

## Senate Inquiry into Wind farms

### Summary

I live outside Ballarat, approximately 7 kilometres from the approved but yet to be constructed Lal Lal wind farm. I thought the wind farm was a good thing until I spoke to someone from the wind farm industry who told me the turbines were too close to homes and would have to be turned off. I started looking into the siting of turbines not because I believed my family would be affected but to find out how this wind farm would affect others in our community. What I discovered, and am still discovering, was initially worrying but has now becoming disturbing.

I believe that turbines are sited too close to homes and workplaces. At many approved or constructed wind farms there are turbines up to 3MW only 800 metres from non-host land holders homes, with some homes completely surrounded by turbines.

Research and experience of existing wind farms lead me to conclude that we need a moratorium on wind farms and an independent and transparent investigation into wind farms. A number of factors need to be investigated.

I believe that our old guidelines were grossly inadequate in calculating audible noise. In Victoria we now have a liberal government and new wind farm guidelines that set distances between homes and turbines of 2km. Unfortunately many turbines were already approved or constructed with the old guidelines. At this stage our government have stated they will not withdraw the existing planning permits.

I am concerned that many factors should have been considered in relation to the old guidelines. I would like all already approved and operating wind farms to be reinvestigated. More importantly though, I believe low frequency noise must be immediately investigated due to the extremely serious health impacts being felt by residents now.

I am also concerned about community division, the industrialisation of the landscape, especially in Western Victoria, and the impact on local wildlife. All this for a power source that can never be a base load.

We need to learn from people already adversely impacted from the inappropriate siting of turbines. Thousands more turbines are approved or proposed. How many people do we need suffering health problems, sleep deprivation, unable to live in their own homes, and work their own properties until something changes?

## AUDIBLE NOISE

My initial concerns regarding wind farms were based on audible noise. Many approved wind farms in Victoria were based on an acoustic standard that is 13 years old, NZS6808:1998 - The Assessment and Measurement of Sound from Wind Turbine Generators. This standard was written when turbines were only 45-50 metres hub height and around 700kW. (Blayney wind farm, NSW - 45 metre hub height, 660 KW motors). The turbines used now are up to 85 metres hub height and have up to 3MW motors.

The Swedish Environment Protection Agency study titled "Noise Annoyance from Wind Turbines – A Review" (page 10) found that common hub heights for operating turbines in Sweden were 40-50 metres. They state that the new turbines have a hub height of 80-90 metres, and note that the turbine wind speeds at these hub heights compared to the wind speed at ground might have been underestimated.

Note: a 10 dB increase in sound equates to double the loudness.

There are two factors that I believe contribute to the inaccurate calculation of audible noise, these are amplitude modulation and stable air.

### Amplitude Modulation

Amplitude modulation is a special audible characteristic, which is often described as impulses or thumping. I believe that this characteristic should be regarded by guidelines as inherent to wind farms which would lead to a 5dBA penalty added to all predicted noise levels from wind farms.

Many recent studies (see references) have found that the noise complaints from existing wind farms are a result of amplitude modulation.

At a wind farm site where multiple turbines are in use, two or three turbines can be operating in phase. This is where the maximum noise level from each turbine is heard at the same time. When a number of turbines are in phase audible modulations (impulses or thumps) are created that can be heard over background noises some distance away.

There are a number of occurrences that can cause amplitude modulations. One is the blade passing the tower. A second is the movement of blades through different wind speeds, known as wind shear. Topography and multiple turbines are also factors.

Many experts agree that amplitude modulation is difficult to predict. A report "Research into Aerodynamic Modulation of Wind Turbine Noise : Final Report" by Department for Business, Enterprise and Regulatory Reform, UK, page 4, states that "AM is not fully predictable at current state of the art." From the Swedish Environmental Protection Agency report, "Noise annoyance from wind turbines - a review", page 9, states that "the modulation in the noise from wind turbines is not yet fully explained and will probably not be reduced in the near future and is therefore a factor of importance when discussing noise annoyance from wind turbines". "Amplitude Modulation of Wind Turbine Noise. A Review of the Evidence", by Dick Bowdler, also discusses the fact that AM is impossible to predict.

In "Amplitude Modulation of Wind Turbine Noise. A review of evidence" by Dick Bowdler, page 5, is an example of AM from G.P van den Bergs study "Do wind turbines produce significant low frequency sounds". It states "If we have two turbines whose sound modulates between a maximum of +3dB and a minimum of -3dB then, when the modulations are in phase, they will vary between a maximum of +6dB (which is a 3db higher pulse level) and a minimum of 0dB. When they are out of phase they will be more constant at a level of around +4dB. Similarly with three turbines in phase the sound will range from a maximum of 8dB (which is a 5dB higher pulse level) to a minimum of 2dB. When out of phase it will be a relatively constant 6dB."

From van den Bergs study, amplitude modulation can cause not only the annoying, pulsing sounds which appear 5dB louder, but also can increase actual noise levels by 3-5dB.

