

**SUBMISSION 2 TO THE SELECT  
COMMITTEE ON WIND TURBINES**

**1 JUNE 2015**

**ELEMENTS OF WIND  
TURBINE SOUND:**

**SYNCHRONICITY, PHASE AND  
HEIGHTENED NOISE ZONES:**

**ANOTHER FAILURE OF THE A-WEIGHTING.**

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# Synchronicity, Phase and Heightened Noise Zones: another failure of the A-Weighting.

## Opening Statement:

The A-Weighting is an anachronistic attempt to describe human hearing, initially conceived, and averaged, on the reception of pure sounds heard through earphones by 23 young laboratory workers in the late 1920s.

The salient point is that humans respond to instantaneous sound pressure levels (SPLs), **NOT** averages ! Averages are a human construct used to generate a single descriptive value (statistic) to represent a complex set of data. While averages have some uses, hence their invention, the danger is not in what they reveal, rather it is in what they conceal.

The 10-minutes averages, used in almost all environmental noise controls, have little value in terms of human (or animal) response. The reason that animals (including humans) respond to instantaneous SPLs is a simple matter of evolutionary adaptation. Single, often sudden, acoustic events are very descriptive of the environment in that they frequently contain 'information' that is indicative of a threat. Let us look at an analogy to make the point:

Tennis players do not try to swing their racquet at the average point in space where the ball returns from the opposing player. To succeed, the tennis player has to position the racquet at the correct angle, at the point where the ball actually is (or where it is projected to be) at the instant the player strikes.

Biological effects also arise from continuous SPLs, but they involve a different mechanism and different cognitive processing. Continuous loud noise can be very debilitating and manifest very adverse health effects in the receiver (witness). Surprisingly, sounds that are not 'loud' can also elicit significant biological effects, including annoyance, if they are continuous. An analogy might be 'Chinese water torture'. That is why it is difficult to sleep with the sound of a dripping tap, for example.

The use of the 10-minute average, so commonly used in environmental noise monitoring, is designed to 'smooth-out' the peaks, thereby missing the most important part of the soundscape: **Sudden loud noise events**. This methodology favours the wind industry. Thus in one fell-swoop, they have managed to hide the very sound events that are causing much of the adverse biological response! The wind industry can and does hide behind the statistics, much to the detriment of public health!

I believe that in the future, the adverse health effects of wind turbines will eclipse the asbestos problem in the annals of history. The greed and scientific half-truths from the wind industry will be seen by history as the rape of humanity in the 21st century.

While the corruption of the wind industry continues to be propped up by governments via generous subsidies, sold on the promise of the 'Green Dream' to a naive populace, justice will not be seen to be done and public health will continue to suffer. There are other environmental consequences of this action, however, they are beyond the scope of this submission.

While human health has been sacrificed in the name of technological progress, including 'Green' initiatives, public health will continue to suffer and many people's lives will be ruined. Property values will continue to be reduced. Livelihoods will be destroyed and unfortunate rural residents will be turned into nomads, desperately seeking refuge to preserve their deteriorating health.

Man's inhumanity to man never ceases to amaze me. Commercial greed always wins over honest truth when the Green-Dream card is played. Desire for a clean, green energy source will continue to be the carrot dangled in front of a wanting public by a devious industry, hell-bent on maximising profit while ignoring the collateral damage of ordinary folk whose only crime was choosing to live in a quiet, rural environment.

My father once told me never to lie, because lies have no 'legs' - you have to hold them up all the time. My arms are tired - I must therefore tell the truth. . .

Information that I believe has been presented to this enquiry regarding the potential adverse health effects of low-frequencies and infrasound relating to phase and synchronicity is flawed on basic fundamental physics. I intend to correct this misunderstanding of the physics in my submission, in addition to other important matters that have arisen.

## Phase, synchronicity and heightened noise zones

The question of phase and synchronicity has been raised in the past by van den Berg, Thorne, Huson, Rand, Stigwood, Kelley, Hubbard and Shepherd and others. More recently, it is my understanding that evidence from Dr. Andrew Bell has been presented to this enquiry relating to phase, postulating a potential mitigation technique to remove the problem of 'constructive interference'. Dr. Bell raises many good points and his work has much to offer the overall debate. In my opinion, however, the effect of phase and synchronicity mitigation techniques he suggests will not work in a complex wind farm environment. I say this for the following reasons. In order to make this extremely complex phenomenon understandable I will begin with some definitions and then use commonplace analogies to demonstrate each point.

### Synchronicity

The Oxford English Dictionary, 9th edition, 1995, describes synchronicity as:

“noun. The simultaneous occurrence of events which appear significantly related but have no discernible connection.”

In scientific terminology the definition is somewhat expanded and more complex. The Larousse Dictionary of Science and Technology, 1995, for example, has the term **synchronism** as used in telecommunications.

“Synchronism is said of two signals of the same frequency with a phase angle of zero and are said to be in step with each other.”

Further, **synchronization** is a term used in image technology to mean: in general:

“the matching of signals in precise time relation; in a TV, esp. establishing the identity of scanning frequency and phase of picture signals between transmitter and receiver.”

There are many other specific definitions, 31 listed in the Larousse are related to other areas of technology, but all of them introduce the same concept of zero phase difference between two systems (variables). In essence, **synchronicity is about entrainment**.

## Phase

The Larousse lists 52 different applications of the term phase, but for the sake of simplicity the clearest general definition comes from the Oxford Dictionary. Even they list six different examples of phase. The simplest definition relating to physics states:

“a stage in a periodically recurring sequence.”

Simply put:

“**phase is a state of synchronous operation.** That is, **things are happening at the same time and at the same part of the cycle** (periodic motion).”

Clearly phase and synchronicity have much in common and are often used interchangeably. But the nuance is of importance here. Imagine two children playing on a set of swings. If both children are swinging backwards and forwards at the same frequency, they can be said to be **in synchrony**, regardless of which part of the cycle they are each in. If, on the other hand, they are said to be ‘in phase’ this implies that both children are in the same part of the periodic motion at the same time. That is, both reach the top of the back-swing, the bottom and the top of the front-swing at exactly the same time. Thus, they are **in phase**. If one child is at the top of the back swing while the other is at the top of the forward swing, they are still **in synchrony**, yet they are 180 degrees **out of phase**.



Figure 1: In synchronicity and in phase



Figure 2: Out of phase. Synchronicity not known.





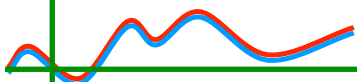
Figure 3: In synchrony but 180 degrees out of phase.

### Synchronicity and Phase of sound waves

Of importance to this enquiry is the contribution of synchronicity and phase to biological effects from both audible and inaudible emissions from industrial wind turbines. It is here that Dr. Bell makes a contribution under the heading of constructive interference, although I need to clarify the issue. In principle, what Dr. Bell is saying appears to be self-evident, that the sound emissions of wind turbines can combine at some distant point where the peaks of the two waves will meet and reinforce each other. This is undeniably true but is better explained by diagram and analogy. The branch of physics that deals with this is the ***interference of waves***.

### Consider water

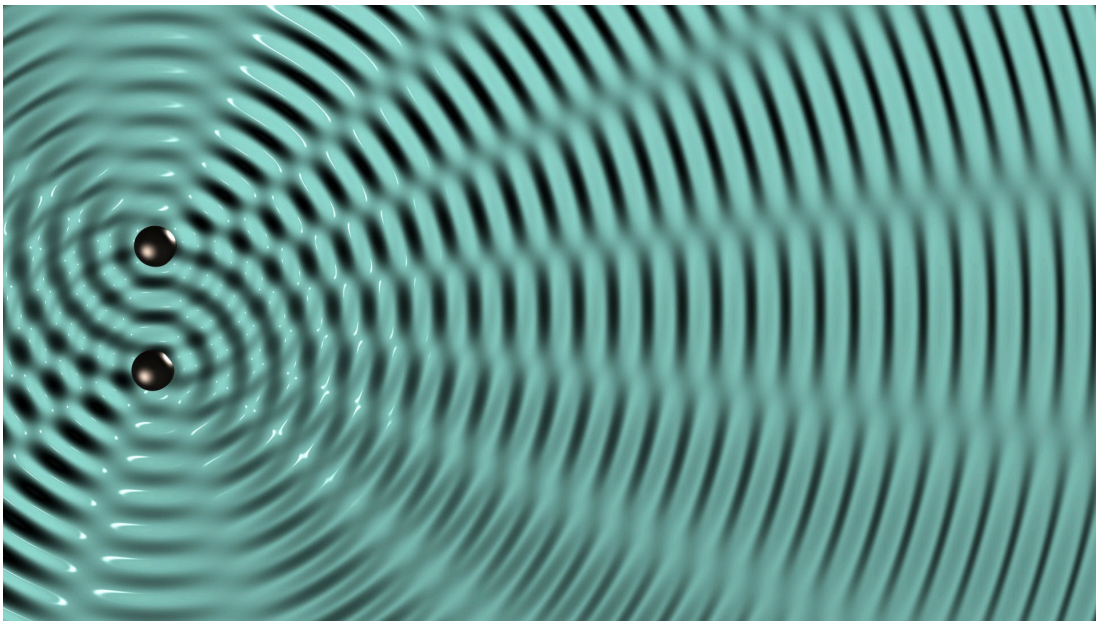
A pond that is still and the surface devoid of waves or ripples. If you drop a pebble into the centre of the pond, what you will observe is something like Figure 4 overleaf:



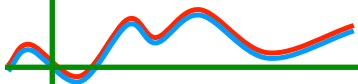


*Figure 4: Single pebble dropped into a still pond.*

We have all seen this effect many times. Pebbles, rain drops, they all create the same effect. What is of interest is the case for two pebbles being dropped from the same height at the same time, that is, ***in phase***. What we observe in this case is the famous nodal lines. That is, areas of still water where the peak of one wave meets the trough of another and the two cancel each other out.



*Figure 5: Interference pattern of two wave patterns - in phase.*



This effect, wave interference, has a particular mathematical structure and definition. As the two waves move outwards from the impact centre, we see areas of light and dark with lines radiating out like rays of the sun. These lines are termed ***nodal lines***. The surface of the pond is clearly in a state of considerable excitation or movement. The salient point is that the nodal lines are in actual fact areas on the surface where the peak of one wave is counteracted by the trough of another, so the resulting surface is flat. A ***node***, in physics is: **a point on a line or surface that remains at rest while other parts of the system are in a state of vibration.**

I have a remarkable memory of seeing nodal lines on a grand scale back in 1972 when I was on holiday in the Marlborough Sounds at the top of the South Island of New Zealand. Having got off the inter-island ferry I made my way to a vantage point overlooking the narrow body of water which ends at the Picton wharf. To my utter amazement, the sea was virtually as still as a mill pond. I could barely see a ripple on the surface. As the large inter-island ferry slowly moved towards Picton, the wake moved outwards towards the shoreline on both sides where it reflected back towards the centre of the channel. There the reflected waves interacted with the waves moving outwards from the bow of the boat. There to my amazement were ***nodal lines***, miles long and wide! Flat lines of water radiated out like rays of the sun providing one of the most spectacular physical phenomena I had ever seen. Unfortunately I did not have a camera then to record the moment. You can get some idea of what I saw from the two images overleaf of the Interislander ferry approaching Picton.



*Figure 6: The Interislander traveling down the Marlborough Sounds towards Picton.*



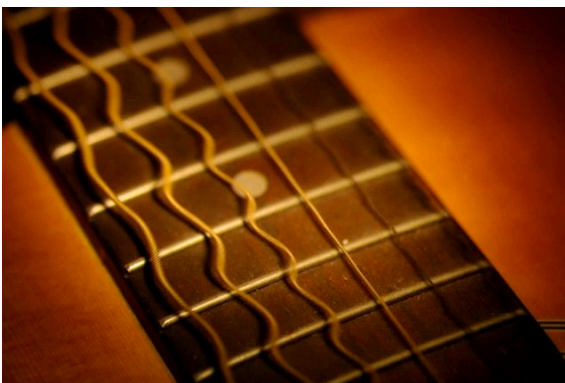
*Figure 7: The Interislander traveling down the Marlborough Sounds towards Picton.*

The conditions are often very calm and the wake and its nodal lines of reflection can be easily seen.

