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SENATE
SENATE SELECT COMMITTEE ON WIND TURBINES

Tuesday, 23 June 2015

Members in attendance: Senators Back, Cameron, Canavan, Day, Leyonhjelm, Madigan, Urquhart.

Terms of Reference for the Inquiry:

To inquire into and report on:

The application of regulatory governance and economic impact of wind turbines, with particular reference to:

a. the effect on household power prices, particularly households which receive no benefit from rooftop solar panels, and the merits of consumer subsidies for operators;
b. how effective the Clean Energy Regulator is in performing its legislative responsibilities and whether there is a need to broaden those responsibilities;
c. the role and capacity of the National Health and Medical Research Council in providing guidance to state and territory authorities;
d. the implementation of planning processes in relation to wind farms, including the level of information available to prospective wind farm hosts;
e. the adequacy of monitoring and compliance governance of wind farms;
f. the application and integrity of national wind farm guidelines;
g. the effect that wind towers have on fauna and aerial operations around turbines, including firefighting and crop management;
h. the energy and emission input and output equations from whole-of-life operation of wind turbines; and
i. any related matter.
WITNESSES

LEVENTHALL, Dr Geoff, Private capacity .......................................................... 9
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SWINBANKS, Dr Malcolm Alexander, Private capacity

Committee met at 17:05

Evidence was taken via teleconference—

CHAIR (Senator Madigan): I declare this meeting open and welcome Dr Malcolm Swinbanks. Information on parliamentary privilege and the protection of witnesses has been provided to you, has it?

Dr Swinbanks: Actually it has not. It was not in amongst the emails that I got. Perhaps you could quickly indicate.

CHAIR: The committee has your submission. I now invite you to make a short opening statement, and at the conclusion of your remarks I will invite members of the committee to put questions to you.

Dr Swinbanks: Just briefly, I will review the submission that I made. I addressed four separate issues: first of all, the physical mechanisms for generating low-frequency sound and infrasound; secondly, the mechanisms by which people can perceive such infrasound; thirdly, I commented on the health effects and, in particular, two reports relating to these supposed health effects or the absence of them; and, finally, I gave an account of my own personal experience of adverse effects I have encountered when taking measurements near to a wind turbine installation.

If I could start off with the generation of infrasound, it is not often realised that NASA, in the early 1980s, actually carried out research on upwind rotor turbines. That is the modern configuration where the rotor is upwind of the supporting tower, rather than downwind. Wind developers have often dismissed NASA's work, saying it was not relevant because it related only to downwind turbines, but this is completely inaccurate. NASA had in fact identified the benefits of going to the upwind configuration at a very early stage. They also examined the effects of multiple turbines operating together and the effects of the separation between those turbines. They found that seven to 10 diameters separation was the ideal requirement for a turbine located downwind of its neighbours. But, in recent years, some wind developers have compromised on that spacing and have reduced it even to as little as three diameters in some cases, and that is asking for trouble, because the increased turbulence leads to increased low-frequency sound and infrasound.

The other effect that has to be considered is that as wind farm arrays are made larger and larger, the rate of attenuation as you move away from the wind farm is reduced. The result is that the setbacks from the boundaries have to be much greater to achieve the same reduction in sound. In recent years, people have stated that they have problems at distances of as much as three miles, and that is entirely consistent with the effects of increasing the size of the wind farms. Finally, I would point out that under conditions where the temperature profile is what is known as a temperature inversion, the low-frequency noise and what would I call the 'silent thump' of wind farms can carry over distances of three miles or more.

I would like to turn to how people perceive infrasound. The conventional method of hearing is through what are known as the inner hair cells of the cochlea. The effects of infrasound can be measured by a G-weighting scale, which is very similar to the A-weighting scale. It is effectively an extension of it, although the exact values do not correspond directly. Many people have evaluated whether or not the effects of infrasound are perceptible by simply comparing spectra with the hearing threshold and stating that the spectra are well below the threshold values and therefore the sound cannot possibly be perceived. That is not correct. At very low frequencies, it is the combination of different frequency components adding together which defines the total level of the infrasound, and that can be significantly greater than is observed simply by looking at the power spectrum.

People have reported having significant problems believed to be due to infrasound at distances from wind turbines. In that context, there are three different mechanisms which may be contributing to enhanced sensitivity. I have analysed a specific effect relating to the interaction with the threshold as a result of low and high frequencies being present simultaneously. In America, Dr Alec Salt has identified that the outer hair cells of the cochlea are actually much more sensitive at very low frequencies. He believes that there is some input to the nervous system resulting from them. Most recently, Paul Schomer, also in America, has considered the possible effects of sound pressure on the vestibular organs, which are the balance organs, and those effects could give the person on the receiving end a sensation of apparent motion, even though they are actually stationary.

I would like to make a further addition, which is just related to my own experience. Lying in bed, at a distance of three miles from a wind farm, my wife and I have on occasions been disturbed by the wind turbine noise. The most marked feature is that when you have gusts of wind, the turbine noise is masked by the gust and you get a huge sense of relief, only to find that when the wind subsides, the turbine noise returns and you again find yourself subject to the relentless sound.
The point is that when the wind gusts rise it is very much like the effect of when you come out of a tunnel into the light—a huge sense of relief. The sound levels of the turbines under those circumstances are probably less than the average sound levels of the wind, but nevertheless they are far more disturbing. This is noted also at higher frequencies, where people have identified that the annoyance from turbines at 35 dB(A) can be comparable to the annoyance of other more conventional sources at 55 dB(A). One commonly sees statements made that wind turbine noise is no different from any other noise, but the fact is it is different. It is clearly more perceptible at lower levels, and criteria relating to more conventional noise do not necessarily apply.

Turning to the health effects of wind turbines, there was an early report in 2009, which was an American Wind Energy Association funded report. This was the first time that experts had been brought together from both the medical profession and the acoustics profession. That report has been regarded as a definitive baseline report, and subsequent reports have tended to draw on it because of the qualifications of its authors. I consider that report to have been extremely biased. It failed to mention at all two of the most important aspects of wind turbine perception. Firstly, that in rural areas the hearing threshold is much reduced compared to the threshold when you are in urban areas and consequently you are much more sensitive to additional noise. Secondly, there is increasing sensitivity with continuing exposure. Some authors have described this a learned aversion. I have also experienced that at firsthand myself 30 years ago when working on natural gas compressor installations, which are effectively jet engines driving a compressor into an exhaust. In those circumstances, I found that over time, ultimately a period of two years, I had become very sensitive indeed to the low frequency noise and I could detect it under circumstances where previously I could not detect it at all.

