 2017

Mrs Jacinta Coffey  
Port Fairy, VIC, 3284

Dear Jacinta,

As requested, I am providing you with some additional information relating to the known adverse health effects from wind turbine noise that is pertinent to the proposed amendments to increase the height and power generating capacity of the currently approved Ryans Corner Wind Farm Planning Permit, approved under the 1998 NZ Standard. I accessed the details of those proposed amendments on the Moyne Council website <sup>1</sup> and note they include increasing the tower height to 180 metres. As discussed, an increase in the tower height and consequent increase in power generation capacity has been shown by Moller & Pedersen to increase the proportion of low frequency noise emitted, and therefore it is likely to increase the disturbances to sleep and other human activities which acousticians refer to as “annoyance” to neighbours.<sup>2</sup>

Firstly, excessive noise at night, regardless of the noise source, is well known to cause sleep disturbance. If this happens cumulatively, sleep deprivation will ensue. The adverse health effects of sleep deprivation are undisputed, even by medical experts employed as paid consultants by the wind industry.

Sleep deprivation and its well known consequences are also well known to health and noise pollution regulatory authorities – indeed setting acoustic parameters for the protection of sleep is specifically mentioned in the New Zealand Standard NZS 6808: 1998 on pages 8 - 9 which states the following under section 4.4.1 :

*“The measured background sound levels are used to quantify the existing sound climate which can be quite low as WTG sites are often located in areas with a rural character. In order to provide a satisfactory level of protection against the potential adverse effects of WTG sounds, this Standard recommends an upper limit of acceptable WTG sound levels outdoors at the residential locations of 40 dBA L 95 (refer to 4.4.2). This has been based on an internationally accepted indoor sound level of 30 – 35 dBA L eq commonly used as a design level to protect against sleep disturbance (refer Berglund & Lindvall)....*

The current problem in Victoria is that despite the express intention to **protect against sleep disturbance**, the NZ Standard, and the way it is implemented, **does not in fact protect residents against sleep disturbance**. In other words, the New Zealand Standard is not fit for purpose, and permits serious harm to human health, via known causal pathways of sleep disturbance, and consequent chronic sleep deprivation. The increase in wind turbine height is likely to make the existing predictable adverse effects and consequent health problems for neighbours to Ryans Corner even worse, out to greater distances.

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<sup>1</sup> <http://www.moyne.vic.gov.au/Public-Notices/Invitation-for-Community-Submissions-%E2%80%93-Ryan-Corner-Wind-Farm>

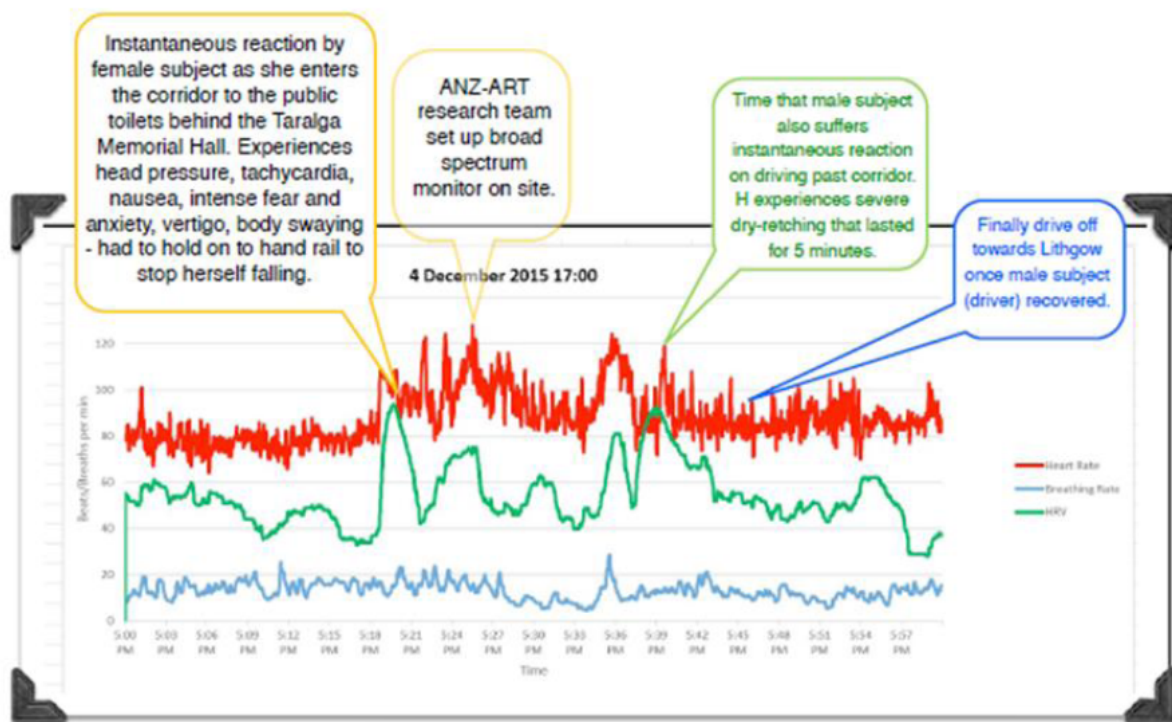
<sup>2</sup> <http://waubrafoundation.org.au/resources/moller-pedersen-low-frequency-noise-from-large-wind-turbines/>