Amplitude modulation cannot be predicted and is a problem with turbines with high hub heights.

### Stable Air - van den Berg effect

According to NZS6808:1998, Acoustics noise levels are to be measured at homes near wind farms sites and wind speeds are measured 10m from ground level. From the recorded wind speeds noise levels from the wind farm are predicted. Predicted noise levels must not exceed the noise levels recorded near homes by more than 5dBA or 40dBA, whichever is the greater value.

The Van den Berg effect is the result of a study by G.P. van den Berg at an existing wind farm in Rhede, Germany that experienced noise complaints. On quite nights it was found that the turbines could rotate at high speed, resulting in the wind farm being heard several kilometres away. This effect is caused by stable air flow, when the wind at ground level (where most background measuring is collected at 10 metres above ground) is moving slower than the air at hub height (85 metres above ground). Stable air occurs at night, which increases the listener's annoyance due to difficulty sleeping and less background noises.

At daytime, the air is mixed by turbulence resulting from friction with the earth, especially from the thermal turbulence resulting from the heating of the earth by the sun. At night there is radiative cooling of the earth, which results in atmospheric stability. This causes the wind to subside. When the cooling begins, wind speed at ground level is reduced. However, wind speeds at hub height can still be relatively high.

A logarithmic relationship between wind speed at height and wind speed at a reference height, normally 10 metres, is commonly used but it has no consideration of atmospheric stability. Therefore it does not adequately predict wind profiles at night. From page 4 of van den Berg's article "Effects of the wind profile at night on wind turbine sound", "*The effect of the change to stable atmosphere is that, relative to a given wind speed at 10m height in daytime, at night there is a higher wind speed at hub height and thus a higher turbine sound power level; also there is a lower wind speed below 10m and thus less wind-induced sound in vegetation.*"

In the article by G.P. van den Berg based on the study at Rhede, it states that the wind speed at hub height at night can be 2.6 times the expected wind speed, which can result in higher rotation speed of the turbines and sound levels up to 15dB higher than predicted.

When there is stable air there is low background noise levels but high noise levels from the turbines as described above, and therefore the background noise fails to mask the noise from the wind farm.

The van den Berg effect has been found to occur in areas with a roughness of 3cm, which is defined as undulating paddocks with occasional crops of trees.

An article from the Bureau of Meteorology titled "Wind Shear" discusses both stable air and wind shear. It states that wind shear is due to friction and the closer to ground surface the slower the wind speed. The article also states that differences in wind speed due to change in height can range from very little in unstable air (around 5%) to enormous amounts in stable air (up to 300%).

From Acoustic Assessment of Wind Farms – A Practical Perspective, by Peter and Rachel Foster, page 2 states that "*some sites may show variations in the vertical wind profile or shear between day and night (eg. due to greater atmospheric stability at night compared to day). In addition, the site wind profile (and terrain roughness) may be different to that at the initial turbine sound power measurement site*". They state that this may lead to errors in the "*assumed turbine sound power level versus wind speed*" at the site and that it is "*important to define the inherent wind profile at the proposed wind farm site*". From this we can see that referencing the wind speed at hub height is not good enough, an investigation into the wind profile is a must.

Further, they recommend that with regard to the lack of "hard data" regarding stable wind in Australia, measurement of wind speed at heights approaching hub height in conjunction with the 10m AGL measurements to "*enable informed decisions*" on this effect.

While it is not for use, the Draft Australian Standard, DR 07153 CP, "Acoustics – Measurement, prediction and assessment of noise from wind turbine generators" does give us further reason to believe that stable air should be investigated. On page 9 it states that the use of 10m AGL wind speed may result in increased uncertainty in the estimation of actual sound power levels, particularly in stable air.

Often in reports to planning panels, wind farm proponents acoustics report on state that "hub height wind speed data was not available at the time of the noise monitoring. Therefore, wind speed has been measured at 10m above ground level (AGL)" Acoustic experts for wind farm proponents often state that NZS6808:1998 does not discuss stable air and therefore they do not have to investigate this effect. That the guidelines do not address stable air should be of little consequence, experts agree that this effect occurs therefore it must be investigated.

#### Calculations of Sound Levels

In a number of proposed and now approved wind farms across Victoria, proponents stated that the

maximum turbine size would be 3MW. However, acoustic experts only calculated noise levels for 2MW turbines. 2MW turbines have a sound power level around 104dB. 3MW turbines have sound levels of up to 110dB.

A peer review by Acousafe Services a wind farm in New Zealand, titled 'Peer Review Mahinerangi Wind Farm Noise for Clutha District Council' states on page 8 that it is difficult to predict noise levels when the type or wind turbine generators is not known. However, they also state on page 8 that the noise impact assessment for this wind farm adopts a "worse case scenario", so that "the noise levels should be less than those predicted."