That same health report misrepresented guidance which had been given in America by the Environmental Protection Agency as long ago as 1974—that is 40 years ago—and they have failed to indicate that the presently permitted sound levels in the USA are too high and can lead to sleep disruption. The most recent health report that has been produced, again, funded by CanWEA, the Canadian Wind Energy Association, finally acknowledges the excessive permitted levels in the United States and the resultant consequences for sleep disturbance, but it does not highlight this. The statement is effectively buried in 25 pages of closely-spaced text. Now I believe a lot of the problems have been created as a result of that report and some of its successors. That report was particularly true of one island community in Vermont where people suffer annoyance from turbines at 35 dB(A) which are in urban areas and consequently you are much more sensitive to additional noise. Further, there is increasing sensitivity with continuing exposure. Some authors have described this as learned aversion. I have also experienced that at firsthand myself 30 years ago when working on natural gas compressor installations, which are effectively jet engines driving a compressor into an exhaust. In those circumstances, I found that over time, ultimately a period of two years, I had become very sensitive indeed to the low frequency noise and I could detect it under circumstances where previously I could not detect it at all.

At the same time, it is common practice to place the burden of the effects of wind turbines onto the homeowners by stating that it is annoyance on the part of the homeowners and nocebo effects. By placing the burden on the homeowners, the apparent responsibility of the wind developer is reduced but, at the same time, this ignores completely the fact that the noise and, indeed, the infrasound can represent a significant intrusion into a rural home, particularly at night when people are trying to sleep. So I believe the correct terminology is to say that people suffer annoyance. It is something which is imposed on them.

I would also comment with respect to the nocebo effect that many communities welcomed wind turbines—this was particularly true of one island community in Vermont—but once the turbines started they discovered that there were some significant adverse effects. That is the very opposite of a nocebo effect. A nocebo effect is when there is prior anticipation of a problem, not when the problem is noted after the event. In that sense, I would like to make a brief comment that NASA, as long ago as 1982, presented a curve which showed the levels of infrasound that could cause adverse reactions by occupants. This showed that the levels of infrasound could be very much lower than the nominal threshold of hearing. People debate whether or not this is due to effects of vibration on a house structure—this is for people inside a house—or whether it is a true perception of infrasound; but that does not really matter. The fact is that, at octave levels as low as 60 decibels, which is a very low level for infrasound, there can be adverse reactions from occupants. That data goes back almost 35 years.

Finally, I would like to—

CHAIR: Excuse me, Dr Swinbanks—

Dr Swinbanks: comment briefly on my own personal experience of wind turbine health effects. I was asked by some friends of mine to help them measure the infrasound levels in the basement of their home at the wind farm at Ubly in Michigan. It is noteworthy that this particular wind farm had been designed in 2005, at which time Dr Nina Pierpont, a doctor in New York state, had been opposing that wind developer because of concerns she had relating to the likely noise environment of a wind farm. She has been roundly criticised all around the world for supposedly promoting scare stories. But in fact the wind farm that was developed at Ubly by exactly the same developer has proven to demonstrate all of the adverse effects that Dr Nina Pierpont warned about. Indeed, 10 families ultimately took legal action against that wind farm. The matter was settled out of court. But the
important point is that I myself experienced directly many of the effects that Dr Nina Pierpont warned about, and she certainly was not making it up. The fact is that these effects can occur.

In my particular case, I was working on a very calm evening when wind turbines were operating but there was very little wind at ground level and you could not hear the turbines at all inside the house. I actually had to keep going outside to check that they were still running. After three hours in the house I began to feel ill and I found that I was lethargic and losing concentration, but it was not until sometime afterwards that I began to realise that it was the wind turbines that were likely to be responsible. The level of infrasound that I was measuring was a level that I considered to be very low and definitely not a problem. After five hours in the house I was only too glad to leave, and I thought, 'At last I'm getting away from this,' only to find that, when I started driving, my driving ability was completely compromised. The front of the car seemed to sway around as I consistently oversteered. I had lost coordination and I had difficulty judging speed and distance. When I arrived home, my wife observed immediately that I was ill; she could see that straight off. And it took me a further five hours to finally recover and for the effects to wear off.

The important point about that incident was that I had considered that the conditions—a nice calm evening at ground level, but with the turbines still running—were extremely benign, and I had wondered whether I would even get any results. So I certainly was not anxious about infrasound. Similarly, when I got—

CHAIR: Excuse me, Dr Swinbanks—

Dr Swinbanks: Yes?

CHAIR: We have got very short time. Would you mind if we go to questions now?

Dr Swinbanks: Yes, that is fine. In fact, I had effectively completed, so that is fine.

CHAIR: We will start with Senator Urquhart.

Senator URQUHART: Thanks, Dr Swinbanks. I picked up, I think, from your opening statement that you live near an operating wind farm—is that right?

Dr Swinbanks: Yes. We have a farmhouse in Michigan, and the county, Huron County, in which we live decided that they were going to install very large numbers of wind turbines. They installed a first set at two locations in the interior of the region where we are, and significant problems developed at one of those wind farms, but since then they have been installing progressively more wind turbines. We have an installation three miles south of us, which affects us only when the wind blows from a southerly direction and then only under certain weather conditions. But the intention is to install many times more turbines, and, essentially, the whole county will be covered in turbines if this situation continues as it is.

Senator URQUHART: Have you published any articles on infrasound from wind turbines in any peer-reviewed journals?

Dr Swinbanks: Not in peer-reviewed journals. I have presented, at conferences, the work that I have done, and it has represented a sequence of work. But I believed that it was better simply to get the information out into the public domain.

Senator URQUHART: In your submission you mention Steven Cooper's study from the Cape Bridgewater wind farm. Do you believe this was a scientifically valid study equipped to make conclusions about the link between participant sensations and infrasound?

Dr Swinbanks: I believe that in a situation where people are reporting the effects that they observe while at the same time the operating characteristics of the wind farm are being monitored remotely, if you find that there is then a close correlation between those two situations, when they are well separated and there is no communication between the relevant parties, that does imply that there is a significant link and that people are reacting to real events.