I have previously given detailed evidence to the Cherry Tree case in VCAT in Victoria,<sup>3</sup> and the Stony Gap case in the ERD court in Adelaide,<sup>4</sup> both of which summarized the then available knowledge about wind turbine noise and its adverse health effects, especially via well accepted pathways of sleep disturbance and stress. My opinion in those cases is consistent with the limited advice and information relating to the known effects of noise on human health that is contained in Section 7 of the Victorian Health Department’s Technical Note on Wind Farms Sound and Health.<sup>5</sup> There is no scientific reason to exclude wind turbine noise from those listed adverse effects.

My opinions have since been further supported and strengthened by the emerging scientific field evidence relating to identification of the acoustic triggers for these physiological stress events, and relevant animal research showing how these events if repeated can lead to progressive noise sensitization with ongoing exposure. The sleep disturbance is directly caused by repeated physiological stress events, via the **startle reflex**, as evidenced by the common reports of nearby residents that they are “**waking up repeatedly in an anxious frightened panicked state**” and that they wake up feeling exhausted in the morning.

Objective physiological evidence of these “fight flight response” events both overnight and during the day is now being captured with concurrent acoustic monitoring. The graph below shows the sudden heart rate accelerations at the time the intense “fight flight” and other symptoms were experienced. It is reproduced from Steven Cooper’s presentation to the International Conference of the Biological Effects of Noise in Zurich.<sup>6</sup>

Figure 3 shows the results of biomonitoring during a field expedition where two of the noise sensitized residents experienced severe disturbance when entering a wave guide effect from operational wind turbines located over 3.5 km from the nearest turbine.



Physiological Monitoring of Female Subject between 5:00 pm and 6:00 pm at Taralga toilet stop, 4/12/15.

<sup>3</sup> Cherry Tree statement of evidence can be accessed here: <http://waubrafoundation.org.au/resources/cherry-tree-wind-farm-waubra-foundation-statement/>

<sup>4</sup> Stony Gap expert opinion can be accessed here: <https://docs.wind-watch.org/Stony-Gap-Expert-Opinion-Laurie.pdf>

<sup>5</sup> <http://waubrafoundation.org.au/wp-content/uploads/2013/05/Wind-farms-sound-and-health-Technical-information-WEB-29April2013.pdf>

<sup>6</sup> the presentation and accompanying paper can be accessed here: <http://en.friends-against-wind.org/health/a-new-methodology-for-investigating-ilfn-complaints>

## Cross sensitisation and low frequency noise sensitization – a growing public health problem

The two people in the Taralga field trip were already sensitized to amplitude modulated low frequency noise from a coal fired power station and an extractor fan from an underground coal mine at Lithgow. They also had previously reacted strongly and unexpectedly to wind turbine noise, and this subsequent field trip was undertaken to try and identify the acoustic trigger for this reaction. Dynamically pulsed, amplitude modulated wind turbine noise across a range of frequencies was identified as a likely cause.

This observed “cross sensitization” effect to other noise sources is also being increasingly reported to the Waubra Foundation by wind turbine noise sensitized residents,<sup>7</sup> and by other residents sensitized to other noise sources including noise from coal seam gas field compressors and associated infrastructure, noise from gas fired power stations, and noise from smart meters. The common acoustic trigger appears to be the noise character rather than the level of noise alone – especially where noise is impulsive, pulsing, or amplitude modulated.