#### Guidelines applied to Host landholders properties

Host landholders properties often have predicted noise levels greater than the limits set out by NZS6808:1998. The Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria states, "The Guidelines include reference to several other documents of relevance to wind farm proposals, including the New Zealand Standard 6806:1998 – Acoustics – The assessment and measurement of sound from wind turbine generators".

Proponents acoustic experts often state that host landholders properties will comply with the European Working Group on Noise from Wind Turbines (ETSU-R-97), which allows 45 dBA sound level limit where the "occupier of the property has some financial involvement in the wind farm". This is not in line with the required 40dBA( or 5dBA over background noise levels) from the current standard and the guidelines.

In some cases host land holder properties predicted noise levels are outside even ETSU-R limits.

Noise levels and character of the noise that the host land holder residents will be subjected to is outside their experience, and that they cannot be expected to sign a contract regarding noise levels when sound is such a complex matter. While these residents receive a financial gain, it is still important that their amenity is protected.

Noise levels of 45dBA, 5dBA over normal night time limits, will result in sleep disturbance. According to the World Health Organisation measurable effects on sleep start at background noise levels of about 30dB inside a house. With a 10dB reduction in sound levels through an open window host land holders will experience 35dBA.

Contracts which state " the Landlord releases the Tenant from any liability for loss, damage or injury occurring in the Premises or on the Land arising from the Tenant's breach of the Environment Protection Act 1970 (Vic) due to noise emitted from the Wind Turbine Generators." (See appendix B) mean that these residents will have little chance to rectify noise issues when they arise.

#### Questions regarding NZS6808:1998

Marshall Day Acoustics (often used as expert noise witnesses by wind farm proponents) state in their report on the proposed Moorabool wind farm that the "noise predictions in NZ6808:1998 are based upon a simple equation that may be conservative..." – page 9. This contradicts a report by Marshall Day Acoustics titled "Wind\_farm\_noise\_in Australia ©\_Marshall\_Day\_Acoustics\_2004" ( see Appendix A) which states:

"NZS6808 also details a simple method of predicting noise levels at various distance from the turbines"  
"The method was always considered conservative as it ignored any ground absorption and topographical shielding"  
"As the turbines have grown in size the method is no longer conservative as the low frequency noise content is greater and the model under predicts"

In a paper titled "Peer Review Kaiwera Downs Wind Farm Noise for Gore District Council", New Zealand, in February 2008, on page 11, Nigel Lloyd from Acousafe recommends that the base noise limit from NZS6808 be made stricter, so that noise impacts can be minimised.

#### Noise Monitoring

From the recently approved Moorabool wind farm, the background noise monitoring was not undertaken in accordance with NZS6808:1998. However the panel still granted the permit. From Moorabool Wind Energy Facility Panel report: September 2010:

6.5.14 Conclusions and Recommendations – Adequacy of Noise Assessments Provided  
It is concluded that:

The noise assessment provided with the Application as modified by the evidence presented to the

Panel does not satisfy the requirements of the Planning Scheme and the WEF Guidelines because:

- A prediction of compliance with the noise limits specified in NZ6808:1998 is not provided; and
- The assessment has not been completed in accordance with the WEF Guidelines and NZ6808:1998 in relation to:
  - The selection of locations for measurement of background sound levels;
  - The positioning of noise monitoring equipment relative to that of trees and vegetation; and
  - Anomalous background sound level and wind speed data at one location.

How can a permit be granted when guidelines are not met and calculations need to be redone?

#### Homes surrounded by turbines

Houses at the approved Moorabool, Yallock, Lal Lal wind farm (and others) will be surrounded by turbines. These are non host land holder properties.

Residents of these properties will hear wind turbine noise every time the wind blows due to the properties being for the most part surrounded by turbines.

The report "Bald Hills wind farm project: EES, EES supplement and called-in permits, Panel report: 24 June 2004", page 193 stated that, referring to problems with the Toora wind farm, the panel '*should seek to learn such lessons as can at this stage be learned from previous cases*'. Further, it states, on page 202, '*no dwellings located as at Toora, at short range, with turbines surrounding them such that almost any wind direction will deliver down wind turbine noise, with little relief. ... The Panel would suggest that such siting vis a vis dwellings is now beginning to appear somewhat unwise, and on a precautionary basis to be avoided.*'

We now have the case of the Godfrey's whose property at the Waubra wind farm was surrounded by turbines. They complained about noise levels, health problems, blade flicker and impacts of the aviation lighting. Their property has since been bought by the wind farm operator, Acciona. While the Acciona state the property was bought due to the "visual impact of turbines on their property" we cannot ignore the fact that the problems the Godfrey's were concerned about were **health** and **noise**.

#### Future Developments

I believe the guidelines should protect land holders that wish to build in the future, whether they have made an application to build or not. Oberon Council Development Control Plan, Part O, Wind Generation, 2005 recommends 1.5km distance between turbines and boundaries of properties that have the capacity to be built on in the future.

#### Vulnerable Groups

Those in the planning stages should be concerned for vulnerable groups who live in the neighbouring or landholder properties where sound levels are high. Testing of the affects of noise on the listener has focused only on healthy adults, not the young, elderly or those with ailments.