Senator URQUHART: We heard from the Association of Australian Acoustical Consultants. They had done a small statistical analysis of Mr Cooper's work. In this they found that Mr Cooper did not meet his hypothesis 63 per cent of the time. Do you think it is reasonable to suggest causality when a hypothesis is not meeting close to two-thirds of the event occurrences?

Dr Swinbanks: I would point out that I am not a statistician. I do not approach my own work from a statistical point of view. What I prefer to do is go and find out for myself what it is all about, and from my own experience I believe that what Steven Cooper has observed is entirely credible.

Senator URQUHART: Here in Australia we have had a population level study done that found no difference in the prescriptions that Australians had been given regardless of the distance that they lived from wind farms. Are you aware of any population level studies internationally that have found otherwise?
Dr Swinbanks: I am not aware of such studies. But I do know a lot of families whose life has been made pretty miserable by the wind turbines, and I find that every bit as impressive as the statistics that people collect. It is a characteristic of the medical profession that they operate hands-off and perform their evaluations entirely on a statistical basis. In the engineering profession, whenever possible we go and find out what it is like and subject ourselves to those conditions to gain an appreciation for ourselves. Sometimes I read documents from people who clearly have no direct experience. It is apparent from what they say. In this particular instance, occurrences are so comparatively rare amongst the general population that it is very easy to end up with a large number of negative responses and only a very small number of positive responses; yet the fact is that those positive responses can be directly associated with real problems.

Senator URQUHART: We are going to hear in a minute from Dr Leventhall. He has put forward in his submission that a much higher correlation in Mr Cooper's work could be found between audible noise and sensations rather than infrasound and sensations. Do you agree with Dr Leventhall that the correlation that Mr Cooper found is statistically much higher with audible noise than infrasound?

Dr Swinbanks: There are both components of sound present. The definition of infrasound, according to Dr Leventhall himself, is that there is a very fuzzy boundary between infrasound and low-frequency noise. He has stated that that often causes confusion. In reports that he has written his definition of infrasound versus low-frequency sound, which is generally considered to be audible sound: he has defined 20 hertz on some occasions as being the boundary between the two effects and sometimes 16 hertz. In a different report he talked of 10 hertz to 200 hertz. Finally he even proposed 5 hertz to 200 hertz in a 2006 paper. So the point is that this definition of where you are between infrasound and audible noise is a very flexible definition. I do not consider that it is particularly important whether the noise is truly audible or just perceived as a sensation. The important effect is that people do detect something; they detect a sensation and can tell that something is happening. I learnt this 30 years ago when I was working on a gas turbine installation. Initially, I was very insensitive to the sound but, ultimately, I could drive up in my car and detect that the gas turbines were running even before the car engine had been turned off. There was a very marked increase in sensitivity. So I do not really think that it is important whether it is audible noise or inaudible noise that gives rise to the sensation. The fact is: people do experience real sensation, and these sensations can be very unpleasant.

Senator BACK: You mentioned size of wind farms. Were you referring to numbers of turbines or the actual physical size of the individual turbines, or both, when you made your comments in that regard?

Dr Swinbanks: I am referring primarily to the number of turbines. That is obviously related to the overall dimensions of the wind farm. But I have in mind, in particular, the Macarthur wind farm, which has very closely spaced turbines. It has a very large number—something in excess of 140. People are, I understand, experiencing adverse effects at distances of three miles. I believe that is a consequence of a large, closely spaced wind farm. Whether the effects would be as severe if the spacing of the turbines is made greater, I believe that would relieve some of the effects. But I think the main issue is the sheer number of turbines.

Senator BACK: You mentioned about what the 2009 American Wind Energy Association report had failed to take account of. You made the reference to increased sensitivity over time—increased exposure—and you gave an example of your own situation with gas turbines. One of the witnesses who has appeared before us, Dr Tonin, from this Association of Australian Acoustical Consultants, put to the committee that you could undertake this testing for infrasound using a pneumatic signal attached to hearing protectors effectively in a quiet room for a limited period of time. I think he mentioned 15 or 20 minutes. Could you comment on how much value you regard such testing would be in trying to come to terms with our situation?

Dr Swinbanks: My attention was drawn to that paper, and I have read it. I have two immediate comments. Firstly, he was attempting to distinguish whether symptoms were due to actual infrasound or due to nocebo effects. The important point is: there are two different outcomes which could distinguish between those effects, but, in fact, there are many more than two possible outcomes from the experiment. There are up to 16 outcomes of which only two are definitive outcomes relating to nocebo effects or infrasound effects. When I looked at the data, the most impressive correlation that I could see from the data was that the sheer action of putting on the headphones appeared to have increased the symptoms of the people being studied by at least 44 per cent. This was an experiment in which putting on the headphones had a measurable effect. I would argue that we do not yet know what exactly the mechanism causing people to suffer adverse effects. As I indicated, NASA, 30-odd years ago, had shown that people could experience adverse reactions at what are nominally very low levels of infrasound, but that was in houses where there was possibly vibration from the structures—and we do not know whether people are sensing anything through their body rather than their ears, because people often report in low-frequency noise or infrasound environments that they can feel—
Senator BACK: Can I stop you there. We need to get the answers fairly quickly so that all of us can have a go. You made reference to the circumstances of your own experience, where the wind was gusting and then was not gusting and the sound of the turbines with each. Some people have put to us the idea that an average sound or an average level is adequate. You in your paper have suggested that the use of an averaging technique may be missing cumulative pressure fluctuations and, in particular, peak pressure. Could you briefly explain that further and whether or not there is a value in averaged sound or averaged levels of infrasound decibels, please?

Dr Swinbanks: My immediate comment is that there is no value at all in an averaged level. In that example I gave, if you average it all, you find that the wind turbine level if anything would be less than the gusting level and you would then conclude that the wind turbines are not significant, whereas in fact it is very clear that they are significant. But the other important point is that there is a very well acknowledged paper that was written in 2004 by two authors, Moller and Pedersen, where they made it very clear that for the very low frequencies it is the actual shape and time history and peaks of the waveform that are important. In fact, Dr Leventhall, in an expert witness statement a couple of years ago, criticised me for supposedly not having read that report properly, but what I was doing was studying directly what the report recommended—namely, the time history and shape of the waveforms rather than long-term averaged versions of the waveforms.