Once sensitized, people report that they cannot easily escape the adverse effects of their involuntary physiological stress response to the sound, even if they move away from the existing noise source to which their sensitization originally developed. This therefore restricts where they can live, sleep, and work, without suffering these ongoing adverse effects. This is particularly a concern for children who become sensitized.

The Victorian Health Department document specifically mentions low frequency noise sensitivity as an issue. In their April 2013 Technical Note<sup>8</sup> in section 7.5.3 they state: “*Some individuals have a particularly sensitive response to low frequency noise*” ... and go on to state that “*once a person has become sensitized to any noise, the slightest elevation over the hearing threshold can be perceived easily, and may become unbearable*”.

This **new** sensitisation is precisely what increasing numbers of residents living near wind farms are reporting, and once sensitised they do indeed find noise including wind turbine noise, to be unbearable.

### Repeated stimulation of the startle reflex leads to sensitization

There is good animal research in wild seals showing that when the acoustic startle reflex is repeatedly elicited with an acoustic trigger, (in this research it was impulsive noise) that progressive and increasing sensitization to the noise stimulus will occur, but no sensitization occurred in an identical group of wild seals exposed to an acoustic trigger at the same level, without those impulsive sound characteristics. In other words, the effect was dependent upon the character of the noise, and was independent of the noise level that in that study was the same for both experimental groups of seals.<sup>9</sup>

This same phenomena of increasing sensitization with ongoing exposure to wind turbine noise is observed and reported by residents around the world.

Human research into Post Traumatic Stress Disorder (PTSD) uses this known relationship between acoustic startle and physiological stress response to determine the presence, and the severity, of PTSD.<sup>10</sup> This enhanced acoustic startle effect in people with PTSD is not confined to military veterans alone, and there is research showing that children who report a history of childhood sexual abuse also have an enhanced

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<sup>7</sup> eg Mrs Jan Hetherington <http://en.friends-against-wind.org/testimonies/my-101st-formal-complaint-to-agl>

<sup>8</sup> <http://waubrafoundation.org.au/wp-content/uploads/2013/05/Wind-farms-sound-and-health-Technical-information-WEB-29April2013.pdf>

<sup>9</sup> the wild seal research was conducted by Gotz and Janik in Scotland, and was published in 2011 : <https://bmcneurosci.biomedcentral.com/articles/10.1186/1471-2202-12-30>

<sup>10</sup> <https://www.ncbi.nlm.nih.gov/pubmed/8540594>

acoustic startle response.<sup>11</sup> The authors suggest that *“increased startle may be a biomarker of stress responsiveness that can be a persevering consequence of early trauma exposure during childhood”*.

Children with autism also have an enhanced acoustic startle reflex response,<sup>12</sup> and this could explain the reports from parents of children with autism and sensory processing disorders of rapid and obvious distress in their children when exposed to wind turbine noise. These adverse effects of industrial low frequency noise on especially vulnerable children are not limited to wind turbine noise - other noise sources including coal seam gas generated industrial noise can also induce severe distress, such as was reported by John Jenkins in a recent Federal senate inquiry into the effects of coal seam gas on the surrounding community near Chinchilla, Queensland.<sup>13</sup>

If these especially vulnerable children who already have an enhanced acoustic startle reflex response, are further chronically exposed to acoustic stimuli that further sensitises them, their health and wellbeing is predictably going to suffer.

Adults with PTSD, including military veterans, are reporting rapid deterioration in their health and wellbeing and worsening PTSD symptoms when exposed to operating wind turbines. Barry Funfar is a US Marine who has made his story about his experiences in Falmouth USA publicly available,<sup>14</sup> but there are numerous others who have reported their stories to me, who had histories of childhood sexual assault, or work induced PTSD if they were nurses, police, paramedics or ambulance officers, in addition to those who have served in the armed forces.

In addition to those already diagnosed with PTSD, prior to their exposure to operating wind turbines, some former Victorian wind turbine neighbours from Waubra and Toora have been bought out and gagged, and describe symptoms consistent with PTSD which they did not have prior to exposure to operating wind turbines, suggesting that the chronic exposure to the noise could induce PTSD, de novo. Some of these people were formally diagnosed with PTSD by their treating medical practitioners. The same clinical histories of newly diagnosed PTSD are also being obtained from residents in Canada and North America.<sup>15</sup>

## **Additional Recent Acoustic Research Results implicating “strong AM”**

Steven Cooper’s recent conference presentations shared the results of his re analysis of the acoustic WAV files from his Pacific Hydro funded Cape Bridgewater Acoustic investigation at the times when residents reported the worst impacts (sensation level 5). Those WAV files showed dynamically pulsed “strong” Amplitude modulation at those times, with a bigger distance between the peaks and troughs than at other times when the symptoms were not as intolerable to those residents.<sup>16</sup>