### **One dimensional model of wave interference**

To understand this very important physical phenomenon, the usual way to teach interference of waves is to resort to a one-dimensional model on a blackboard. Consider the wave moving along a line, like a skipping rope, or the string of a musical instrument.

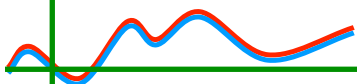
The string, when plucked, vibrates in a sine wave motion, Figures 8, 9, 10.



*Figure 8: Vibrating guitar strings.*



*Figure 9: Vibrating violin string recorded by a digital camera.*



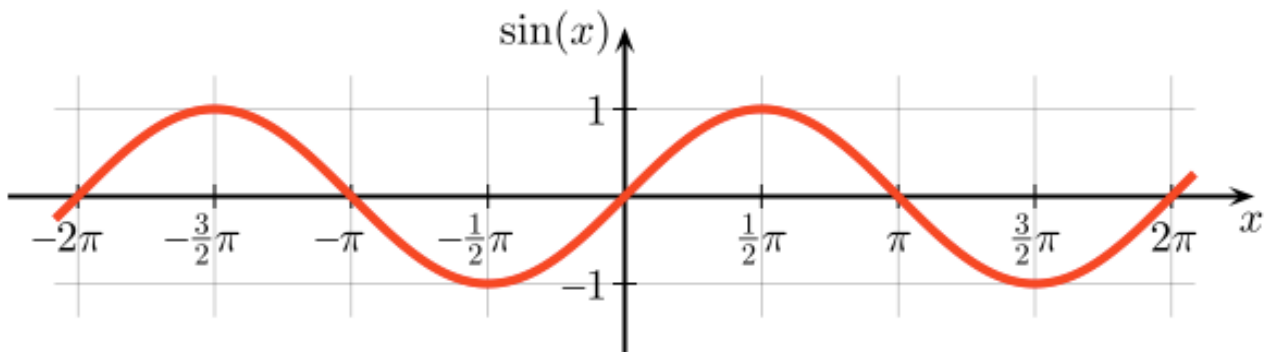


Figure 10: Mathematical description of a sine wave.

Sine waves have a mathematical definition but the technical details are not of great importance to this narrative. Suffice it to say that a sine wave is a side-ways projection of the path of an object rotating in a circle as it moves through space. It resembles the shape of a spiral spring that is drawn out, as viewed from the side.



Figure 11: Spiral spring viewed from the side.

The question arises: What happens when two sine waves meet? This is the crux of the matter and a simple, one-dimensional explanation will be given that will demonstrate how the logical extrapolation to a three-dimensional situation is easily misunderstood.

Consider a string where a 'blue' wave is moving towards a 'red' wave moving in the opposite direction. At time = zero we see the two waves moving towards each other. At time = 1, we see that the red and the blue wave have met and their energy has been added together to produce a wave which is the sum of the two energies (heights). At time = two, the two waves have met, interacted and moved past each other, none the worse for their collision experience. What this figure shows is the case of two crests meeting.

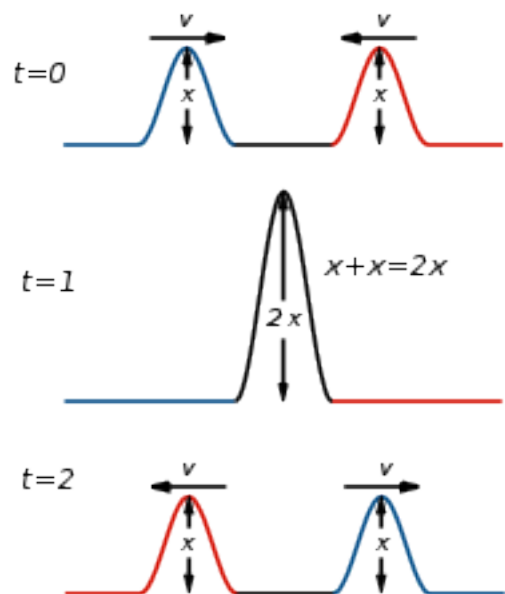
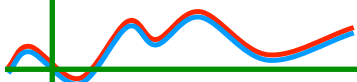


Figure 12: Two wave crests meeting.



This experiment is easily carried out by using two people holding a skipping rope.

The other case to consider is when a crest meets a trough. If we consider the case as shown in Figure 12, but with one of the crests becoming a trough, hence it is now on the underside of the string, what happens when they meet? See Figure 13.

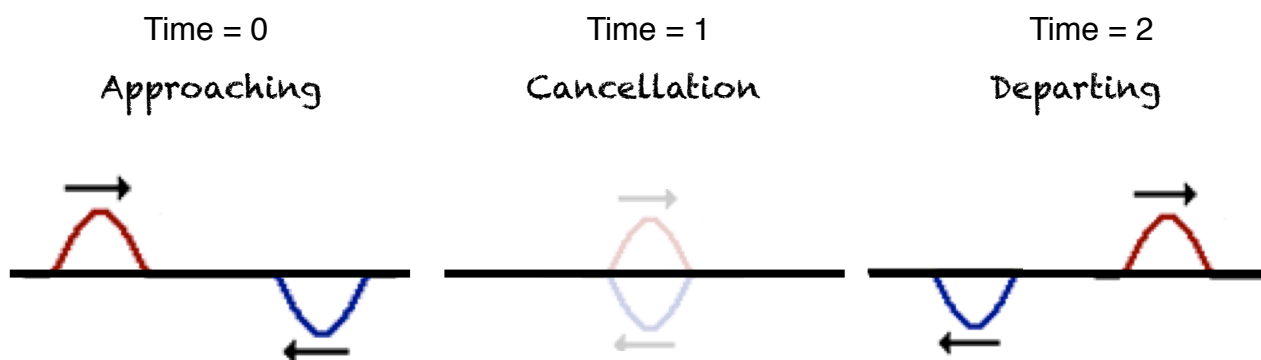


Figure 13: A crest meets a trough.

What happens in this instance is that the crest and the trough **cancel out**. The result is a flat line. Zero displacement (wave height, or amplitude) at that instant. There are many good animations on the web that are worth looking at as dynamic demonstrations.

The cancellation of a crest and a trough is what you see at a node, or in three dimensions, a nodal line. This topic is often referred to as **Superposition Theory**. So, when two waves meet, depending on their phase, either they can add together and form a large wave, momentarily, being the sum of the two energies (amplitudes) or they can destructively interfere (180 degrees out of phase) and the result is a null point. Constructive and destructive interference are summarised in Figure 14 below.

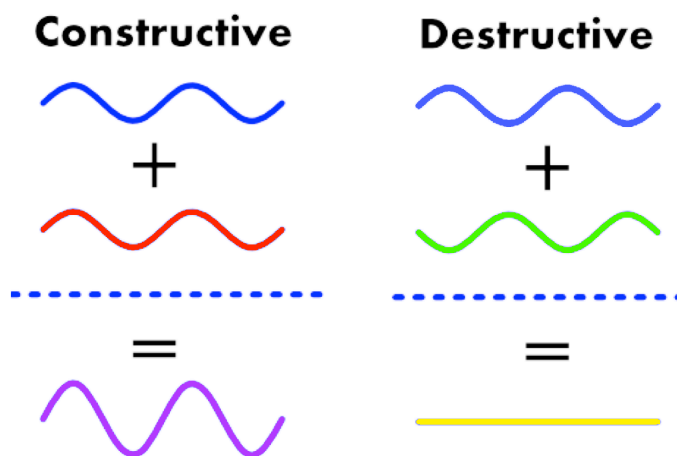
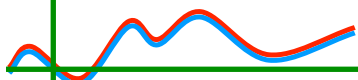


Figure 14: Constructive and Destructive Interference.



The obvious implication of the superposition (or interference) of two waves would lead one to suspect that it would work in practice. A solution to the sound emissions of wind turbines could be as simple as phase alignment of the rotors. Unfortunately this is a naive conclusion. To understand why this **cannot** work in a real landscape, it is important to consider the nature of sound from multiple turbines in a real landscape. Real life is always more complex than the simplistic theory we learn in school. In theory an idea should work: In practice it seldom does.

The situation becomes more complex when the two frequencies are slightly different. Then the resultant wave is very much more complex and the sound will be very different.

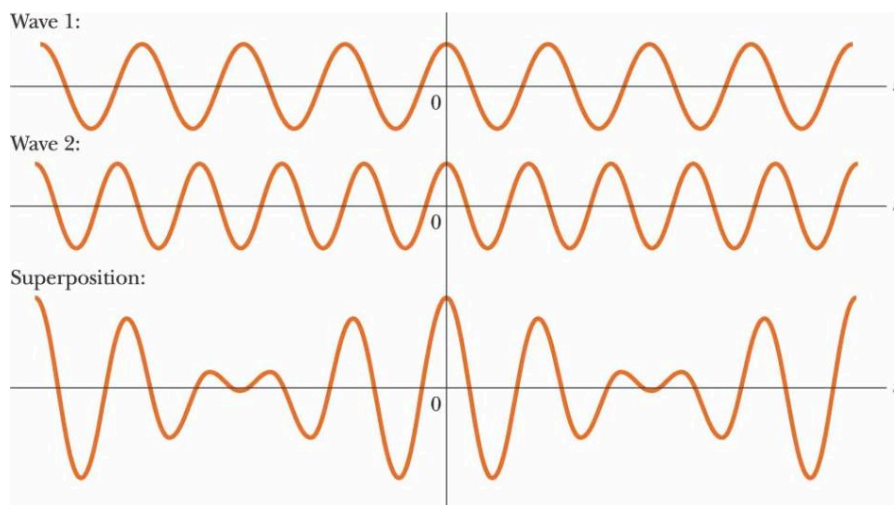
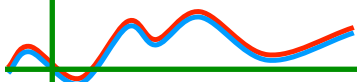


Figure 15: Superposition (addition) of two different frequencies showing the resultant waveform.

In the example given in Figure 15, a periodic change in loudness will be perceived that is similar to amplitude modulation and a *beat note* may be heard. While this last example is a little more complex, it is included for completeness. Now imagine the combined effect of ten or more sound sources, all at slightly different frequencies as is observed in a wind farm. When the frequencies being considered are the fundamental of the blade-pass frequency (around 1 Hz) then the effect will be the “whump-whump” sound described by many residents. The sound heard is actually an amplitude modulation of the overall sound - hence it is audible.

To return to the concept of nodes and anti-nodes, the anti-nodes are where there is constructive interference - two crests adding together or two troughs adding together. This results in a super-large crest and trough.

In between the anti-nodes of constructive interference are the areas of cancellation: Destructive interference or nodes. See Figure 16 below. These are observed as lines



radiating out from the source, like rays of the sun.

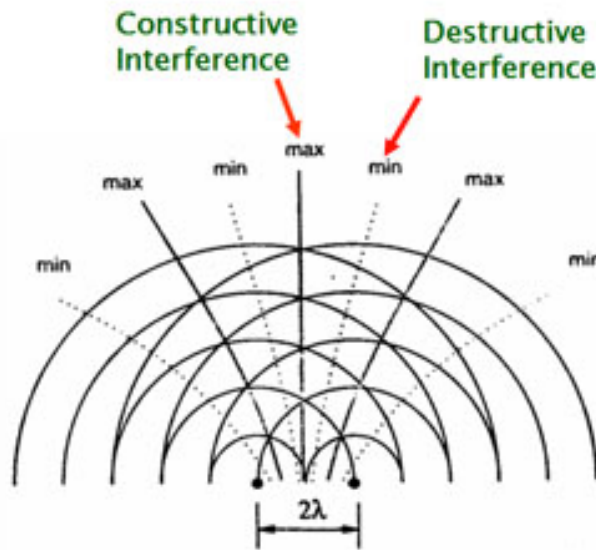


Figure 16: Constructive and destructive interference.

NB: The symbol  $\lambda$  LAMBDA represents the wavelength.