Senator BACK: Thank you.

Senator LEYONHJELM: Dr Swinbanks, I have several questions. I hope we have time for them. Dr Leventhall was giving evidence in 2013 to a Vermont Senate hearing on the adverse health impacts of wind turbine operations in which he said they were 'made-up, make-believe', 'hoo-hah' and 'a propaganda technique'. I understand he also dismissed some of your work on impulsive infrasound. Has he communicated those concerns to you?

Dr Swinbanks: He has not communicated the concerns directly. I have known Dr Leventhall for 40 years, but until very recently I had not seen him for 20 years. I was quite surprised, when I met him, that he appeared to have a very different perspective on the noise conditions in America from the perspective he gave at that Vermont meeting. When he was in the UK, he told me that he thought the sound levels in America were disgraceful. At the Vermont conversation, he attributed problems to 'hysterical reaction'. The point is that permitted noise levels in the United States are significantly higher than in other countries and certainly higher than in Australia, so it is hardly surprising that there is what he called 'hysterical reaction'. You would certainly expect that, if people are subjected to more adverse conditions, they are going to react and respond more strongly.

But it most certainly is not hoo-ha. I can say that from my own experience. There is no question that there are some significant effects. We do not know precisely what the mechanisms are. But people did not know what the mechanisms for seasickness were for many hundreds of years, and they still recognised the existence of seasickness.

Senator LEYONHJELM: In the NASA work in the 1980s, Kelley describes in detail the physical sensations resulting from infrasound. Are his descriptions consistent with what residents are now describing as the physical impacts of wind turbine sound?

Dr Swinbanks: Yes, I believe they are consistent. These symptoms have been known for a long time. Dr Leventhall says they are entirely consistent with his knowledge of low-frequency noise. He does not find it surprising, but he argues that it is not due to infrasound. As I have indicated, Dr Leventhall has even defined low-frequency noise as being from five hertz up to 200 hertz, which overlaps very substantially a region that most people tend to call infrasound. So we have a situation where, for frequencies around 12, 13 and 14 hertz, do you say, 'That's infrasound. That can't be a problem,' or do you say, 'That's low-frequency sound. The symptoms are perfectly understandable'? The fact is it is a very fuzzy distinction and you can place yourself either side of that boundary dependent on precisely how you choose to define the boundary. I believe that the symptoms are consistent. They are certainly consistent with low-frequency noise. It is a moot point whether or not people are subconsciously hearing something. They are aware of something. I have no doubts about the nature of the symptoms.

Senator LEYONHJELM: I just want to ask you a few technical questions. Your submission had some graphs that showed the pressure fluctuations and frequency. Mr Cooper's report points out the need for narrowband measurements and not one-third octave bands for dB(A) or dB(G) when looking at infrasound and low frequency. Do you agree with that?

Dr Swinbanks: Certainly. I would not even dream of using one-third octaves or even averaging, over extended periods of time, just the pure spectrum levels. A proper analysis is both a narrowband frequency analysis coupled with a temporal analysis to look at the time history, as I commented earlier. If you go out to sea...
in a small boat, you do not worry about the spectrum of the waves; you worry about the shape of the next wave. This is what happens as you go down in lower and lower frequencies. For frequencies like 20 hertz and upwards, you tend to be more concerned with the blurring overall effect, but, as you get down to the very lowest frequencies, it is the shape of the individual waveforms that influences you. So one certainly should not be using these long-term averaging techniques.

Senator LEYONHJELM: Following up on from a question from Senator Back earlier in relation to peaks and averages, could you comment on whether or not it is possible to take a recording of infrasound or low-frequency sound—whatever you like—from a wind turbine and replicate it in a laboratory under controlled conditions in order to measure whether or not there is an adverse effect to it?

Dr Swinbanks: Yes, it is possible to do so, but the way in which people have been doing it so far, to me, seems a bit back to front. What they should be doing is, first of all, testing people who are known to be sensitive to wind turbines to try to find out what conditions enable an accurate replication of the effects. I do not see the point in just setting up an experiment in a laboratory and saying, ‘We didn’t observe anything’ if you have not first established, for a person who does suffer ill-effects, whether or not they actually respond to that test. There are real questions about what exactly are the important effects and what exactly should be reproduced in a laboratory. For example, I have quoted the NASA work of 30 years ago. People consider that, possibly, it was the vibration of the structures that people were sensing rather than the physical pressure variations of the infrasound. We do not know exactly what gives rise to the adverse effects. One has to validate any laboratory testing by being satisfied that people who are sensitive and have reported adverse effects can indeed experience those effects under the test conditions.

Senator CAMERON: Thank you for being here, Dr Swinbanks. You are three miles from the wind farm—is that correct?

Dr Swinbanks: That is correct.

Senator CAMERON: Was your house there before the wind farm was built?

Dr Swinbanks: Yes. I must make it clear that I am not directly complaining about those noise levels because at the moment the effects occur only when the wind is blowing from the south, which is only five per cent of the time. They only occur under circumstances of very severe temperature inversion. So it is a very occasional event. The point is simply that it can occur, and people who are in a position where they are encountering those sorts of conditions more frequently could also be expected to encounter such effects at such distances. The point that I am making is that such effects can be detected at these distances, not that those effects are a significant intrusion at the moment. But I would point out that in the future they are proposing to build turbines not just to the south of us, but to the west and the north-west, in which case those conditions may prevail for 35 or 40 per cent of the time. The fact is that modest numbers of turbines at sensible distances are not generally a consistent problem. Large wind farms operating under adverse circumstances can indeed be a significant problem at those sorts of distances.

Senator CAMERON: So when the turbines started to be built, was there an opposition group formed in your area?

Dr Swinbanks: There was never an opposition group as such, but there were a significant number of people who were making known their concerns. There was not a formal opposition group, but people were making known their concerns. The fact that there were two wind farms built at an early stage meant that people had some experience of what could be happening. The interesting feature was that you might say that those two wind farms, if you looked at them initially, looked pretty similar and pretty comparable; but one of them gave rise to very severe problems, while the other one did not appear to give rise to anything like as many complaints. The skill of constructing a good quiet wind farm is still pretty well lacking. It is very much a trial and error process, unless people obey sensible guidelines like ensuring that the separation between the turbines is of a sensible size and they are not choosing to mount turbines in locations, for example, on ridges where there can be a significantly distorted wind pattern and shear flow effects. The point is that there is a difference between a well constructed wind farm with sensible spacings and numbers and a poorly constructed wind farm.