The World Health Organisation has suggested that guidelines should be more stringent when considering the affects of noise on listeners who are in these vulnerable groups. In "Report on the Second Meeting on Night Noise Guidelines", the WHO has also found that sound levels should be less than 30dBA during sleeping periods to protect children's health.

#### Problems at Existing Wind farms

The following are by no means the only wind farms where residents experience noise and health problems.

#### Mr & Mrs Davis – Lincolnshire, England

At the Second International Meeting on Wind Turbine Noise, in Lyon France, September 20-21, 2007, Julian and Jane Davis presented their experience with a neighbouring wind farm. The wind farm consists of eight 100 metre tall 2MW turbines. The closest turbine is 930 metres away. Their account highlights the consequences of siting turbines too close to homes.

They discuss the pulsing nature of the noise and document their sleep deprivation, and other effects on their living. These include influence on the ability to enjoy the amenity of their home, health issues, loss of property value, concentration difficulties, and the affect on their cognitive ability, social life and moods. They are now renting what they title a "sleeping house" 5 miles away, but are unable to sell their property.

I have spoken with this family and discussed a letter from estate agents, see attachment, who state

that they are in 'the rare situation of having to decline any instructions to market the above property' due to their belief that no purchaser would be interested in the property due to the problems caused by the wind farm'. (see appendix C)

(Real estate agents in Australia also state that wind farms could lead to a 30 to 50 per cent reduction in property value)

#### Toora Wind Farm

Toora Wind Farm, in the South Gippsland Shire, was commissioned in 2002. Since that time noise has become a significant issue to those who live near the wind farm, and a number of properties have been bought by the wind farm company. Properties have since been demolished.

There are residents who are still trying to resolve the noise issues at their property, which is 1.2km away from a turbine. Resident have stated that it was not so much the loudness of the noise that they had problems with, but the character of the noise, ie the pulsing, thumping noise.

#### Media release – Victims of Industrial Wind Turbines on the Rise in Ontario 2009

- This release reports an increasing number of people in Ontario reporting adverse health affects due to wind turbines.
- Release states that more suffers may not be coming forward due to non-disclosure agreements in their contracts with the wind farm operators.
- Complaints include sleep disturbance, inner ear problems, cardiac arrhythmias, headaches and mood disturbances. Some have had to leave home.
- The release asks for independent monitoring of sound levels using both dBA and dBC, the frequency of the sound, and exposure time.

#### Waubra Wind farm.

- A number of families have moved out of their home due to low frequency noise. This low frequency noise causes pressure build up in the head and a number of health problems. They are unable to work on their property. Turbines 1.3-3km away from their home.
- Many families have trouble sleeping at night. They say the turbines can sound like jets over the house.
- One family used to go to sleep wearing head phones but were still woken every night by the turbine noise. They could hear the turbines every time the wind blew. They were surrounded by turbines, the closest turbines is approximately 800 metres away. They also experienced shadow flicker. House now bought by wind farm operator.
- Many residents describe feeling pressure in their head, pain behind their ears, blood pressure problems, dizziness, nausea, unable to work for long periods outside,
- Many homes have now been bought by Acciona and other homes are empty as families have had to leave the area for the sake of their health.

#### Capital Hill Wind farm

See articles from Sydney Morning Herald titled "George in a spin over noisy wind power", September 21, 2009. and "Tilting at wind mills: why families are at war", April 2, 2010

- Resident describes sound like "having a washing machine running constantly, or car idling outside your window, or an aircraft overhead which stays in one position...it is a constant drone which is quite disturbing"
- Another resident describes "it's as loud as an aircraft overhead, but there is also a "whoomp, whoomp, whoomp" regular sound with the blades passing the stem". When the blades turn on frosty nights they also "hear a high-pitched sound as well."

#### Summary of Recent Research on Adverse Health Effects of Wind Turbines, October 2009.

This paper discussed recent peer-reviewed research which substantiate adverse health claims in relation to wind farms.

- Ontario - as of September 2009 98 people reporting adverse health affects from wind farms. Some families have left their homes, page 9

- Health Canada states that “there are peer reviewed scientific articles indicating that wind turbines may have an adverse impact on human health.”, page 9
- States on page 10 that “Like the wind industry today, the tobacco industry denied for many years that there were any adverse health effects from their products. Corporate denial of a health problem is generally a delaying tactic not in the best interest of the public.”
- Minnesota Department of Health, page 11, “conclusion noted that wind turbines generate a broad-spectrum of low-intensity noise. The low frequency may affect some people in their homes, especially at night.”

Dr Christopher Hanning, page 11, “In weighing the evidence, I find that, on one hand, there is a large number of reported cases of sleep disturbance and, in some cases, ill health as a result of exposure to noise from wind turbines, supported by a number of research reports that tend to confirm the validity of the anecdotal reports and provide a reasonable basis for the complaints. On the other, we have badly designed industry and government reports which seek to show that there is no problem. I find the latter unconvincing.” (Dr Chris Hanning is a retired NHS sleep disorder specialist, he was the director of the Sleep Disorders Clinic at Leicester General Hospital.)