The angles at which the constructive and destructive interference occur depends on the wavelength and the distance between the sources. This can get very complex, very quickly, Figure 17.

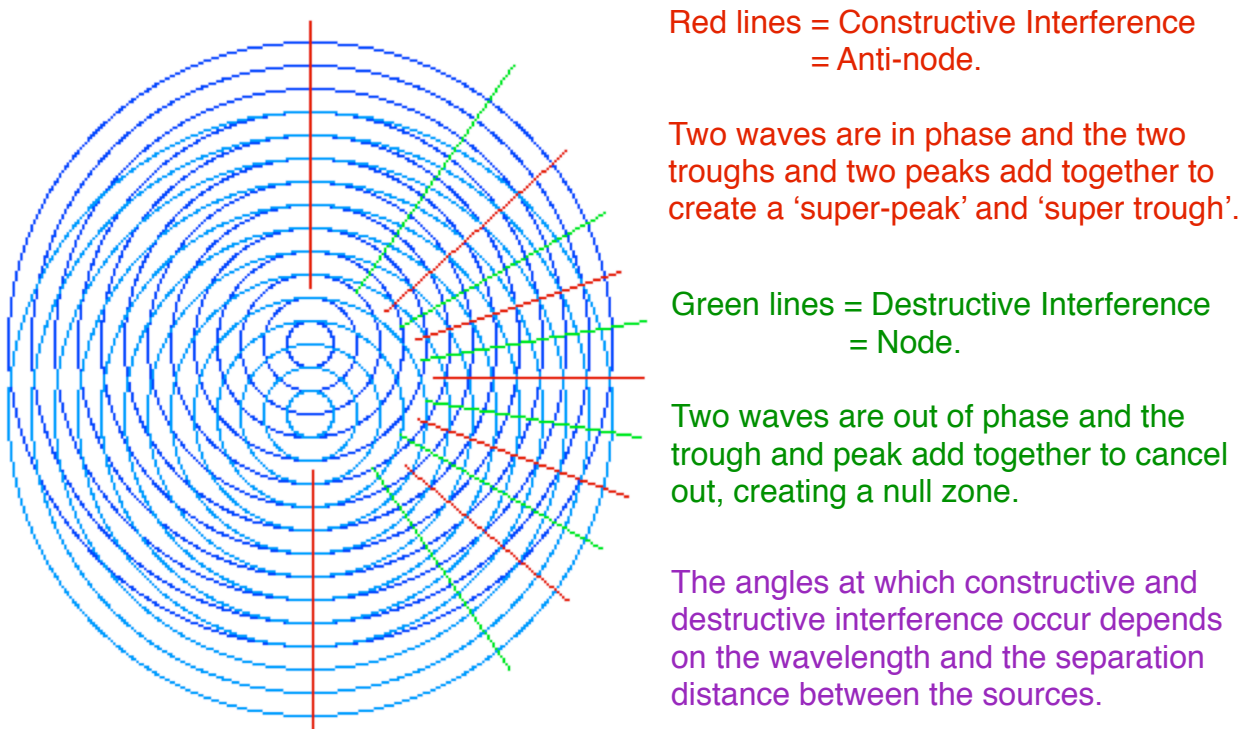


Figure 17: Constructive and destructive interference - a more complex picture.



The problem becomes totally unmanageable when real wind farms are considered in a three-dimensional landscape. Work I carried out with Dr. H. Bakker and Miss R. Summers at a wind farm in Makara, New Zealand, shows that when more than one source of sound is considered, the resultant nodes and antinodes are **extremely complex**, Figure 18.

The following figure is used by permission and appeared in the book:

**Sound, Noise, Flicker and the Human Perception of Wind Farm Activity,**  
**edited by Bruce Rapley and Huub Bakker, 2010, p 229.**

The wind turbines are indicated by a red \* while the dwellings are shown as brown houses. The road is shown in orange.

Note how the nodal lines appear to bend as they move away from the source.

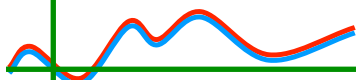
While each turbine is, by definition, a point source, the overall effect of the wind farm is that the turbines act as a **LINE SOURCE**. This accounts for the lower attenuation of sound pressure with distance. Add to this the long wavelength of low frequency sound and the resultant pattern is a complete nightmare.

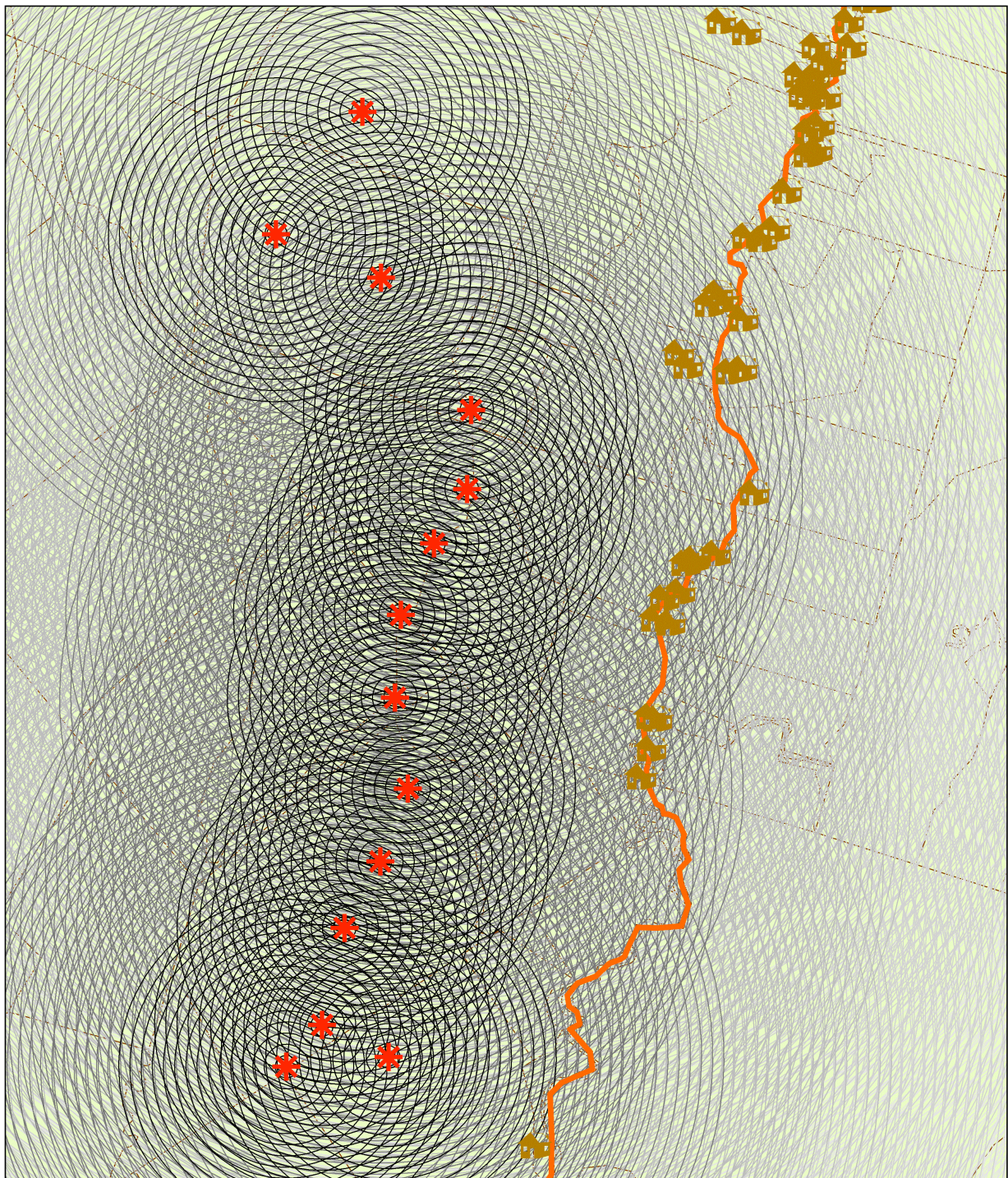
The position of each turbine is critical to the pattern of interference. Figure 18 can only be considered as a '*snapshot*' in time where, for the purpose of this illustration, all the turbines are in phase.

As turbines are never operating at exactly the same frequency, with each turbine varying over time, so the interference pattern changes second to second, minute to minute, hour to hour.

NB Figure 18 shows the situation for all turbines being synchronous and in phase. The phases will be continually changing as the rotation of the individual blades varies, minute to minute, so the interference pattern will be continually changing. This accounts for why the sound is reported to come and go with respect to one location.

Just as the surface of the ocean is forever changing, so will any complex soundscape. There may be areas that are 'turbulent' for some time while 'quiet' at others.





0 500 1,000 m

Blade Diameter is 82m



**Legend**

- Turbine
- Building
- Road
- Noise level
- Parcel

*Figure 18: Noise from 14 turbines creating heightened noise zones affecting noise-sensitive places. Graphic simulation by R. Summers.*

Wind farms provide an every-changing soundscape. Because of the spacing of the turbines and the long wavelengths of low-frequency and infrasound, the resultant interference patterns of the sound waves interacting (superposition theory, i.e. constructive and destructive interference) the position of heightened noise zones (constructive interference resulting in 'louder' sounds) will be forever shifting: This is what we observe.

In theory, if you could control the synchronicity of two turbines, that is, with both blades in exact phase, then you could predict, or measure, the position of heightened noise zones at one instant in time for one geographical location. With two turbines in this simple example, you could determine where the *constructive* interference was, geographically, and also where the *destructive* interference was. If you take any random point, it would theoretically be possible to control the turbines so that the chosen location was experiencing a null spot (destructive interference). That point would be a low-noise area. But just to the side, in any direction, there would be heightened noise zones, followed by more quiet, null spots. You cannot change the physics.

***What cannot be done is to control all the turbines in a wind farm so that null spots occur at all dwelling locations.***

The physics of landscape, the distance of each dwelling from the sources, combined with the long wavelengths, would mean that it is totally impossible to create multiple null zones via phase control for a number of dwellings in different locations in the surrounding landscape.

While the blackboard example of wave interference is simple and it can be shown that two waves of the same frequency can be arranged in such a phase relationship as to cancel each other out, in practice this is simply impossible in the real 3-dimensional environment.

As each turbine slowly changes its frequency, so do all the heightened noise zones continually meander about the landscape. Add to this the effect of wind and weather, and it is easy to understand that phase control is a complete fantasy with respect to a modern, industrial wind farm in a 3-dimensional landscape.

There is one last gremlin to consider: ***Diffraction***.

## Diffraction

Diffraction is the phenomenon observed when waves are obstructed by obstacles or apertures and describes the resulting disturbance spreading beyond the limits of the geometrical shadow of the object.<sup>1</sup>

The effect is marked when the size of the object is of the same order of magnitude (size) as the wavelength.

In simple terms, diffraction is the effect observed when wave energy interacts with the real geometry of the physical environment. This interaction is greatest when the length of the wave is of similar orders of magnitude to the physical structure of the environment.

In considering Superposition Theory above, only simple interference was considered. In a real landscape, the actual 3-dimensional topography will add another controlling factor to the sound. Different vegetation is also an important feature. In other words, the above example considered a flat pond with ripples created by falling objects.

In the real environment, hills and valleys act as wave guides, causing the waves of energy to change course. Just like water in a river rolling down a hill, the path of the water will always follow the valleys. So it is that the physical topography will add yet another layer of complexity to the creation of heightened noise zones and the corresponding quiet, null areas. The point is, ***the location of nodes and anti-nodes will be forever changing.*** The physics of a real, 3-dimensional landscape makes this is unavoidable.

## The speed of sound

It should be clear that heightened noise zones in a real landscape in close proximity to a wind farm are subject to the multiple factors including distance from the noise sources. The wavelengths of low frequencies and infrasound are of the same order of magnitude as turbine spacing and the distance to near neighbours' dwellings in many instances.