Senator CAMERON: You also indicated that an inversion caused problems, and you gave evidence in relation to one night when it was not windy, and you had to keep going outside to check if the turbines were operating, then you became lethargic, you were losing concentration, you lost coordination when you were driving. Were you the only one in your household who had these symptoms?

Dr Swinbanks: It was not my household, it was the house belonging to some people who lived at the wind farm, who had asked me to take the measurements for them. Those people have experienced adverse effects to the
extent that they actually had to rent alternative accommodation and go and sleep in the alternative accommodation at night. They initially tried to look at weather forecasts and decide if they could sleep in their own house or not, but they ultimately decided that the wind conditions could change during the night, and it could go from a benign night to a bad night. Therefore they began to sleep away from the property routinely and regularly. The particular point that I should like to make is that I was extremely surprised to experience these symptoms. I thought it was a non-event. But one particular point was that I was using a computer very extensively, and if there is a relation to motion sickness, I would certainly comment that if I am in a motor car and I try to use the computer or read—assuming I am not driving—I can very quickly become ill. I wondered whether this was purely conjecture, whether the fact that I was concentrating on using a computer actually enhanced the severity of the effects.

Senator CAMERON: Are you aware of the study that was done by Fiona Crichton, George Dodd, Gian Schmid, Greg Gamble, and Keith J. Petrie, titled ‘Can expectations produce symptoms from infrasound associated with wind turbines?’ It was a peer reviewed analysis reported in Health Psychology. They indicated that if there were high expectancy that you would get sick from infrasound then you would become sick. They did work with infrasound and sham infrasound, and it really did support the analysis that the psychogenesis and nocebo effect were real. Have you had a look at that?

Dr Swinbanks: Yes, I am familiar with that and I wrote a criticism of that document at the time. The point was that the difference between their sham infrasound and their real infrasound was essentially negligible. The real infrasound was at a level of 40 decibels, which is very low, and not surprisingly there was no difference in the response of any of the people between the sham and the actual infrasound. The other point is that the duration was only 10 minutes. In the effects that I described it took five hours for the full effects to become apparent.

I have related that whole situation to sea sickness. It used to be the case, in the 1970s, when I did a lot of sailing, that one would frequently encounter people who considered that seasickness was just psychological. Very often, they learned the hard way that it is not. But the point is that, if you wanted to test two groups of people for seasickness, you would not put two separate people into two separate boats and put them on a flat, calm lake for 10 minutes and then announce that any reactions prove that seasickness was caused by a nocebo effect. That would actually be regarded as a joke. So I am afraid that I consider that that particular experiment was not an experiment in a pretty obvious psychology than anything relating to the validity of whether infrasound represents a real problem or not.

Senator CAMERON: So many questions, so little time. Thank you.

CHAIR: Dr Swinbanks, is the sound pressure level important when considering biological effects of infrasound and low frequencies, or could it be the frequency via acoustic resonance?

Dr Swinbanks: I think I should make it clear that I am not a biology specialist, so anything I say is amateur in that context. But I believe that the long exposure times can be a factor in inducing effects in people. Again, drawing a parallel with seasickness, it was not uncommon to go to sea for eight, 12 or even 24 hours and think, well, you are not going to get seasick this time, only to discover suddenly at the end that you do in fact start to succumb. In that context you can find that the onset of the symptoms can seem to be very rapid, even although you have been exposed for a long duration. So I think there are important considerations relating to duration of exposure.

I point out briefly that Dr Alec Salt, who is an expert on the characteristics of the cochlea, has suggested there is a phenomenon known as temporary endolymphatic hydrops, which is a progressive swelling and blockage of the little pressure relief hole at the end of the cochlea. If that becomes blocked then you can become very much more sensitive to infrasound. So it is quite possible to hypothesise that long-duration exposure is causing a blockage to progressively develop, and when it becomes severe then the person will start to experience much more extreme effects from the sound pressure than they would if there were no blockage.

So you could imagine in those circumstances that there might be a protracted period where there was no effect and then a comparatively rapid onset of effects. It would then take time after the exposure for those effects to clear, so you would then have persistence for some time afterwards. This is a whole area that requires a great deal more study. One of the conclusions, though, of the original 2009 AWEA report was that there was no need for any further research. I would completely disagree with that. I think it is apparent that people are now taking the issue seriously and at last people are beginning to investigate more thoroughly exactly what may be happening.

CHAIR: From what you have told me, I take it that the level of sound pressure is less important?

Dr Swinbanks: There are several factors that are important and when they come together they can effectively reinforce one another. I am not certain that you can take out one specific component and reject the rest. It is a combination of different contributions that can ultimately lead to the end condition. But the obvious conditions
are length of exposure, sound pressure levels but also the frequency and the nature and character of the time history of the wave forms.

CHAIR: Thank you. We are running over time. If there are no further questions—

Senator BACK: I have one, but it will have to go on notice.

CHAIR: Dr Swinbanks, there may be further questions placed on notice by senators. We would appreciate it if you accept those and respond.

Dr Swinbanks: Certainly.

CHAIR: Thank you for your appearance before the committee.

Dr Swinbanks: Thank you for giving me the opportunity to speak. I am very grateful for that.

CHAIR: Thank you.
LEVENTHALL, Dr Geoff, Private capacity

[17:57]

Evidence was taken via teleconference—

CHAIR: Welcome. Information on parliamentary privilege and the protection of witnesses and evidence has been provided to you, I believe?

Dr Leventhall: That is correct.

CHAIR: Thank you. The committee has your submission. I now invite you to make a brief opening statement, and at the conclusion of your remarks I will invite members of the committee to put questions to you.

Dr Leventhall: I am a UK based acoustical consultant and a former president of the UK Institute of Acoustics. I work internationally on problems of noise and my professional life has been split between academic and consultancy work. During my time as an academic I ran the acoustics research group at London University and personally supervised 30 PhD students to the completion of their theses and also supervised far more MSc students.