- Further of page 12, Dr Hanning states, “In my expert opinion, from my knowledge of sleep physiology and a review of the available research, I have no doubt that wind turbine noise emissions cause sleep disturbance and ill health.”
- Dr Hanning, page 12, “families whose homes were around 900m from wind turbines found the noise, sleep disturbance and ill health eventually drove them from their homes.”
- Dr Hanning, page 12 “inadequate sleep has been associated not just with fatigue, sleepiness and cognitive impairment but also with an increased risk of obesity, impaired glucose tolerance (risk of diabetes), high blood pressure, heart disease, cancer and depression. Sleepy people have an increased risk of road traffic accidents.”
- Dr Michael Nissenbaum (USA) ,”symptoms (including sleep disturbance, headaches, dizziness, weight changes, possible increases in blood pressure, as well as increased prescription medication use), all appear to coincide with the time when the turbines were first turned on.”page 13 (Radiologist in Maine, in radio interview quotes residents as saying “nobody will help us, cant leave here, cant live here. See <http://vodpod.com/watch/2060980-interview-with-dr-s-micheal-a-nissenbaum>)
- Page 13, In Japan in February 2009, 70 adverse health effects were reported due to wind farms. “Bouts of dizziness and inability to sleep properly were reported. When victims spent time away from the house, the symptoms quickly dissipated. But as soon as they returned, they would flare up again”, page 14
- Page 14, Ontario, “Sleep disturbance is the most common complaint. Other symptoms include inner ear problems, cardiac concerns such as arrhythmias and palpitations, headaches and cognitive and mood disturbances. Several suffered acute hypertensive episodes which are most concerning. Some have had to leave their homes in order to protect their health”
- On page 15 they discuss the effects of wind turbines on animals.
- Page 16 discusses Shadow Flicker

#### Farming Zone

In many wind farm panel reports they state “the purposes of the Farming Zone are to provide for productive agricultural use of the land and to ensure this primary function is not adversely affected by non agricultural uses.”

If you look at the Waubra wind farm example a large number of farmers are having difficulty farming their land. Some cannot live in their homes and so must travel to the farm. Some cannot work their farms for long periods of time as they become unwell. And some are sleep deprived and therefore have difficulty completing jobs.

From this and looking at the use of land near approved wind farms we can see that the same situation will affect farmers in other regions. This is outside the purpose of the Farming zone, as farmers that have to leave their homes, work less hours and struggle to complete their work are much less

productive.

#### Bias at Panel Hearings

Opponents arguments will only be heard if they are within the guidelines. Precedents from other wind farm panel hearings are not considered.

The Waubra and Lal Lal wind farm panels choose to ignore findings from the Bald Hills wind farm project: EES, EES supplement and call-in permits, Panel report: 24 June 2004", page 193 stated that, referring to problems with the Toora wind farm, the panel "Should seek to learn such lessons as can at this stage be learned from previous cases." Further, on page 202, "no dwellings located as at Toora, at short range, with turbines surrounding them such that almost any wind direction will deliver down wind turbines noise, with little relief... The Panel would suggest that such siting vis a vis dwellings is now beginning to appear somewhat unwise, and on a precautionary basis to be avoided."

As stated above, the Godfrey residence has been bought by the wind farm operator. If and when other wind farms are built, residents will undoubtedly have to sell their homes too.

From page 76 of the Lal Lal wind farm panel report, the noise expert for the proponent, Mr Delaire, stated that he "supported the inclusion of a *condition* requiring an *assessment* prior to installation of turbines of predicted noise emissions to show compliance with the NZ Standard noise limits if a 3MW turbine is used." Council for the Proponent agreed that a permit condition to that effect would be appropriate. However the planning panel wrote "We do not agree with Mr Delaire that additional predictions should be required if the indicative turbine is not ultimately selected." It can be seen that the panel has even gone against the proponents own expert in this matter.

Proponents however, can use precedents' from other wind farm developments and are permitted to change the noise limits for host land holders. The proponent for the Lal Lal wind farm stated at the panel hearing that "residents in Rural or Farming Zones cannot expect the same levels of amenity as in residential or rural living zones" citing the Bald Hills Wind Farm panel.

Proponents are also allowed to use standards from other countries, as discussed earlier.