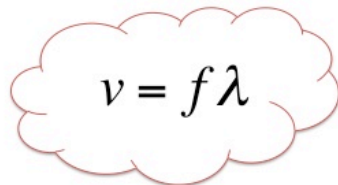
The speed of sound in dry air at 20 °C, is 343.59 metres per second (1,127 ft/s). This equates to 1,236 kph or 768 mph. The wavelength and frequency are described by the general wave equation:

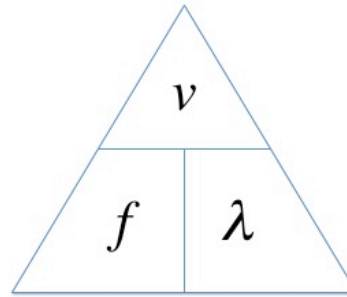
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<sup>1</sup> Larousse Dictionary of Science and Technology, 1995.

## The wave equation (f)

- The wave equation relates three properties of waves:
  - Frequency ( $f$ )
  - Velocity ( $v$ )
  - Wavelength ( $\lambda$ )


$$v = f\lambda$$



Blade pass frequencies for modern industrial wind turbines are in the range of 0.8 to 1.2 Hz. The wavelength is easily calculated from the general wave equation where the wavelength is equal to the velocity divided by the frequency.

For 0.8 Hz the equation is:  $343.59 / 0.8 = 429.49$  metres.

For 1.2 Hz the equation is:  $343.59 / 1.2 = 286.33$  metres.

These calculations are based on dry air at 20 degrees Celsius. Note that the speed of sound varies mainly with temperature, *not pressure*.

From this it can be seen that with a wavelength varying between 0.8 Hz and 1.2 Hz the resulting wavelength varies between 429 to 286 metres. This makes an enormous difference to the resulting interference pattern of constructive/destructive interference.

As turbines are always changing speed very slightly, so the interference pattern is continuously morphing as sound moves across the landscape, changing continually over time.

It should be abundantly obvious that control of the phase of a number of industrial wind turbines is an impossibility as is the control of the position of heightened noise zones and quiet, null areas in the real landscape. Phase, weather, physical geography and the resulting diffraction make it an impossibility to create simple phase cancellation from multiple turbines in a 3-dimensional environment.

To put it even more simply: Just because you drop pebbles into a pool at different time intervals, they all still makes waves, and these waves will interact with each other creating nodes and anti-nodes.

The phase (or degree of synchronicity in time) between dropping the pebbles into the pond simply causes different patterns to eventuate.

**All the pebbles make waves.**

**All waves interact, regardless of phase.**



Figure 19: Pebbles dropped into a pond.

### Summary of the effect of phase on wave interference

In simple terms, the phase of sound waves emanating from two (or more) sources simply changes the spatial position of the nodes and anti-nodes, Figures 20 and 21. Nodes (areas of cancellation) are shown in yellow.

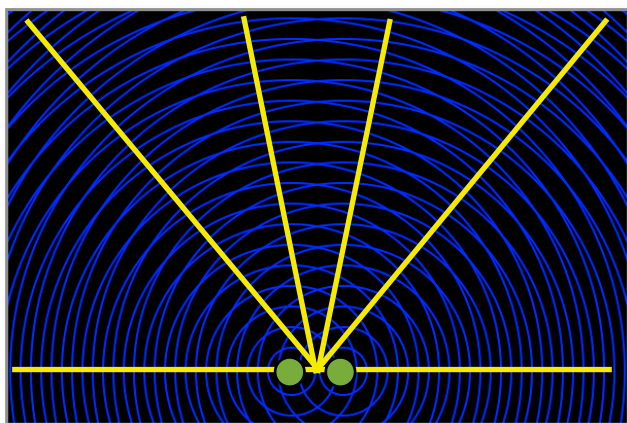


Figure 20: **In-Phase** sound sources.

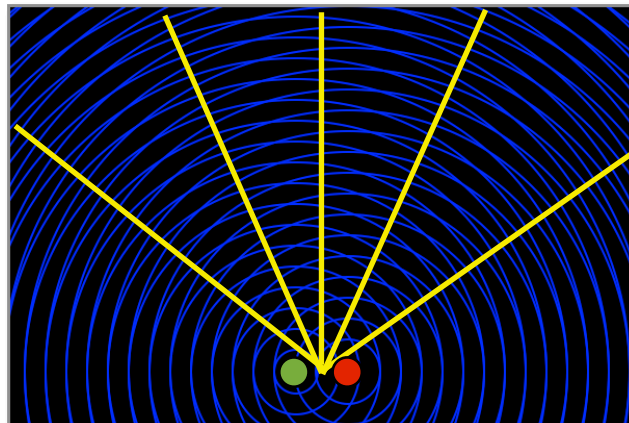
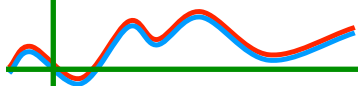


Figure 21: **Out of phase** sound sources.

With multiple sources, the resultant interference patterns are extremely complex.

Controlling the phase of multiple wind turbines cannot reduce the impact of constructive interference in real space (geography). The speed of sound, the wavelength of low-frequencies and distance from source(s) makes the concept of using phase cancellation to solve wind turbine noise emissions simply, physically impossible.



## The causal mechanism - nocebo or not nocebo?

The adverse biological, health effects reported by people living in heightened noise zones as a result of wind turbine emissions are unlikely to be the result of a single causal agent. A common argument used by the wind industry is that the adverse effects reported by people living in close proximity to wind farms is primarily due to the nocebo effect.

The first flaw regarding the nocebo hypothesis is that it is not possible, by definition. The nocebo, like the placebo, requires a non-palpable medium to confer the effect. **This cannot be true of an observable phenomenon such as sound, including low-frequency, that is readily observed by the senses.** In any case, from a standpoint of common sense, no one explanation will necessarily apply to all cases. To write off complainants as 'nutters' who are either suffering from some psychological problem or are just gullible and easily manipulated by media is to do them a grave injustice.

The second major failure of the nocebo hypothesis is that it fails to explain the reaction of people who were initially in favour of the wind farm development and only after commissioning were they able to relate their new adverse health effects to the turbine operation. That this phenomenon is reported across the world is certainly a strong argument to challenge any theory of single causation.

The third challenge to the nocebo hypothesis is that observations of adverse effects in animals that are not susceptible to human influence, and certainly not to the public media, have been reported on many occasions. A simple google search using the keywords 'wind turbines adverse animal effects' will reveal of the order of 742,000 citations. It is generally accepted that animals are not susceptible to placebo/nocebo effects. In order to understand the biological effects from heightened noise zones it is appropriate to review just a few of the reported phenomena involving animals.

## Evidence from nature - use of animal models in science

In consideration of the noise emissions from industrial wind farms, the perspective, not surprisingly, is rather anthropomorphic. Humans are a remarkably self-centred species. While it is understood, from a species perspective, that the primary concern is one's own survival, so often the actions of man affect other organisms in the biosphere, and indeed the biosphere as a whole. As a result of animals not having a 'human voice', the effects that are manifest as a result of man's technological advances are often unobserved or overlooked. For some reason, man seems to rate the human species above all others. As a consequence, the damaging influence of man's existence on the animal kingdom is not always given the importance or press-time it deserves.

The purpose of this senate enquiry is largely to consider the human impacts of wind turbines, economically, socially and biologically. **The missing ingredient is an understanding of the importance of animal models in assisting us to understand ourselves.** It is pertinent to note that the NHMRC *excluded all animal research* in their recent investigation into wind turbines. This is very unscientific and, as a result, they missed some of the most important research in the area which clearly demonstrated physiological and pathological impacts. In essence, they have cherry-picked the data.

For hundreds of years, animals have been used as educational models for human biology. The discipline of medicine owes much to the research of animal structure and function. So do the disciplines of anatomy, physiology, psychology and behaviour. It is virtually impossible to find a single pharmaceutical drug that has not been tested in animal models for effectiveness and toxicity before being released on the open market for human use.

It is undeniable that the existence of man on this planet has changed the nature of the ecosystem. The felling of rain forests, air pollution from industry and transportation, plastic pollution of the ocean - the list of consequences of man's existence appears endless - and most of it bad!

While it is easy to see some of the effects, particularly those that directly affect humans, such as smog, for example, many of the effects of man are more subtle and largely go unnoticed in the popular press. How well known are the gyres of swirling plastic pollution in the major oceans? How does man's creation of sound from industrial sources contribute to noise in the ocean? Recent research has shown that man's noise pollution is certainly affecting animal behaviour of whales.



## Whales change their behaviour as a result of man-made noise pollution

Susan Parks<sup>2</sup>, a research associate in Penn State's Applied Research Laboratory, is investigating the possibility that some whales are changing their tune—specifically, the acoustic frequency at which they communicate—as a direct consequence of commercial shipping in waters near their feeding and migration routes. Her current focus is on the Right Whale, a baleen species characterised by comb-like plates rather than teeth - an adaption to filter-feeding.



Figure 22: Right whale and calf

“Right whales produce sounds ranging from about 50-200 hertz, a low-frequency range just at the lower end of human hearing, that overlaps with noises produced by ship propellers in the range of 100 hertz or less.”

“There has always been background noise in the oceans. However, chronic noise pollution, caused primarily by commercial shipping and other human activities, has grown exponentially in recent years. Researchers at Cornell suggest it is doubling every decade, pointing out that comparable industrial noise levels on land would require headphones to protect our ears. “A blue whale born in 1940 has had his acoustic bubble shrunken from 1,000 miles to 100 miles because of noise pollution” over the course of his lifetime, Cornell marine biologist Christopher Clark told the online publication LiveScience in 2005. (Blue whales can live for 100 years.)”

As noise in the ocean increases, how are whales adapting? What Parks and her colleagues have found is that two closely-related species, North Atlantic and South Atlantic Right whales are shifting their communications to higher frequencies as a result of increased noise from shipping lanes. Her research reveals that whale calls recorded in 2000 are two-thirds of an octave higher than the average values from 1956.

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<sup>2</sup> <http://news.psu.edu/story/141609/2008/09/12/research/right-whales-may-be-adapting-ocean-noise-pollution>

## Foetal absorption - a classic sign of aggression

The value of animal models to science far eclipses their simple use for drug toxicity testing. The study of animals is able to shed light on all aspects of life, including man's. Animal behaviour is one such area. In this example, rats have a lot to teach us.

In a now classic experiment, rats that were living in a confined space in a laboratory and given limitless food and water continued to reproduce until the numbers increased to a point where aggression and competition over territory reached a breaking point. At that point, animals continued to mate and females became pregnant, but many fetuses did not come to full term. Interestingly, they tended not to abort. Rather, the mothers absorb their fetuses! This mechanism is a natural biological control system that prevents overcrowding when critical levels of aggression are reached. This is just another example of how animal behaviour has something to teach us. Animal models provide a valuable addition to our knowledge, in this case, showing us the extreme effects of overcrowding and aggression on reproduction.

## Seek and ye shall find . . .

The old adage '*seek and ye shall find*' is never more true than in science. Unless you look for a phenomenon, you are unlikely to stumble across it. Even if you did come across it by some serendipitous stroke of good fortune, you may not recognise it. The wind industry appears to be blinkered to the wider consequences of their noise emissions, apparently turning a blind eye to what evidence does surface and buying the silence of those that are brave enough to complain. Buyouts and severe gagging clauses appear to be the wind industry's favoured methods to silence objectors. When the continual spreading of misinformation fails, then a more aggressive public relations strategy takes over, ridiculing those who are affected while fostering 'science' that suits their purpose.

It has been said before that inconvenient truths do not go away. When will an aggressive wind industry eventually acknowledge the sheer magnitude of evidence and 'collateral damage' accumulated with thousands of sick, affected people world-wide taking a stand in order to preserve their declining health? The way forward can only lead to a successful outcome if the science is recognised and the stories of adverse health effects are properly investigated. At this time, particularly with the highly unethical and inappropriate stance of the AMA, medical practitioners in Australia are left wanting for a diagnosis that explains the plethora of symptoms being presented on a daily basis as a result of wind turbine noise.

Until such time as the science can be allowed to proceed, facilitated in a state devoid of commercial bias and influence, the collateral damage will mount as the coffers of industry continue to increase.