Subsequently, after a period in a large engineering consultancy where I was head of acoustics, I became professor and head of the Institute of Environmental Engineering in London. I have had a scientific interest in infrasound and low-frequency noise since the late 1960s. One of my many publications on low-frequency noise has been downloaded over 45,000 times and is the most viewed publication in the journal Noise and Health, and the next one down makes about 25,000 views. I was well established as an expert in infrasound and low-frequency noise before modern wind turbines came along, and I have applied my existing knowledge to these. Much of my work has been on how people are affected by noise and the psychological stresses that might occur. Additionally, I have initiated and guided a UK government supported project on helping people accommodate to unsolvable noise problems. Some of these problems have arisen when all required criteria have been satisfied, but a small number of people were still distressed by the noise. I believe I am well qualified to contribute to the debate around infrasound from wind turbines and responses to infrasound and low-frequency noise.

There are many misconceptions about infrasound. It has even become associated with surreal and paranormal events or described as a subtle weapon and cause of illness. Much of this misunderstanding arises from not appreciating that the word 'infrasound' used on its own has only a limited meaning related to a frequency range. Full meaning comes from the inclusion of actual frequencies and levels. One should not make claims about infrasound without also giving the relevant frequencies and levels.

I believe that many opponents of wind turbines have latched onto infrasound and have used it as a stick with which to beat wind turbines. For the past 10 years or more the leading objectors to wind turbines have led a very successful propaganda campaign against wind turbines, partly based on supposed dangers of infrasound. They have tried very hard to inculcate negative attitudes and unhelpful thinking about wind turbines, so setting people up to be adversely affected. We are now in a confused situation in which many people hold sincere beliefs about infrasound, but these beliefs are based on false information which have been fed to them by well-organised objector groups and their allies. This skilful and successful misinformation campaign, which is largely based on repetition, serves only to heighten adverse effects whilst holding back research in significant areas.

Acousticians and others who come new to the area of infrasound and low-frequency noise—and this could be through their work on wind turbines or otherwise—now do so in the shadow of the misinformation, and it is difficult for thought patterns and emotions to remain unaffected by it. I believe that a very calm, unemotional and resolutely logical approach is required for consideration of wind turbine infrasound and low-frequency noise in order to separate fact from speculation and reality from misinformation.

Senator URQUHART: You have been referred to as a debunker in relation to infrasound and wind turbines. Can you outline for the committee some of the most common myths you are aware of and why they are wrong?

Dr Leventhall: That is a big question. I believe one would have to look at it in the sense that we are all familiar with safe and unsafe doses of medication, but people do not seem to be able to realise that there are safe and unsafe doses of sound. I believe that is the main problem with infrasound. Just the word 'infrasound' has been used to raise people's concerns. Because of this, you have to include the level and the frequency along with any mention of infrasound so we really know what we are talking about. Does that answer your question?

Senator URQUHART: Thank you. Are you aware of any jurisdiction or country in the world that includes infrasound levels as part of its compliance measures for wind farms?
Dr Leventhall: No. There was an attempt by a small town in Canada—the town of Plympton-Wyoming—which introduced a by-law towards the end of last year. But then when they were pushed with having to defend the by-law they withdrew it.

Senator URQUHART: Would there be any technical impediment to regulating infrasound emissions from wind farms as part of a regulatory regime? Can infrasound from wind farms be effectively isolated from other forms of infrasound in the environment?

Dr Leventhall: There are similarities generally in the levels of other natural infrasound and wind turbine infrasound. But under favourable circumstances you can measure wind turbine infrasound separately. So yes, if you want to introduce legislation, then it should be possible, but you have to have a sensible level for the limit.

Senator URQUHART: What would that sensible level be?

Dr Leventhall: Well, I do not think it is the level that has been suggested. Plympton-Wyoming, which I mentioned, were suggesting about 50 dB at one hertz. Most people who work with infrasound or know about infrasound find that incredibly low as a level. It has to be somewhat higher than that if you are going to introduce it.

Senator URQUHART: Some witnesses have submitted to the committee that there is something unique about infrasound from wind farms compared with infrasound from other sources. Is that accurate? Is there a difference between the different types of infrasound that we have?

Dr Leventhall: The infrasound from other sources in the environment is generally a random, fluctuating noise, and this is from machinery, where it is repetitive. And the infrasound from wind turbines is actually a series of pulses which are produced when a blade passes the tower.

Senator URQUHART: The committee, through its majority report—it has released an interim report—has called for a national environment protection measure on wind turbine infrasound and low-frequency noise to determine and regulate safe levels of infrasound near wind farms. Would you recommend this sort of regulatory measure?

Dr Leventhall: No. I think levels of infrasound from wind farms are safe. Occasionally low-frequency noise becomes audible. One important point is that none of the regulations require inaudibility.

Senator URQUHART: Some of the research suggests that concerns about health impacts of wind turbines are largely concentrated in English-speaking countries. Is this borne out by your understanding of the issues raised in acoustics circles in the different countries?

Dr Leventhall: Yes. Australia and Canada are the main ones. It is not just that they are English speaking, but there are groups there that promote the negative attitudes to wind turbines.

Senator URQUHART: Are you aware of any acoustics body in the world that holds the position that infrasound from wind turbines is dangerous to human health?

Dr Leventhall: No.

Senator URQUHART: I just want to go back to the level of noise. You talked about a level of LA 50. Is 90 a level that you think would be acceptable? What would the figure be that you would talk about being background noise or being excessive?

Dr Leventhall: Noise from wind turbines? Are you referring to infrasound from wind turbines?

Senator URQUHART: Yes.

Dr Leventhall: Say, 20 dB below the hearing threshold.

Senator URQUHART: Which would be?

Dr Leventhall: The hearing threshold at one hertz is probably about 120 dB; it is not very well known. At four hertz it is better known; it is 107 dB. That is the average hearing threshold. Allowing for the spread of hearing sensitivities, if you go 20 dB below the hearing threshold it is most unlikely that anybody will hear it.

Senator BACK: In your report you have given us a commentary on the preliminary work done on the pilot cooperation between Mr Cooper, at the Cape Bridgewater wind farm, and Pacific Hydro, the company that operates that particular facility. Have you been retained by Pacific Hydro to review Mr Cooper's work?

Dr Leventhall: Yes, I have.