#### Guidelines

There is a degree of variation in noise limits for wind farms country to country, state to state. But it is worth noting that some areas have greater distances from homes to turbines than setbacks in already approved projects. And we need to remember that turbines are getting larger. Some examples follow:

- French National Academy of Medicine has called for a halt of all large-scale wind development within 1.5 kilometres (roughly 1 mile) of any residence, March 2006
- The U.K. Noise Association recommends a 1 mile (1.6km) separation distance, July 2006
- Riverside County, California where turbine distances from dwellings can be no closer than 2 miles, County of Riverside General Plan – Hearing Draft
- [Retexo-RISP](#), Germany. 'housing, should not be nearer than 2 km to the windfarm'
- Epuron, wind farm company - say wind turbines audible within 2km
- Glen Innes Council, NSW - a distance of 2km between homes and turbines.
- Upper Lachlan Shire Council, NSW – a distance of 2km or 15 times blade tip height, whichever is greater.
- Oberon Council, NSW – a distance of 1.5km between turbines and existing homes or boundary of properties that may be developed in the future
- Study titled "Noise radiation from wind turbines installed near homes" – distance between homes and turbines should be 2km.
- Nina Pierpoint, MD, PhD – says 1.5 miles between homes and turbines, "Health Effects of Wind Turbines", March 2006.
- Safe Buffer zone of at least 2km for turbines up to 2MW. Greater setbacks for turbines over 2MW. "Noise Radiation from Wind Turbines installed near Homes effect health", page 3, Feb 2007
- NSW Legislative Council recommendations of 2km setbacks

#### INAUDIBLE NOISE - LOW FREQUENCY NOISE OR INFRASOUND

In the last year and a half I have begun to realise that wind farms also cause health problems due to inaudible noise - low frequency noise or infrasound. I have met people from Waubra wind farm and other areas and are very concerned for their well being. I believe that low frequency noise requires immediate attention from our government and even the above setbacks for audible noise appear to be inadequate.

I believe that NZS6808:1998 is inadequate as it does not include low frequency noise. Noise



measurements in NZS6808:1998 are in dBA, which is noise that the average health adult can hear.

Graeme Hood from Ballarat University conducted preliminary testing at various properties at the Waubra wind farm over a year ago after residents experienced effects such as dizziness, ear ache, nausea etc. Sound pressure testing revealed low frequency noise between 70-80 dB, even though the A-weighted (audible noise) reading was only 20dbA.

The World Health Organisation Guidelines for Community Noise, by Berglund et al. states on

- “a large proportion of low-frequency components in noise may increase considerably the adverse effects on health”, page xiv
- “Special attention should also be given to the following considerations: c. Sound with low-frequency components. Disturbance may occur even though the sound pressure level during exposure is below 30dBA., page 28
- “When prominent low frequency components are present, noise measures based on A-weighting are inappropriate”, page 28
- Since A-weighting underestimates the sound pressure level of noise with low frequency components, a better assessment of health effects would be to use C-weighting.” page 28
- “The evidence on low frequency noise is sufficiently strong to warrant immediate concern”page 28

As stated earlier, from the Marshall Day Acoustic presentation titled Wind farm Noise in Australia, 2004

- “As turbines have grown in size the method is no longer conservative as the low frequency noise content is greater and the model underpredicts.”

A paper titled Infrasound and its Effects on Humans by Diana Carolina Fernandez Valencia, Faculty of Architecture, Design and Planning, University of Sydney describes a study in the UK where music was played to an audience with infrasonic sound (frequency of 17Hz) introduced in two of the musical pieces without letting the audience know it was there. Results showed “emotional and physiological responses such as anxiety, headache nausea, and increase in heart beat”. (section 5.1)

A similar study was conducted in Sydney, with a 19 Hz low frequency stimulus (sound pressure level of up to 83dB) played at the same time as music. The results after just 10 minutes of listening to both the infrasound and music are as follows.

After 10 minutes of listening to both the infrasound and music. “36.4% of the population felt no physical sensation nor differences among parts of the experiment. The remaining 63.6% described the effects on their body when the stimulus was on with words such as “pain on the left side above the ear”, “difficulty to focus”, “hurting joints”, “change in body pressure”, “sensation of illness” and “pump in blood pressure” among others.” (section 5.2.2)

These effects are similar to those experienced by Waubra residents and those living near other wind farms.

A Review of Published Research on Low Frequency Noise and its Effects, Dr Geoff Leventhall, 2003

- Page 32, “Twenty subjects compared the two noises within the dynamic range 49-86 dBA. At equal A-weighted levels, the noise dominated by the low frequency component was perceived as 4-7dB louder and 5-8dB more annoying.
- Page 32, “Nakamura and Inukai used a stimulus sound of a pure tone in 20 conditions from 3Hz to 40Hz and pressure levels from 70dB to 125dB, with evaluation by 17 subjects. There were four main subjective factors in response to low frequency noise: auditory perception, pressure on the eardrum, perception through the chest and more feeling of general vibration.”
- Page 34, The difference between C- and A- weighting's of greater than 20dB is a predictor for a low frequency noise problem.

#### Community Concern

Many people like the idea of wind farms. They, as I do, worry about global warming and their children's

and grandchildren's future. Many have put money into community wind farms with the intention of doing something good. But they have never heard the other side, the health and social impacts. Even those with turbines already on their land at Waubra and other wind farms probably thought they were doing something good for the environment. They never thought that these things could be so loud and make such an impact on health.