### **Dead minks in Denmark**

While the premature death of minks in Denmark was covered in part one of my submission to this enquiry, the story begs repeating. While the death of hundreds of premature minks was correlated to the commissioning of a wind farm in close proximity, this is only the tip of the iceberg. Aggressive behaviour is now rampant and in view of what we have learned from the rat experiments, the question remains: How many minks absorb foetuses as a result of the wind turbine emissions?

Aggression, stillbirths, deformed foetuses, the list is horrendous. How could the Green Dream go so badly wrong? The answer to that question is simple: Ignore the evidence that does not suit your purpose.

That the process of gestation in animals is somehow affected by certain acoustic emissions is a warning for human society. Will we see deformed babies as a consequence of noise pollution? Unless we look, we will never know . . . after all, man is just an animal.

### **Montage of aggression, birth deformities and death - "least we forget" . . .**



*Figure 23: Mink montage - the damage.*

## Deformed lambs in Portland

Bill and Sandy Rogerson of Glenthompson presented information to the Portland hearing of experiencing adverse health effects after the commissioning of the wind farm<sup>3</sup>.

“The number of deformed lambs increased over the period of the wind farm operating near our property. The lambing rate in our merino stock decreased to a rate of 37 per cent from 85 per cent prior to the wind farm being established.”



*Figure 24: Deformed lamb.*

The Rogersons recount several years of hell living near wind turbines.

## Dead goats in Taiwan

A disturbing story printed in the UK Telegraph<sup>4</sup> 22 May, 2009 outlines the report by a farmer on an outlying island of Taiwan reporting the death of 400 goats. A Council of Agriculture inspection official, Lu Ming-tseng, stated: “After the eight turbines were installed in the notoriously windy Penghu archipelago in the Taiwan Strait, a neighbouring farmer reported that his goats had started dying”.

"If noise at night can keep people awake, then it could also keep the goats awake, and when the wind kicks up it makes a louder noise," Lu said.

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<sup>3</sup> <http://wcfm.org/2015/04/02/wind-farms-deformities/>

<sup>4</sup> <http://www.telegraph.co.uk/news/newstoppers/howaboutthat/5364965/Wind-turbines-killed-goats-by-depriving-them-of-sleep.html>

“Agricultural authorities would make tests to rule out any other causes of death”, Lu said, adding that **“if the giant power-generating turbines proved to be at fault, Taiwan Power had promised to compensate the farmer”**.

### Traumatised geese in Poland

In 2013, J. Mikołajczak, S. Borowski, J. Marć-Pieńkowska, G. Odrowąż-Sypniewska, Z. Bernacki, J. Siódmiak<sup>3</sup>, P. Szterk published a paper entitled “Preliminary studies on the reaction of growing geese (*Anser anser f. domestica*) to the proximity of wind turbines” in the Polish Journal of Veterinary Sciences Vol. 16, No. 4 (2013), 679–686.

**The authors state that wind turbines are a source of infrasound that may cause a number of physiological effects, such as an increase in cortisol and catecholamine secretion which are biological markers of physiological stress.** The impact of infrasound noise, emitted by wind turbines, on the health of geese and other farm animals has not previously been evaluated.

Mikołajczak *et al.* aimed to determine the effects of noise generated by wind turbines on stress parameters (cortisol levels) and weight gain in geese kept near the turbines. The study involved forty, 5-week old geese (*Anser anser f domestica*) divided into two groups. Group 1 was kept within 50 m of the turbine while group 2 were kept 500 m away from the turbine. Noise measurements were taken for 12 weeks. The results showed significant differences in cortisol levels and weight gain between the two groups.

The group closest to the turbine (group 1) gained less weight and had higher levels of cortisol in the blood compared to group 2 that were 500 m from the turbine. Further, lower activity was noted in the group 1 birds accompanied by disturbing changes in behaviour. The authors conclude that wind turbines exert a negative effects on geese living in close proximity to turbines.



Figure 25: Geese in Poland.

## Closure of a Canadian emu farm due to the destruction of flock by wind turbines

The following article appeared in the media on 16 November, 2013: **ONCE SUCCESSFUL NOVA SCOTIA EMU FARM FORCED TO CLOSE AFTER TURBINES DESTROYED THEIR FLOCK** - A message from Digby, Nova Scotia<sup>5</sup>. The story is best told in the words of the writer. . .

From: Debi VanTassel  
Date: Fri, Nov 15, 2013  
Subject: Ocean Breeze Emu Farm-closing

Dear Friends,

It is with great sorrow that I write this e-mail.

Due to the abuse we are experiencing from the Industrial Wind Turbines our emus have suffered greatly. First with the installation of the test towers and the high pitch sounds emitting from them, we lost 26 of our 38 emus with no eggs laid. During the time the turbines were erected and the test towers were still in place; we lost 5 more emus. Leaving us 8 emus. The Agriculture in Truro reported to us that these birds had died of fear.

Three years after the turbines were up and running we finally had 7 eggs and 4 out of the seven survived, expanding our emu count to 11. A female emu will lay approximately 40 to 50 and we were accustom to incubating 100 per year in which half would hatch.

The next two years we had no eggs on the third year we had 52 eggs laid and 27 chicks hatched.

From the time the Industrial Wind Turbines were erected we here had NO meat or oil to sell—only the egg shells to generate any income from our emu farm. Two years ago we put up a little shop selling polished beach stone jewellery and novelties, which Judy and Dave (Davey's Mom and Dad) and I create. People come to see the emus and sometimes visit the shop. Unfortunately, this does not generate enough revenue to even begin to support our farm.

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<sup>5</sup> <http://globalwindenergyimpact.com/2013/11/16/once-successful-nova-scotia-emu-farm-forced-to-close-after-turbines-destroyed-their-flock/>

Over the past two years we have struggled to keep these 35 emus alive, but we could not keep their weight up...the agitation from the turbines caused them to run and run night and day wearing them down to practically nothing. The young ones suffered the most from the effects of the infrasound emitting from the turbines.

Emus habits are to lay down together at dusk—males and females pick their mates and the others huddle together for sleep. We noticed that our emus were not laying down, but running through the night. We noticed that the birds were getting thinner and thinner. We contacted the feed company and they added more vitamins and fibre to the feed hoping that this would help, but unfortunately it did not.

In the last two weeks we lost 5 our the younger emus. We have SEVEN of the 27 emus and SIX of the mature emus remaining; totaling 13 in all. We cannot prove that it is due to the effect of the turbines, but one thing we do know is that for the 18+ years before the turbines we NEVER had any problems with our birds, no unexplained deaths, no agitation they would lay down in the evening content and low us to sleep with their gentle drumming. We had healthy, productive, and content emus.

People would come literally from all over the world to visit our emus. Some from Sweden, Austria, Holland, London, all over United States and Canada, senior buses and tour buses have come to visit our Emu Farm and have been delighted in the antic and uniqueness of our emus. One of our emus “Ernie” was taken to Halifax to the Children’s Museum and appeared on the Breakfast TV show.

These unique animals have not only supplied us with healthy meat, eggs, and oil, but have brought entertainment, joy and happiness to everyone who has had the opportunity to meet them...they will be truly missed.

So with great sadness, after 18+ years with our emu farm, Ocean Breeze Emu Farm will be closing. We would like to thank everyone who has supported us and may God Bless you.

Davey and Deb Van Tassel

## Is There an Equine Version of Wind Turbine Syndrome?

That is the name of an article that appeared on the “Watts Up With That?” website of 26 September, 2013 by Ric Werme<sup>6</sup>.

While not much gets past WUWT, this story from Portugal has only recently gotten some press, well after its posting in March, and I think it warrants attention here. While I don't know much about horses, I've known several people who do, so I do know that just because a horse will let you ride it, it may look for a low hanging branch to walk under to scrape you off.

Not surprisingly, I had never heard of “Acquired flexural deformity of the distal interphalangeal joint,” but I came across a web page, [Can Wind Turbines Cause Developmental Deformities In Horses?](#) about a stud farm where horses developed downward pointing front hooves after several wind turbines were built nearby.

If I were a horse, I would not want my feet to look like the one on the right: Left foot is normal, right foot has an acquired (post birth) flexural deformity.



Figure 26: Left foot is normal, right foot has an acquired (post birth) flexural deformity.

No other changes in rearing the Lusitano horses (a famous Portuguese horse breed that I never heard of) were known. In the ensuing investigation, “two of the affected foals were placed in a pasture away from the initial one and two others were admitted at the Faculty of Veterinary Medicine of Lisbon. In those animals, except for one that had to be euthanized for humane reasons, an improvement was observed on their condition, with partial recovery of the deformity.”

<sup>6</sup> <http://wattsupwiththat.com/2013/09/26/is-there-an-equine-version-of-wind-turbine-syndrome/>



The stud farm was studied as part of a masters thesis by Teresa Margarida Pereira Costa e Curto and it surmised:

Cellular Mechanotransduction is the mechanism by which cells convert mechanical signals into biochemical responses. Based on the mechanical effects on cells it was proposed in this research project that the ground vibrations were responsible for a increased bone growth which was not accompanied by the muscle-tendon unit growth leading to the development of these flexural deformities.

***Cellular Mechanotransduction is the mechanism by which cells convert mechanical signals into biochemical responses. Based on the mechanical effects on cells it was proposed in this research project that the ground vibrations were responsible for a increased bone growth which was not accompanied by the muscle-tendon unit growth leading to the development of these flexural deformities.***

That sounds reasonable to me, I know that stressing human bones increases their calcium uptake, and I wouldn't be surprised that something like that could affect feet in other animals.

The wind turbines are obvious prime suspect, they were built nearby:



Figure 27: Turbine placement with respect to the farm.

So, WUWT readers who actually know something about horses, have you heard of this case or similar cases at other farms with new wind turbines? Or, if you live near wind farms that are near farms with horses, cattle, etc, have they had problems like this?

This is just one study, involving one farm and not very many horses, clearly more research is warranted. If it's confirmed, it would be interesting to know if other animals are susceptible to a similar problem.

One foal was bought from another breeder to exclude a possible genetic link to this problem. He came to the farm at 15 days old and like the others, developed a flexural deformity.



Figure 28: Flexural deformity.

This is only one study with a very small number of horses, but it is an interesting observation that begs more investigation. It is from empirical observations that science progresses.

## Animal reproduction in Wisconsin - BMJ editorial 8 March 2012

The editorial<sup>7</sup> quotes biologist Dr. Lynne Knuth, in a letter to the Public Service Commission of Wisconsin, testified as follows:

“The problems with animal reproduction reported in the wind farms in Wisconsin are lack of egg production, problems calving, spontaneous abortion (embryonic mortality), stillbirth, miscarriage and teratogenic effects:

In chickens: Crossed beaks, missing eyeballs, deformities of the skull (sunken eyes), joints of feet/legs bent at odd angles.

In cattle: missing eyes and tails (updated Excerpts from the Final Report of the Township of Lincoln Wind Turbine Moratorium Committee). (4)

There are more here. (5)

**“In conclusion it is possible [that in] humans wind farm illnesses could be psychogenic. In animals it maybe a bridge too far.”**

1. <http://www.bmj.com/content/344/bmj.e1527>
2. <http://www.ncbi.nlm.nih.gov/pubmed/24597302>
3. <https://www.repository.utl.pt/bitstream/10400.5/4847/1/Deforma%C3%A7ao%20...>
4. file:///C:/Users/DaveA/Downloads/viewdoc.htm
5. <http://canadafreepress.com/index.php/article/62126>

“It is disturbing to me that in chickens and cows in separate wind farms (separated by 50 miles) similar teratogenic effects are being observed, namely missing eyeballs. Based on the correlation of effects seen experimentally and those seen in the wind farm in chickens, these defects may be due to low frequency vibration. Jim Vollmer, the farmer who owns these chickens, reports

<sup>7</sup> <http://www.bmj.com/content/344/bmj.e1527/rr/695014>

that the tin structures on his farm buildings vibrate. If the infrasound/ low-frequency sound is strong enough to vibrate structures on his farm as it passes through, what is it doing to the delicate connections and circulation inside the developing chicken embryos, and inside people, as it passes through them?”