Senator BACK: In your past I have noticed the plethora of work you have done. Have you ever been engaged by residents who would appear to be subject to what they say is adverse health effects? Have they engaged your professional services at any time here in Australia or elsewhere?
Dr Leventhall: No. I have had discussions with some. But normally they come to me because they are afraid of infrasound, and I have to tell them 'Don't waste your time on infrasound.' Put your efforts into something more important in relation to the wind farm.

Senator BACK: Are you of the view that they are suffering adverse health effects of any sort, be it annoyance or stress?

Dr Leventhall: You have to look at why they are suffering adverse health effects.

Senator BACK: But do you think the people in this circumstance may in fact be suffering adverse health effects?

Dr Leventhall: They are suffering adverse health effects because they are stressed by the presence of the wind turbines.

Senator BACK: I was going to ask you about the nocebo effect, but I will not—

Senator CANAVAN: I have a follow-up on that line of questioning. From memory, I thought your submission might have indicated that in the Cape Bridgewater situation you felt that some people may be suffering annoyance from audible noise. Just to clarify this, are you saying that all the people who made complaints are suffering from stress, or is it that some of them are and some of them are, in your view, suffering from annoyance from audible noise.

Dr Leventhall: The point about Cape Bridgewater is that the turbines are audible at the locations. Someone issues a statement saying that they were not. But that is a nonsense. The turbines are audible. People are hearing the turbines. They have been hearing the turbines for six years. They do not want to hear them, so therefore they are stressed and they are displaying what are familiar to me as many symptoms of stress, like the feeling of sensations.

Senator BACK: I am very much of the view that a preliminary study involving three dwellings and six people is only a pilot, but of course that is what was directed by Pacific Hydro, and that is fine. The only question I would ask you about that relationship is that one of the six people involved is profoundly deaf and cannot see the turbines. Yet, my recollection was that the person was, with reasonably unerring accuracy, able to tell when the turbines were on, off or increased or decreased by about 20 per cent, I think it was. This was without being able to hear the turbines. Do you recall that situation?

Dr Leventhall: As I look through all the diary records that are put on the level variations of the turbines, all the six people record hearing noise. And I do not know what is meant by profoundly deaf in this circumstance.

Senator BACK: Perhaps we could refer you further back, because I recall hearing that.

Dr Leventhall: People who are deaf tend to be deaf in the higher frequencies, not in the lower frequencies. They often retain their low-frequency hearing. So they could be hearing the turbines.

Senator BACK: That is something we should follow-up further. I think I have seen that in the past you have acknowledged the work of Dr Kelley, in the early 1980s, in which NASA, the Massachusetts Institute of Technology and a few others, were able in testing to identify the perception of wind turbines and indeed gas turbines below the threshold of audibility. Am I correct in my assertion that you have acknowledged that work and those outcomes?

Dr Leventhall: I do not remember acknowledging it. But regarding Kelley, what people heard in the Kelley work was a higher frequency, about 300 hertz. What happened was that the pulses from this rather awful model wind turbine impacted lightweight buildings and caused vibration of the buildings. It is a bit like striking, say, a wine glass. You put energy into the wine glass and then it vibrates at its natural frequency. That is what was happening with those buildings. People were not hearing the infrasound and not hearing the pulses. They were hearing the response of the buildings to those pulses, which was about 300 hertz.

Senator BACK: The responses of the buildings to the pulses?

Dr Leventhall: Yes, the vibration of the buildings.

Senator BACK: That is interesting. And what is the possible impact on people of the vibrations of the buildings?

Dr Leventhall: I have lost you.

Senator BACK: You mentioned the vibration of the buildings. I am asking what is the possible impact on people inside those buildings?

Dr Leventhall: People responded to the 300 hertz and they did not like it.
Senator BACK: Cooper, Dr Schomer and Professor Hansen have also appeared before this committee. They have identified, by way of standard acoustic measurements, that there is an infrasound signature present when the turbines are operating and that signature is not present when the turbines are turned off. The residents themselves have identified that there is a difference in sensation with the turbines operating, as opposed to when they are off. Schomer and Cooper have experience of individuals who, without visual or auditory sensation, have been able to identify whether or not the turbines were in operation. With your understanding, how would you explain that scenario?

Dr Leventhall: Regarding Cape Bridgewater, the turbines were audible when they were on. There is of course an infrasound signature, but the infrasound signature occurs along with the higher frequency noise, the audible noise. To me the people in Cape Bridgewater were responding to the audible noise. If you have an audible noise and a very low level inaudible infrasound I believe it is the audible noise that is going to affect you and not the very low level infrasound.

Senator BACK: As a sequel to that, is it not the case that acousticians internationally who have been retained to investigate noise complaints on behalf of residents indicate that there are low-frequency noise issues and that measurements reveal an infrasound signature? But your evidence to us would refute that. Is that what I understand you—

Dr Leventhall: There is a low-frequency noise signature. In a paper I published nearly 10 years ago about infrasound from wind turbines I said that wind turbines produce infrasound but the levels are very low and of no consequence. Wind turbines produce low-frequency noise, especially when there is turbulence in the inflow air, and the low-frequency noise can sometimes be audible. But we hear low-frequency noise all the time. It is not something to be afraid of.

Senator DAY: You say that wind turbines produce infrasound that is of no consequence to humans, but the Australian National Health and Medical Research Council and the German Medical Assembly have both called for more research into the adverse health effects of infrasound from wind turbines. Do you support that research, or do you think the science is settled in this area?

Dr Leventhall: It is research that has to be done because of the public pressure. As to the German Medical Assembly: as far as I understand, one person raised a question and it was passed up to be considered later. The NHMRC has to respond to both public pressure and, may I say, political pressure. The work has to be done; it will be done. Whether it will show anything, I could not say, but I am dubious.

Senator DAY: Thank you.

Senator CAMERON: Dr Leventhall, I want to get it clear from your perspective. You were asked a question by Senator Back about whether you had been retained by Pacific Hydro. You have an international reputation as a scientist, and because you do work for one group—that would not influence your evidence here, would it?

Dr Leventhall: No.

Senator CAMERON: One of the arguments that is being proposed in Australia against wind turbines is that, under a certain synchronisation of the blades, it can cause real problems. Is that true?

Dr Leventhall: It is possible, but it is very easy to desynchronise.

Senator CAMERON: Sorry—it is what?

Dr Leventhall: It is very easy to run the turbines so they do not synchronise.