So a low budget ad campaign was recently organised to highlight the health problems people living near wind farms are experiencing. People donated money, varying from \$40 to much larger amounts, even when they didn't know those organising the ads. People did what they could because they are so concerned and they want the general population to hear the negative side of wind farms.

Generous film makers came on board and local residents offered their faces and stories to the commercials. The results can be seen on the link at <http://www.youtube.com/watch?v=Gpe63k5yh5M>.

People are sick, many are worried. But we are working together in the hope that the public and the government will listen.

#### Turbines Not a Base Load Power Source

I am concerned about global warming but wind turbines can never be a base load power supply. Wind is intermittent, turbines often create more power at night (due to stable air) when demand is low (There report from the United Kingdom where wind farm operator was paid to keep turbines off at night), turbines must switch off at temperatures of 30 degrees Celsius, wind power cannot be stored and they require power from coal fired power stations to start up and to keep the oil inside at a constant temperature. Turbines might have a place, but an intermittent power supply is not a good enough reason to destroy life's, communities, the landscape and wildlife.

#### Community Division

I am concerned about the division in communities that is created by wind farms. I have heard from families who have been friends for many years who are no longer talking and of threats and intimidation. In farming communities in particular it is very important to have good relationships with your neighbours. For generations people have been helping each other out, either with advice, equipment, man power or mateship. This is being lost in many areas.

#### Industrialised Landscape

Large areas in rural Australia are being industrialised by wind farms. Western Victoria in particular has thousands of turbines approved, constructed or proposed. With such large structures that can be seen from a great distance away, and flashing red aviation lighting at night, these beautiful areas are being destroyed.

#### Wildlife

I love to watch the wedge tailed eagles and I am extremely sad to think many of these incredible birds ( and others) that will be destroyed by turbines. Wind farm turbines have been described as "black holes" to eagles. They don't see them, are killed by them and then another pair will take over the area and the same thing happens again.

#### Conclusion

Many rural residents are suffering from the effects of audible and inaudible noise due to wind turbines too close to their homes. With thousands of wind turbines have been proposed or approved across this country many, many more are facing the same situation

I have met decent, genuine people who have been forced out of their homes, or who continue to live in their homes while suffering from serious health problems. I have also met or spoken with people facing a similar fate. Many are worried. Some speak out and many more are quite. Many people move to rural Victoria to get away from the rat race and can not cope with planning panels and the like.

Those already suffering are speaking out not just to help their own situation but also to stop this happening to anyone else. I ask those involved in this Senate Inquiry to listen to the people who are already suffering. They do not ask for money, they are asking for you to listen, to care, and to help.

**How many people do we need suffering health problems, sleep deprivation, unable to live in their own homes, and work their own properties until something changes?**

**We need a moratorium on wind farms until an independent and transparent investigation has been carried out.**



## New Zealand Standard 6808

- NZS6808 also details a simple method of predicting noise levels at various distances from the turbines
- This simple method only predicts noise levels base on the attenuation due to distance and air
- The method was always considered conservative as it ignored any ground absorption and topographical shielding
- As the turbines have grown in size the method is no longer conservative as the low frequency noise content is greater and the model under predicts

## APPENDIX B - LANDLORD'S RELEASE

### 6.5 Usual Insurance Policy

Notwithstanding anything contained in this **Clause 6** or the Lease, the Landlord agrees that it must not withhold its consent to any insurer or insurance policy taken out by the Tenant which is commercially usual for wind farm projects undertaken in Australia.

## 7. INDEMNITY AND RELEASE

### 7.1 Indemnities

The Tenant indemnifies the Landlord against any liability for loss, damage, injury or death caused by or arising directly or indirectly from:

- (a) any act or omission on the part of the Tenant or any clerk, servant, licensee, invitee, workman, sub-contractor, employee, client, agent, customer or visitor of the Tenant, or
- (b) the Tenant's use or occupation of the Premises; or
- (c) the services to or originating from the Premises.

### 7.2 Release

- (a) The Tenant occupies and uses the Premises at the Tenant's Risk.
- (b) The Tenant releases the Landlord from any liability for loss, damage, injury or death occurring in the Premises or on the Land or arising from any of the circumstances set out in **Clause 7.1**, except to the extent that it is caused by negligence on the part of the Landlord.

### 7.3 Landlord's Release

To the extent permitted by law, the Landlord releases the Tenant from any liability for loss, damage or injury occurring in the Premises or on the Land arising from the Tenant's breach of the *Environment Protection Act 1970* (Vic) due to noise emitted from the Wind Turbine Generators.

## 8. USE

The Tenant must use the Premises only for the Permitted Use.

## 9. TENANT'S OBLIGATIONS

- 9.1 The Tenant must at its expense punctually comply with and observe all laws and the requirements of any authority in connection with the Premises and the use and occupation of the Premises (including obtaining all permits).
- 9.2 The Tenant must keep the Premises and any property erected or installed on or in the Premises clean and in good repair and fenced, if required.
- 9.3 When accessing the Premises the Tenant must ensure that the gates accessing the Land are shut when not being used.