“Animal health problems in the Srnkas’ formerly award-winning herd include cancer deaths, ringworm, mange, lice, parasites, cows not calving properly, dehydration, mutations such as no eyeballs or tails, cows holding pregnancy only 1 to 2 weeks and then aborting, blood from nostrils, black and white hair coats turning brown, mastitis, kidney and liver failure. . . .”

### **Acoustic startle reflex in seals leads to subsequent avoidance behaviour and induces fear conditioning**

Thomas Götz and Vincent M Janik<sup>8</sup> conducted acoustic research into seal behaviour that was reported in the journal BMC Neuroscience 2011, 12:30 (13 April 2011).

Autonomous reflexes are an evolutionary mechanism that enables animals to respond quickly to potential threats, prevent injury and mediate fight or flight responses. Sudden onset, intense acoustic stimuli can elicit a startle reflex, while stimuli of similar intensity but with longer rise times only cause a cardiac defence response.

Physiological habituation of all these reflexes has been observed in laboratory settings where the response amplitude generally decreases with repeated exposure to the stimulus. Accordingly, the startle reflex has become a model system for the study of the neural basis of simple learning processes and emotional processing and is often used as a diagnostic tool in medical applications.

One of the features of the early research is that previous studies did not allow animals to avoid the stimulus and the evolutionary function and long-term behavioural consequences of repeated startling remain speculative as a consequence.

Götz and Janik investigated the follow-up behaviour associated with the startle reflex in wild-captured animals using an experimental setup that allows individuals to exhibit avoidance behaviour. What they discovered is that repeated elicitation of the acoustic startle reflex led to rapid and pronounced sensitisation of sustained spatial avoidance

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<sup>8</sup> <http://www.biomedcentral.com/1471-2202/12/30>

behaviour in grey seals (*Halichoerus grypus*). Animals that had developed rapid flight responses, if left the exposure pool, showed clear signs of fear conditioning. **Once sensitised, seals even avoided a known food source that was close to the sound source.** In contrast, animals exposed to non-startling (long rise time) stimuli of the same maximum sound pressure habituated and flight responses waned or were absent from the beginning. The startle threshold of grey seals expressed in units of sensation levels was comparable to thresholds reported for other mammals (93 dB).

Götz and Janik were able to demonstrate that the acoustic startle reflex plays a crucial role in mediating flight responses and strongly influences the motivational state of an animal beyond a short-term muscular response by mediating long-term avoidance. **The startle reflex is therefore not only a measure of emotional state but also influences emotional processing.**

Götz and Janik hypothesise that the biological function of the startle reflex is most likely associated with mediating rapid flight responses. Their data indicated that repeated startling by anthropogenic noise sources might have severe effects on long-term behaviour. Future studies are needed to investigate whether such effects can be associated with reduced individual fitness or even longevity of individuals.

The important points to come out of Götz and Janik's work is that **animals, like humans, respond to the instantaneous sound pressure level, not averages, as such environmental signals offer great survival value.** In an article in the New Zealand Listener, March 7-13, 2015, the Head of Audiology at the University of Auckland's School of Population Health stated that:

"The auditory system has evolved to act as a warning for our bodies. It's a way of alerting us to potential environmental threats. Sound is transmitted through to the brain, which is where your emotions are processed. If you go back a few hundred years, it's what stopped us getting eaten."

It must be abundantly clear now that any reliance on a weighting system, particularly the A Frequency-Weighting, is totally inappropriate for the determination of biological response to acoustic queues. That what little data is gathered via this archaic, artificial hearing construct is further diminished by the use of 10-minute averages rendering the entire process of environmental consents for wind farms an absolute joke perpetuated by an apparently devious industry.

To exclude the very frequencies that many scientists are now convinced are responsible for biological / psychological effects is a travesty. To continue to limit the funding stream so that qualified scientists cannot research this important area of public (and animal) health is an indictment on human society that is predicated on financial greed at the expense of health and well-being.

The current reports of biological effects are only the tip of an iceberg that even now is rising out of the water. The continued failure of government agencies to act ethically and morally to fund genuine scientific research, free from commercial bias, is deplorable. It is no longer acceptable to claim “well, we didn’t know that”. I know. You know. We know. Evidence abounds as the number of scientific papers and reports increases daily. Patients are increasingly reporting to their medical practitioners with problems related to wind turbine exposure. How long can the wind industry hold its stance in the face of increasing evidence that is testament to adverse health effects of their technology? You can’t fool all the people all the time.

### **Other anecdotes of effects on animals**

I am aware of a large number of cases where abnormal animal behaviour has been reported after wind farms were commissioned. In New Zealand I have been told about sheep dogs suddenly ‘freezing’ and staring at the ground when the local wind farm in the Manawatu is operating. Sometimes the dogs would refuse to leave their kennels to work. Others have reported dwindling wildlife around wind farms and the native New Zealand bat dying of pulmonary implosion as a result of sudden pressure changes while flying in the vicinity of a wind farm. Death results from asphyxiation and internal blood loss.

It is generally accepted that animals do not suffer from the placebo or nocebo effect. So how are such behaviours, some of them extreme while others are fatal, to be explained? The only common factor appears to be the operation of a nearby wind farm.

If only a few anecdotes of such adverse effects on animals existed world-wide, then one would have good grounds to question the testimony along with the theory that the wind farms are to blame. But that is not the case. There is an ever-growing number of such reports which only serve to confirm what the human sufferers are reporting.

That correlation does not prove causation is a well-accepted scientific mantra. However, evidence is mounting on a daily basis that is all pointing in the same direction. There is sufficient evidence to warrant a serious scientific investigation now. Empirical observations

are the foundation of the scientific method. Now is the time to respond with targeted research free from commercial bias.

When a potentially dangerous new phenomenon is discovered, the Hippocratic oath of “*primum non nocere*” - “**first, do no harm**” is entirely appropriate. Therefore it is entirely reasonable to invoke the **Precautionary Principle** until such time as the science can determine cause and effect. To continue to allow or facilitate the continued building of wind farms in close proximity to people and livestock is nothing short of fool-hardy.

## Veterinary textbook on diseases caused by physical agents

The textbook of **Veterinary Medicine** by Blood, Henderson and Radostits, 5th edition 1981, has a section on diseases caused by physical agents (chapter 30, pp 927 - 934). This book is a standard ‘bible’ for veterinary science students and the authors are regarded as being at the top of their fields. They are:

### **D.C. BLOOD, BVSc, FACVS,**

Professor of Veterinary Medicine,  
School of Veterinary Science, University of Melbourne, Australia

### **J.A. HENDERSON, DVM, MS**

Former(v Professor of Veterinary Medicine and Dean of the College of Veterinary Medicine, Washington State University, Pullman, Washington, USA

### **O.M. RADOSTITS, DVM, MSc**

Professor of Veterinary Medicine,  
Department of Veterinary Clinical Studies, University of Saskatchewan, Saskatoon, Canada  
Diplomate of the American College of Veterinary Internal Medicine

### **J.H. ARUNDEL, BVSc, MVSc**

Reader in Veterinary Parasitology,  
School of Veterinary Science, University of Melbourne, Australia

### **C.C. GAY, DVM, MVSc, FACVS**

Senior Lecturer in Veterinary Medicine,  
School of Veterinary Science, University of Melbourne, Australia

The book was first written in 1960, with a revision in 1979. The copy I am quoting from was published in 1981.

### **Disease's Caused by Physical Agents**

The following quotation is from page 928. The references cited in the text are reproduced with their original numbers.

**Pollution by noise, a matter of increasing importance for veterinarians who police codes of practice for animal welfare and for those who are 'called upon to act as expert witnesses in cases involving excessive noise and its effects on animals, is also an important subject. An extensive review is available (3). Some examination has been made of the effects of the sonic bang produced by aircraft (4) but the effects on cattle, sheep, ponies, chickens and wild and laboratory animals appear to be minimal (5, 6, 7, 8). Most of the effects reported are short-lived and are due to fear reactions and include injury due to sudden flight, killing of young by mink and rabbits, suffocation in panic stricken chickens and reduced egg production. Cows appear to be unaffected. Experimentally, loud noises of 90-100 phons applied to horses cause an increase in heart rate (9).**

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## An anecdote from Penn State University

Some 25 years ago, when I was studying for my Masters degree, a colleague at that time shared an interesting anecdote regarding the mysterious deaths of deer in Pennsylvania. My erstwhile colleague (Varella-Alvarez) related that some local hunters contacted the Penn State University to investigate unexplained deaths in a natural deer population.

The veterinary department agreed to investigate the deaths and carried out a number of autopsies but were unable to determine a cause of death. The animals appeared to be in good condition and there was sufficient feed. No major organ failure was detected nor any infections or poisonous substances in the blood analysis. The staff were perplexed.

After a number of weeks with no progress, Varella-Alvarez suggested they have a clambake. Clams were ordered as was beer and butter. The staff who attended cooked the clams, smothered them in fresh butter and consumed considerable quantities while lubricating the process with beer.

Late into the clambake, the participants were in a state of extreme relaxation, the topic of the mysterious deer deaths surfaced. Much banter followed until one well-lubricated academic suddenly said, "I bet they just dropped dead out of fright!". The penny dropped. Extreme fear could be a cause of sudden death. But was it?

Varella-Alvarez suggested that a number of the zoologists on the staff should carry out an experiment using sheep kept for the veterinary students. The university owned a number of guns for the purpose of animal research (culling), and so it was arranged, at 2.00 am a number of staff crept into the sheep yard and discharged a number of rifles in quick succession. The results was that many of the sheep dropped dead instantly of fright!

The suggestion that sudden, fast rise-time acoustic energy, if experienced in the middle of the night when animals were in a deep state of sleep could result in sudden death. Could it be that the wild deer were experiencing the same scenario?

A stake-out of the area where the unexplained deer deaths were reports revealed that poachers were hunting under the cover of darkness and their gunfire was causing animals to drop dead out of fright.

There is no doubt that fast rise-time, loud acoustic events can and have caused sudden deaths in animals. Now that we know the extreme end of the spectrum, death by sudden acoustic shock, the question remains: What is the lowest dose of a fast rise-time 'loud' acoustic event, including the infrasound range, that can cause physiological stress in people who are chronically exposed due to repeated, long-term, pulsating noise from industrial wind turbines?

## German doctors speak out to halt building of wind turbines

From the current state of knowledge of animal studies and observations, it is clear that the nocebo effect cannot operate. (Regardless of the fact that the nocebo is the *wrong term* in any case.) So if the effect of propaganda and general media hype is not the single causal symptom, what is? Again I draw your attention to the theory of **Multiple Causation**. I have no doubt that many factors are responsible for the observed/reported adverse health effects.

Until such time as there has been sufficient serious science conducted without industry or commercial pressure, we will not know all the answers. But that does not mean that we should not adhere to the Precautionary Principle until the full extent of the harm and its causal mechanisms are known. As recently as 21 May, 2015, German doctors have swung into action calling for a ban on all new wind farm developments within close proximity to human habitation. This is a very responsible, professional response. As Germany has been one of the leading countries to introduce wind power, it is significant that the medical profession has come out with such a strong statement. This needs to be put into context of Brown County Town Health Board, Wisconsin, USA, who declared industrial wind turbines are a health hazard. The article taken from the Australian is reproduced below:

### German doctors push to halt building of wind turbines

Credit: German doctors want more research into the health effects of wind turbines -  
Graham Lloyd, Environment Editor - The Australian | May 21, 2015  
[www.theaustralian.com.au](http://www.theaustralian.com.au) Filed: May 21, 2015 • [Germany](#)

The “parliament” of Germany’s medical profession has called on its leaders to support a halt to further wind farm developments near housing until more research has been undertaken into the possible health impacts of low-frequency noise from wind turbines.

The issue was debated at the German Medical Assembly in Frankfurt on Friday and transferred to the executive board of the German Medical Association.

Association policy adviser Adrian Alexander Jake confirmed a motion calling for -research had been forwarded to the board “for further action”.