These results are consistent with the sleep research of Smith et al from Sweden, who found that even young fit healthy study participants developed sleep disturbance with “strong AM” episodes of laboratory wind turbine noise<sup>17</sup> and with other research findings that amplitude modulation correlated with reports of annoyance during laboratory listening tests.<sup>18</sup>

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<sup>11</sup> <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2852033/>

<sup>12</sup> <https://molecularautism.biomedcentral.com/articles/10.1186/2040-2392-5-23>

<sup>13</sup> Hansard containing John Jenkins testimony on 17 February 2016 at Dalby about the effects on his son can be accessed here: [http://www.aph.gov.au/Parliamentary\\_Business/Committees/Senate/Gasmining/Gasmining/Public\\_Hearings](http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Gasmining/Gasmining/Public_Hearings)

<sup>14</sup> <https://www.bostonglobe.com/lifestyle/2014/01/24/falmouth-veteran-battles-wind-turbines-and-health-woes/dVF6q3ur3oO4706FRpKPLJ/story.html>

<sup>15</sup> Personal communication, Dr Robert McMurtry

<sup>16</sup> Personal communication, Steven Cooper

<sup>17</sup> <http://waubrafoundation.org.au/resources/smith-m-g-et-al-physiological-effects-wind-turbine-noise-sleep/>

<sup>18</sup> <http://waubrafoundation.org.au/resources/lee-s-et-al-annoyance-caused-by-amplitude-modulation-wind-turbine-noise/>

## The Regulatory Vacuum – what can residents do?

Despite Amplitude Modulation being specifically mentioned in the NZ Standard, noise investigations in response to noise complaints from wind turbine noise in Victoria are essentially non-existent, unless residents fund them themselves, which most people cannot afford. It is the Foundation's consistent experience across a number of sources of noise pollution that if operators learn that noise testing is occurring, that machinery is operated in noise-reduced mode until that testing has concluded. The wind industry is no exception.

On the rare occasions when a wind turbine noise investigation is instigated by someone from a responsible authority, it is usually not conducted completely independently of the operator, nor does it specifically look for the presence and strength of amplitude modulation and other potential acoustic triggers for the startle reflex **inside** homes where people are experiencing the sleep disturbance.

The Federally appointed Wind Farm Commissioner does not have a budget for noise investigations, which should have been a mandatory part of any formal assessment of a resident's complaint about wind turbine noise, and the Clean Energy Regulator claims the reported adverse effects are due to the discredited nocebo effect.

As a result, residents are left in a regulatory vacuum, and as you know first-hand, some are being driven out of their homes, and off their farms, because of the intolerable effects of the noise.

Planning authorities refuse to acknowledge the harm that is clearly being caused, about which they are repeatedly warned. They continue to approve more powerful wind turbines at existing approved wind power developments, and new wind power facilities far too close to human habitation.

Victorian health authorities refuse to conduct investigations themselves, despite two of their medical practitioners admitting in 2011 that they knew there were problems for residents from wind turbine noise.

However, the recent cases for noise nuisance internationally (UK, Ireland, USA), and the court orders for wind turbines to be shut down because of the harm to human health they are clearly causing (eg Portugal, and Falmouth, USA) as well as improved and more affordable acoustic monitoring and recording equipment, and a better understanding of the physiological reactions and how to measure and record them now make it possible for residents to act to protect themselves and their families. This requires full spectrum acoustic monitoring and recording of WAV files, starting pre-construction and continuing on after the turbines start operating, together with thorough baseline health checks, detailed environmental noise diaries pre and post construction, and where possible the usage of wearable devices such as the FITBIT HR or Apple Watch or similar can assist with the gathering of objective data about sleep disturbance and heart rate.

This sort of data collection, pre and post construction, will especially assist families who find that they are severely nuisanced by the noise after construction.

Some residents have also gained specific knowledge and expertise in environmental noise monitoring, via the Acoustar Environmental Noise Training Program, based in Queensland but available online.<sup>19</sup> I am happy to put you in touch with residents who have already completed the course, if you are interested.

I hope this information helps.

Yours sincerely

Sarah Laurie  
CEO, Waubra Foundation

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<sup>19</sup> <http://www.acoustar.qld.edu.au/>