Senator CAMERON: So you do not have to run in synchronisation. Would that help alleviate any problems?

Dr Leventhall: Yes.

Senator CAMERON: There is also the argument that I have seen that, if you are near a huge ventilator fan or fans in coalmines, you can be affected by infrastructure noise. As a former fitter in the power industry at a major power station, I would have been exposed to infrasound from the turbines and the fans in the coal fired power station, wouldn’t I?

Dr Leventhall: Possibly, yes.

Senator CAMERON: Have you had any evidence that workers in coal fired power stations are suffering from infrasound related health issues?

Dr Leventhall: No. I did have a complaint from somebody who lived not far from a coalmine in which there was a large fan that gave off about 12 hertz and they could hear the 12 hertz, just on the limit of their audibility.

Senator CAMERON: An article in one of our major newspapers talks about people waking up with excruciating pressure in their head as a result of infrasound. What are your comments on that?
Dr Leventhall: I do not know of any medical evidence for that, but I do know of a number of syndromes that are headache syndromes and people can wake up with those, so it is not necessarily from infrasound. There is something called exploding head syndrome where you wake up with a pain in your head. These headache syndromes are well known medically.

Senator CAMERON: This article in The Australian also said that the denial of problems with wind turbines was akin to big tobacco's denials. You are not allowing yourself to be used like scientists were by big tobacco are you?

Dr Leventhall: I do not think so, because remember that in my opening statement I did say that I was well established in the infrasound/low-frequency noise area before wind turbines came along, and it is my existing knowledge that I have applied to these.

Senator CAMERON: Dr Leventhall, are you aware of the work done by Fiona Crichton?

Dr Leventhall: Yes.

Senator CAMERON: They subjected people to infrasound and other people were told that they were subjected to it. Can you explain it, if you know what the outcome of that study was?

Dr Leventhall: Some people were given a negative attitude to infrasound. They were told it would be harmful. Other people were given a positive attitude to wind turbines. The ones who were given the negative attitude were affected more than the others when they were told that infrasound was on. Sometimes they were exposed to sham infrasound. In fact they were told infrasound was on, but it was not, and they had similar negative effects. It is very much to do with people's expectations and their beliefs which determine how they are affected.

Senator CAMERON: Is that what you would call the psychogenesis and the nocebo effect?

Dr Leventhall: I do not call it nocebo as nocebo has become a dirty word. What I have been calling it for years, long before nocebo was talked about, is that it is a question of people's attitude to the noise source which are the big determinants of their responses to the noise.

Senator CAMERON: There is discussion in Australia and propositions that there should be a wind turbine commissioner to oversee the operation of wind turbines in Australia. Do you see any need for that in terms of your experience, internationally, with wind turbines?

Dr Leventhall: No, but I thought it was initially called an industrial sound commissioner for general industrial noise. It could possibly be useful to have a commissioner that is specific to wind turbines, but I do not see a lot of point in it. It may be that the general criteria and work around effect of wind turbines should be strengthened.

Senator CAMERON: Thank you.

CHAIR: Dr Leventhall, did you do some peer review work for the NHMRC in 2010?

Dr Leventhall: Yes, they asked me to comment on a quick review that they had produced.

CHAIR: What conflicts of interest, if any, did you disclose to the NHMRC?

Dr Leventhall: They did not ask for any disclosure. I had very little to say about the report. I can recollect that they had a reference wrong in it and I corrected the reference, but I cannot remember what else I said about it.

CHAIR: Were you paid for that peer review work?

Dr Leventhall: No, I was not.

CHAIR: Do you still agree with your statement to the NHMRC workshop in June 2011 that the set of symptoms that you call 'noise annoyance', I believe, which Dr Nina Pierpont has called 'wind turbine syndrome' are the same, have been known to you for years, are not unique to wind turbines and are caused by the lower frequency sound and vibration energy?

Dr Leventhall: No, I do not think I said that they were caused by the lower frequency sound and vibration. They are caused by noise related stress. A build-up of stress can, in a very small number of people, give those symptoms. This survey of people and the effects on them was published in the 1980s. What Pierpont did was to rediscover this and give it a new name. People who are stressed by noise, very badly stressed, will have symptoms. What you have to remember is, although a list of symptoms is given, they do not all occur in the one person. One person might have only one or two of the symptoms.

CHAIR: Why did you agree with the NHMRC summary statement in the 2010 rapid review that there were no direct pathological effects, when it seems that you were clearly aware that both sleep disturbance and stress could be caused directly by excessive noise, and that both sleep deprivation and chronic stress could lead to adverse health effects?
Dr Leventhall: You have to distinguish between direct pathological effects and indirect effects. Direct pathological effects of high levels of noise is noise induced deafness. I am not aware of anything similar for low levels of sound from wind turbines.

CHAIR: Why didn't you accept Dr Paul Schomer's invitation to be part of an international team helping overseas—

Dr Leventhall: I do not wish to work with Schomer. I found him to be—how can I put it—a bit of a loose cannon, and I would not wish to work with him.

CHAIR: Okay.

Dr Leventhall: I am aware of the statement he put out about the people at Cape Bridgewater being affected by some non-audible, non-visible pathway. Cape Bridgewater is audible. I do not think he read the report before he put that statement out.

CHAIR: What sort of research do you think is now required as a priority? Do you support the detailed investigation of the full acoustic spectrum inside affected residents' homes, together with concurrent physiological testing of their brainwaves, heart rate, blood pressure and stress biomarkers?

Dr Leventhall: I think that the most important aspect of wind turbine noise—which I said in the paper I published nearly 10 years ago—is the amplitude modulation. Work is now developing on that, and I believe that that is where the main answer should be given, in amplitude modulation, because this is what upsets people. Personally, I do not believe that the infrasound and the low-frequency noise are an important problem, but because of the public and political pressure, it is inevitable that some work will be done on that. Work inside residences is obviously more important than work outside residences.

CHAIR: Did you request that your name was not made public as a review of the 2010 NHMRC rapid review?

Dr Leventhall: No, I do not think I did. Reviewing is normally confidential. I think there is a freedom of information request on this. I do not believe I was contacted as part of a freedom of information request.

CHAIR: There being no further questions, we thank you for your evidence this evening, Dr Leventhall. That concludes the hearing and the committee now stands adjourned.

Committee adjourned at 18:34