Germany is considered a world leader in adopting renewable energy and the minutes of the Medical Assembly meeting said that, with the phase-out of nuclear power, more wind energy would be used in future. But it said the entire life cycle of renewable technologies, from the initial raw material supply to disposal and the planning and risk considerations, should be considered in advance.

The Medical Assembly motion said this required **“scientifically sound findings of potential health effects, and a deliberate balance between benefit and validity to be able to make conscious weightings between the benefits and of the disadvantages and risks”**.

**“In particular regarding emissions in the low frequency and infra-sound range there are no reliable independent studies that investigate field measurement methodology suitable for this sound field below the threshold of hearing,”** they said.

The assembly called for the federal government to close the gaps in knowledge about the health effects of infrasound and low-frequency sound from wind turbines through scientific research.

It said: **“research should clarify open questions concerning measurement methods and, where appropriate, adjust regulations to allow the expansion and the operation of wind turbines wisely, carefully, with integrated expertise, sustainability and overall societal responsibility”**.

It said **“the health effects of infra-sound (below 20 Hz) and low-frequency sound (below 100 Hz) in relation to emissions from wind turbines were ‘still open questions’**, as were **“the effects of noise below the hearing threshold or lower frequencies with increasing exposure duration”**. The assembly said the erection of more turbines close to settlements should be stopped until there was reliable data to exclude a safety hazard.

## The long arm of industrial corruption and influence into the heart of academia

The wind industry is a very powerful industry group with long arms to reach into many realms. After I had been working on creating the SAM technology (Soundscape Analysis and Measurement) for 11 years, one of my clients spoke of their involvement in wind turbine consents. At that time I was of the belief that the ‘hoo-ha’ in the press regarding wind farm noise was simply the result of baseless allegations from NIMBYs (Not In My Back Yard) who simply did not want the visual intrusion of large industrial structures in their landscape. I could not have been more wrong.

As a scientist, my interest was tweaked by some of the narrative in the press. I decided to follow up on a few of the complainants, just for interest. Much to my chagrin, one of the first residents I contacted, having traced them from the newspaper article, was a person known to me because they had been an experimental subject in my research for my Masters degree (20 years ago) looking at the use of low-frequency magnetic fields as a possible treatment of Raynaud’s disease.

This person, I will refer to him as “MM”, was an ex-policeman who I had known for more than 2 decades as a person of honesty and integrity. He was not prone to exaggeration or making up stories, so I took great notice of what he had to say.

MM’s narrative proved to be of significant importance as his simple, down to earth description of what he and his wife experienced were to prove most revealing. The salient point was that in response to their complaints, the local wind developer had paid for double glazing to be installed on the side of the house facing the wind farm. All this did was change the *timbre* (transmission spectra or sound ‘quality’) of the noise nuisance, **not eliminate it**. This was a huge clue. Glass, in particular, double glazing, is only effective at reducing the mid to higher frequencies and is virtually useless at the very low end of the acoustic spectrum.

The next point hit me like a bombshell. MM’s wife said that it was worse when she laid her head down on the pillow at night to sleep. The sound came right up through the bed! Now I suspected that the sound nuisance was in the very low end of the spectra. I hypothesised that this could be the result of ground-borne vibration, the wind turbine(s) acting like large ‘tuning forks’ on the hill. Each turbine is mounted on a very heavy concrete plinth, anchoring it to the hill. This could theoretically provide good acoustic coupling to the

ground. All I needed to do was measure the ground vibration and I would have solved the problem . . . so I thought.

Measurement of ground vibration requires a quite different instrument set in comparison to what I had been working with for the past decade in 'audible' acoustics. Through a colleague, I managed to forge links with a major New Zealand university that had considerable expertise in the field of geophysics. They willingly lent me equipment to use that I was able to connect to my SAM data recorders, facilitating measurement of ground vibrations.

The sensors proved to be very, very sensitive, being magnetic accelerometers specifically designed for geophysics applications. I installed several of these around MM's property and studied the results. The sensors were so sensitive that I could detect when a person walked across the lawn, or when the milk tankers drove down the road in the early hours of the morning. They were just perfect for the task.

After months of work, a colleague and I took the vibration **.wav** (Microsoft sound file format) files and played them as audio files through a sound system fitted with a large, low-frequency, powered woofer. When this was placed at the far end of the long hall with MM and his wife at the other end of the house in the lounge, as soon as they heard the low thumping rumble they called out, "that's it!". We had reproduced what they heard with their heads on the pillow by recording the ground vibrations from the turbines. We had aced it!

As a result of our 'discovery' my team wrote and submitted a paper to the Third International Meeting on Wind Turbine Noise, Aalborg Denmark 17 – 19 June 2009 entitled: **Seismic Effect on Residents from 3 MW Wind Turbines**. Authors included: Bakker, H.H.C., School of Engineering and Advanced Technology, Massey University, H.H.Bakker@Massey.ac.nz , Bennett, D.J., Kea Petroleum Limited, Wellington NZ 6012 davebennett@xtra.co.nz, Rapley, B., Atkinson & Rapley Consulting, Palmerston North, [arg@paradise.net.nz](mailto:arg@paradise.net.nz), Thorne, R., Noise Measurement Services, Brisbane, bob@noisemeasurement.com.au

One of our colleagues (Bennett) delivered the paper in Denmark which was to mark the beginning of our serious research into the acoustic and vibration emissions of industrial-scale wind turbines.

For the next experiment I constructed a laser microphone, to detect movement of the glass picture windows in MM's house. Again, the same result was achieved. The window acted like a huge microphone diaphragm, transmitting the low-frequency sound faithfully into the room, thereafter exciting room resonances. Our results were conclusive: The low-frequency signature of the industrial wind turbines, just a couple of kilometres from MM's house, were indeed impacting the dwelling and affecting the residents, at times destroying quality sleep. The effect was particularly bad during easterly winds where the backs of the nacelles were pointing directly at the house with the blades on the far side of the turbine, facing into the wind.

Well-pleased with the results of a year's field work, I contacted the university that had lent me the sensors to share our findings. I was shocked to learn that as soon as I mentioned that I was working on wind turbine emissions, the head of the department instructed the staff to never allow contact with me or my group again. **From that point on, there was to be NO COMMUNICATION with me or my group regarding wind turbines.** It was some time later that I found out that someone in the university was receiving money from the wind industry.

I was somewhat disappointed that the long arm of an apparently corrupt industry with much to hide had now successfully destroyed any possibility of my team sharing any honest academic endeavour free from commercial influences with a major New Zealand University. That just did not seem fair. I had thought that universities had 'academic freedom'. Well, of course they have. ***As long as the funders agree with the research.***

The next project was to write a book, drawing together everything my team and I had discovered regarding the effects of industrial wind turbines. That resulted in the following publication, available through the company website and now on Amazon in a Kindle edition: **Sound, Noise, Flicker and the Human Perception of Wind Farm Activity.**

Dr. H. Bakker and I co-edited the book, with Mr. Nick Jennings as the associate editor and Dr. J.V. Podd head of the peer review panel. Chapters for the book were written by: myself, Dr. H. Bakker, Dr. Daniel Shepherd, Dr. Bob Thorne, Mr. Bryan Leyland, Professor Dr. Philip Dickinson, Dr. Dave Bennett, Mr J. Helig, Mr. M. Simpson and Lt. Col. Dr. David McBride (MB, ChB, PhD). Readership interest and sales have been world-wide.

Some months after the publication of the book, I received a call from a university professor who said, quite bluntly, "You have written the book, how about you write a thesis?". I had never got around to a PhD due to multiple life circumstances, but the opportunity to

engage in a serious piece of focussed research on a problem that appeared to be growing daily was too much of a good offer to pass up. And so it was that I agreed to undertake a PhD on the effects of wind turbines, using the very equipment I had spear-headed the development of over the past decade. After submitting the standard application to the university I commenced the preparatory work. This included background reading, a literature review, planning experiments and determining the equipment and strategies required.

It came as a surprise to all of us that three months down the line, the paper work seemed to be somewhat slow. Upon close investigation we discovered that my application had been binned on day one. And nobody had taken the time or trouble to advise either me or my chief supervisor of this salient fact.

Enquiries were made and the 'excuse' given was that I was not of "suitable academic standard to undertake postgraduate research". We were all stunned. I had a BSc in biological systems and a Masters degree in technology by thesis alone. What more qualifications did I need? After all, it was as a result of an academic *invitation* that I had applied! Further careful investigation unearthed the unspoken problem: Wind Turbines! The university received funding from the wind industry and clearly did not want the boat rocked by inconvenient research embarrassing their sponsors.

What followed, for legal reasons, will not be detailed. Suffice it to say that the biggest battle that my chief supervisor had ever taken on ensued. Those in the university administrating doctoral studies were absolutely immovable on the point, siting poor academic performance rather than choice of topic. This blatant act of deception was to backfire on them. From out of the past came my previous chief supervisor (then in the UK) and one of the external examiners of my Masters thesis (now living in Australia). Both put forward very strongly-worded letters to the university pointing out the egregious position they had taken. Not only would this affect me, but all other students, past and present, who had undertaken postgraduate study and achieved success. Their actions could be seen to undermine the very quality of the university's post-graduate degree programs.

After what seemed like an interminable battle, I was finally accepted, grudgingly I am sure, but I would have to change my topic! The topic of wind turbines was not acceptable to the university. After much negotiation, it was decided that I would study the effects of acoustic exposure in the military environment. The project received the full support of the New Zealand Defence Force and the project could proceed, albeit largely unfunded. Three thousand dollars was all that was made available to me for the entire project, leaving the

bulk of the funding to be obtained by myself. One of the supervisors, from another university, was able to provide funding to the tune of \$10,000 for purchase of specialist equipment, leaving the student, me, to fund the other \$20,000 that was needed for specialist equipment, much of it bespoke.

The project saw me create humanistic methods of measuring sound from an anthropomorphic perspective, rather than the standard approach of just using a sound level meter. Special low-frequency microphones were obtained. The SAM technology was greatly modified to undertake the analysis. Not only was the acoustic spectrum extended down into the infrasound region, but also a large dynamic range was required with very high sound pressure levels up to the order of 165 dB. New microphones had to be developed that were sufficiently robust to be able to withstand the rigours of the military environment. These were all designed and constructed by myself as part of the project.

Once the problems of quantifying the sound environment were overcome, measures of the effects on the human participants needed to be devised. After a long debate, it was decided to assemble a battery of cognitive tests using the ANAM platform. As the NZ Defence Force had no cognitive assessment protocols in place, it was my job to develop some. Fortunately I managed to obtain assistance from an American software house and was able to assemble the necessary testing regimen. Tests were conducted in the field using soldiers undertaking standard training programmes. In this way it was a naturalistic, observational study. We did not need to design experiments with regard to exposure, the soldiers were already being exposed to hazardous situations as part of their training. All I had to do was to measure and quantify those acoustic conditions and conduct before and after trials using multiple participants.

All research was covered off by appropriate ethical approval, and as an added dimension of security, I was allocated 5 supervisors covering fields of: medicine, acoustics, aviation, military defence, system design, technology, psychology and psychophysiology from two universities. My PhD turned out to be a national collaboration effort!

While the human effects of extreme acoustic environments were easy to determine using standardised cognitive techniques, there was also the question of purely physiological effects, notably hearing. To facilitate the project, I developed a screening, pc-based audiometer that could be used in the field under conditions of moderate external noise without the need to rely on an acoustic booth or a qualified audiologist. With this equipment, hearing tests could be carried out in a matter of minutes anywhere in the field,



making the most judicious use of the soldier's time while minimising the impact on their training schedule.

The technical, scientific and psychological aspects were to be the least of my problems. With a team of 5 supervisors, and one 'on reserve', one might be forgiven for thinking that all would be 'smooth sailing'. The reticence of the university in allowing this research, albeit on a different topic from wind turbines, was not to end there. After a year, each PhD candidate must submit to an oral examination predicated on determining if the student is academically up to scratch and capable of completing the designated course of study. It is also an opportunity for struggling students to withdraw without penalty, if the current project was beyond their ability at that time.