Final



**APPENDIX C – Letter Regarding Proposed Sale Of Mr & Mrs Davis Property**



ESTATE AGENTS VALUERS SURVEYORS AUCTIONEERS

16 SHEEP MARKET, SPALDING, LINCOLNSHIRE PE11 1BE.  
TELEPHONE: (01775) 722475 FACSIMILE: (01775) 769958

Ref: RG/FP

29<sup>th</sup> April 2008

Mr and Mrs Davis  
The Farm House  
Grays Farm  
North Drove  
Spalding  
Lincs  
PE11 3JX

Dear Mr and Mrs Davis

**Re: Proposed Sale of The Farm House, Grays Farm, North Drove, Spalding**

Further to your letter dated 26<sup>th</sup> April 2008 regarding the proposed selling of the above mentioned property. Whilst I understand the difficulty of the situation you are placed in with the problems caused by the wind turbines, until such problems have been resolved I am not able to place a current market value on the property as I do not believe any prospective purchaser would want to inhabit the property, or, indeed in the current climate, whether any mortgage lender would be prepared to lend on the property.

I am therefore sorry to say that I find myself in the rare situation of having to decline any instructions to market the above property, until such problems have been resolved to the satisfaction of any prospective purchaser or their mortgage lender.

Yours sincerely

**Russell Gregory MNAEA  
Munton & Russell**



**RICS** Members of the National Association of Estate Agents



James R. Smith BSc (Est Man) FRICS  
Russell Gregory MNAEA  
Carl A. Sewell

## REFERENCES

Studies in relation to Amplitude Modulation and the van den Berg Effect

1. "The measurement of Low frequency noise at three UK Wind Farms", by Hays McKenzie "Wind Turbines and Infrasound" – Canadian Wind Energy Association, Nov 2006
2. "Noise Annoyance from Wind Turbines – A Review", Swedish Environment Protection Agency. August 2003
3. "Effects of the wind profile at night on wind turbine sound", G.P.van den Berg, Jan 2003
4. "Wind turbines at night: acoustic practise and sound research", G.P.van den Berg. 2003
5. Research into Aerodynamic Modulation of Wind Turbine Noise – Final report", Moorhouse, M and Von Hunerbein, S and Piper, BJ and Adams, MD, 2007. Technical report, Department for Business, Enterprise and Regulatory Reform, UK
6. Amplitude Modulation of Wind Turbine Noise", Dick Bowdler. Published in Institute of Acoustics Bulletin Vol 33, no.4, UK

Other references

7. Bald Hills wind farm project: EES, EES supplement and called-in permits, Panel report: 24 June 2004
8. Draft Australian Standard, DR 07153 CP, Acoustics – Measurement, prediction and assessment of noise from wind turbine generators, March 2007
9. New Zealand Standard 6806:1998 – Acoustics – The assessment and measurement of sound from wind turbine generators
10. Wind Shear, Bureau of Meteorology, 2008. [www.bom.gov.au/weather/nsw/amfs/wind%20shear](http://www.bom.gov.au/weather/nsw/amfs/wind%20shear)
11. Wind\_farm\_noise\_in Australia ©\_Marshall\_Day\_Acoustics\_2004, Marshall Day Acoustics
12. Peer Review, Kaiwera Downs Wind Farm Noise for Gore District Council, Nigel Lloyd, Acousafe, Feb 2008
13. Second International Meeting on Wind Turbine Noise, September 2007. Abstracts, page 10
14. Oberon Council Development Control Plan, Part O, Wind Generation, 2005
15. Glen Innes Severn Development Control Plan, Wind Power Generation, May 2008
16. Upper Lachlan Shire Council Development Control Plan, Wind Power Generation, September 2005
17. Report on the Second Meeting on Night Noise Guidelines, World Health Organisation. "Noise pollution from wind turbines - Living with amplitude modulation, lower frequency emissions and sleep deprivation", Jane & Julian Davis
18. Guidelines for Community Noise, World Health Organisation
19. Second International Meeting on Wind Turbine Noise, in Lyon France, September 20-21, 2007
20. Peer Review, Mahinerangi Wind Farm Noise for Clutha District Council Nigel Lloyd, Acousafe, April 2007.
21. Acoustics Assessment of wind farms – A practical perspective, Peter Teague and Rachel Foster, Nov 2006.
22. Lal Lal wind farm panel report - Lal Lal Wind Energy Facility Permit Application PL-SP/05/0461 and Native vegetation removal permit application PL07/067 Panel Report, February 2009
23. Summary of Recent Research on Adverse Health Effects of Wind Turbines, 20 October 2009
24. Rural wind farms, Legislative Council, General Purpose Standing Committee No. 5, 31 December 2009
25. Moorabool wind energy facility permit application 2009012877, Panel Report, September 2010.