I presented myself to the panel, giving a spirited presentation to a significant 'public' audience and then submitted to the interrogation from the panel of judges. Whilst I was never allowed access to all the behind-closed-door discussions of the panel, what did emerge was the comment by one of the academic panel to the effect: "but what are we going to do if we give Bruce this PhD and then he goes out to work on the topic of wind turbines?". I was incensed by this egregious transgression by the academic review panel. Their sole task was to determine the academic suitability of the candidate in question, (me) not to prejudice their decision based on what that candidate might hypothetically do in later life. I was only to discover at a much later date that many of my supervisors were also incensed. One suggested that I consider legal action against one member of the panel. I chose not to bother with such distraction and moved on. Their ruse had failed in any case. It is noteworthy that without the assistance from the New Zealand Defence Force, the outcome could have been quite different. But as it was, the research I was conducting was not only novel, generating several new methods for assessment, but deemed to be of strategic importance for national defence.

After two years of academic enrolment I was able to submit my work to the international panel of my peers and I was awarded the degree of Doctor of Philosophy later that year. At the end of many years of preparation and study, I was physically and mentally exhausted. Having had diminishing health and the need for surgery during my enrolment, I was in no fit state to consider taking actions against my academic detractors, so I let sleeping dogs lie. I have the degree. It has been examined by an international team and deemed to be up to standard. I guess that just goes to show that even an 'academically poor' candidate can pull one out of the hat sometimes. The power of the wind industry and the tentacles it has managed to spread through academia must not be underestimated. Use of just one or two well-chosen people with moderate authority in a university can sway the direction of

research undertaken, possibly without the knowledge of those in high authority and certainly not with the knowledge of the large majority of academics. In the end the resulting flack they may get for its alleged misfeasance may be unfair as those making the decision at the time may well have gone elsewhere, leaving others to take the blame.

Because of its content, and the potential threat to national security, my thesis remains embargoed for an indeterminate period of time. I am unable to discuss the findings. However, I can discuss the technology I developed that made it possible. Perhaps I was not of such poor academic quality as some of the university staff had believed.

Much to the chagrin of my detractors, my team and I continue to pursue the question of wind turbine emissions. Our team is now truly international. Technical development work of the SAM technology continues to this day, with the completion of a new technology to measure infrasound down to 0.01 Hz that is about to be released to the market. This will include not only a PC-based environmental analyser that has internet connectivity as a feature, allowing instantaneous data from wind farm sites to be uploaded to the world wide web in real time, but also a personal recorder that subjects can wear on their body 24/7 to determine their exposure to infrasound, wherever they may be.

The past 16 years has been tumultuous. Not only has it been a long, arduous journey to develop new technology specifically designed to detect, measure and analyse full-spectrum acoustic emissions from wind turbines in real time with data upload-able to the web, also in real time, but the continuing struggle against a recalcitrant industry that is determined to suppress the truth of their emissions takes a large toll on one's energy and resources. That the wind industry continues to deny the facts regarding their emissions, paying out complaining residents, imposing gagging clauses on the sufferers while continuing to promote erroneous propaganda to further their commercial takings is simply immoral and unethical. That such an industry can extend its influence to include academic institutions, stifling research, is beyond contempt. That they are able to persuade medical associations to become complicit in their deception is egregious and may rate as one of the worst crimes against humanity of the 21st century.

## Commercial Conflict of Interest and Academic Freedom

It is important to understand that my personal experience with two universities in New Zealand cannot be blamed on the institution(s) as a whole. Rather, institutions are made up of many different people, and it may be that the way I was treated was simply the result of a small number of staff members within the wider institution with a particular agenda. Universities continue to pride themselves on the unalienable right of academic freedom. It is just the actions of a few who manage to function in a particular way for their own reasons. By and large, universities are filled with genuine, honest academics who pride themselves on their ethical stance, predicated on freedom of thought. For without this, no new discoveries would ever be made. We would forever be living in the lifestyle of our ancestors.

My experience at one University is not an isolated one in New Zealand, where other academics have been bullied into silence by their employers or threatened with litigation by external parties.

One notable example of wind industry interference in academic freedom was the sacking of highly regarded acoustics Professor Henrik Moller, from Aalborg University - the details of which are now in the public domain. Industry interference appears to be payback for Moller's important work demonstrating that larger turbines emit proportionately more low frequency noise and would therefore require larger setback distances was clear.

More broadly there is increasing recognition of the growing problem of a failure to properly disclose, and prevent, financial conflicts of interest. A recent article in the international journal "Environmental Health" by Kathleen Ruff is just one example. This failure to properly disclose the financial conflicts of interest in the acoustic representation on the NHMRC's expert panel, exposed in the Australian Parliament by Senators Madigan and Back, is just one example, and has clearly profoundly and materially impacted on the documents issued by the National Health and Medical Research Council, resulting in false and misleading advice being given by that organisation to the governments and government departments who rely on it.

This will inevitably result in further serious harm to human health, which would have been prevented had the NHMRC followed its own advice to adopt the precautionary principle. To exclude important acoustic field research indicating excessive levels of infrasound and low frequency noise out to 10km is unforgivable, especially when the sole Australian

author of a study included in their 2014 Systematic Literature review made it very clear that sleep disturbance was indeed occurring out to 10km (Morris, 2012).

It is plain that institutional corruption with respect to the wind industry has infiltrated many former trusted institutions, including government authorities and academic institutions, as well as the professional bodies such as the AMA and the AAAC. There are many examples of wilful blindness at worst, and gross ignorance at best.

**The facts remain - rural residents are being seriously harmed by pulsating infrasound and low frequency noise from a range of industrial sources, wind turbines being just one example. This knowledge dates back 30 years to the NASA and Kelly research and has been known by science and the wind industry since that time. They have simply chosen to ignore or deny it.**

## Denouement

The science, however inconvenient, will not go away. *Paralysis by analysis* is never a good strategy, nor is 'burying one's head in the sand'. Senators, you have the opportunity to intervene now to minimise further damage. As time is no longer on our side, I urge you to act with integrity to turn this eco-juggernaut around before it is too late. People (and animals) are being harmed every day across the world while you deliberate.

I have obviously been influenced, in one way and another, by the undoubtedly successful tactics of the wind energy lobby to persuade various sectors of society that the promotion of their interests overrides virtually all other social and ethical values. For that reason I will not make further comment on that issue but will leave it you, the Australian Senate Enquiry into Wind Farms, to determine the appropriate words or phrases to describe their programme that has been so designed to influence in their favour those many sectors of society that may be complicit to their aims.

Senators, you have been advised of the science regarding adverse health effects of industrial wind turbines. The ball is in your court. It is your actions that will define you in the pages of history books. I wish you luck in your quest and commend you for your bravery and foresight.

## Appendix 1 - Bees and wind turbines



### Research – Bees and wind turbines<sup>9</sup>

It is known to everyone that noise from wind turbines generates sound both heard and inaudible to humans. Sounds emitted that are not within the scope of being audible to humans, basically come in the form of vibrations. These vibrations can travel much further than audible sound and affect a vast area, several miles from the wind farm itself. Downwind, these low frequency vibrations can travel up to 50 KM from the source.

The drastic increase in the number of wind farms in the United States began between 2004 and 2005, and has blossomed to cover vast sections of the country today, as seen on the blue map below.



Interesting to note is the time frame of drastic increases of the number of wind farms from 2004 to 2005. This time frame becomes very important, because it is also the exact time when massive disappearances of honey bees began to be reported, beginning in 2005, with drastic increases in the years to follow.

The next map shows the states where the most losses of honeybees have occurred.

The orange map below is also an interesting map, because if you didn't know better, you would believe it is another wind farm map. Although the southeast area of the United States, such as Florida does not have large numbers of operating wind farms, the honeybee disappearances in that area are attributed to weather events.

A series of hurricanes in 2004 and 2005, including hurricane Katrina virtually wiped out this area's honeybee population. With this in mind, the direct link to wind farms for the massive die off can be made.

While scientists scramble trying to find answers and offer theories ranging from a new form of virus, the earth's magnetic shift, to perhaps solar flares. It would be wise for them to look into the effects of sound vibrations emitted from wind turbines.



In a report by WH Kircher, titled Acoustical Communication in Honeybees on 02/05/1993, finds that airborne sounds and vibrations play an important role in honeybee communication. It is also coming to light that honeybees use sound

<sup>9</sup> <http://apisuk.com/Bees/2013/01/research-bees-and-wind-turbines/>

vibrations to navigate, similar to sonar used by marine life and bats.

Since vast areas are within affective range of low frequency sound levels emitted by wind turbines, it becomes clear that there is a connection between low frequency sound produced by wind turbines and the disappearance of honeybees. The areas with the most disappearances of honeybees directly correspond with that of operating wind farms.

California is second, behind North Dakota for honeybee losses and first in wind farm operations, within range of areas where honeybee colonies are located. As of 2007, most North Dakota wind farms were concentrated within a small area in the southeastern portion of the state. Since then, wind farms have spread to many other sections of the state, and the resulting losses of honeybees will most likely increase as well.

On a world scale, areas of honeybee disappearances does correlate with operating wind farms in particular regions. It isn't enough that the wind industry continues to operate under the guise of being a renewable energy source that will help in getting us off fossil fuel, when in reality they use more fossil fuel than they will ever produce.

The sad fact is this industry is only responsible for degrading our countryside with useless spinning towers. While the building and operations of the wind farms are killing millions of endangered bird species, raping pristine land and turning it into nothing more than a cluttered mess of steel and fiberglass. Turbines are destroying the natural habitat of wildlife in such areas. It seems now, that it may be responsible for the near destruction of the world's honeybee population.

\*\*\*\*\*

The above has been taken directly from the [www.ufodigest.com](http://www.ufodigest.com) website and does give room for thought on the matter. To see what a research consultant says about this aspect of possible bee destruction, let's take a look at what Bio3 says about the matter.

Bio3 is a company recognized as a national leader in biodiversity consultancy, research and information systems. It has been awarded the title of SME Leader in Portugal in 2009, 2010, 2011 and 2012. In 2011 Bio3 was considered one of the 174 most innovative SME's operating in Portugal and was integrated in the COTEC SME Innovation Network.

Founded in 2005, Bio3 achieved a solid growth rate and is currently a national reference operating in its market. During the first 7 years of existence, Bio3 developed the biological section of over 400 projects, mostly related to environmental assessment, post-evaluation, environmental management and planning. Bio3 also executes applied research studies. They are experts on Ecological Baseline Studies and Biodiversity Monitoring Surveys, with an emphasis on renewable energy projects. Our clients include big Portuguese companies, such as EDIA, EDP Renewables, ENEOP2, ENERSIS, GALP Energia, GENERG, IBERWIND, REN and Ventinveste.

**From day to day experience and knowledge of bee behaviour and ecology serious concerns are arising concerning to potential negative impacts of wind farms on bees derived from several effects, such as the noise, stray voltage, air pressure changes and turbulence and electromagnetic field caused by the turbines.**

Some American apiarists have shown concern by the shadowing, flashing, strobing effect from the blades, since it lasts 2 to 3 hours a day for 2 to 3 weeks in spring and fall when the sun comes up. They fear that the bees would either become disoriented or irritated by the effect. Other concerns of these apiarists were the "thumping noise" from the blades and the effect of "stray voltage" to the bees.

## Appendix 2 - German doctors push to halt building of wind turbines

Credit: German doctors want more research into the health effects of wind turbines -  
Graham Lloyd, Environment Editor - The Australian | May 21, 2015  
[www.theaustralian.com.au](http://www.theaustralian.com.au) Filed: May 21, 2015 • [Germany](#)

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**“In particular regarding emissions in the low frequency and infra-sound range there are no reliable independent studies that investigate field measurement methodology suitable for this sound field below the threshold of hearing,”** they said.

The assembly called for the federal government to close the gaps in knowledge about the health effects of infrasound and low-frequency sound from wind turbines through scientific research.

It said: **“research should clarify open questions concerning measurement methods and, where appropriate, adjust regulations to allow the expansion and the operation of wind turbines wisely, carefully, with integrated expertise, sustainability and overall societal responsibility”**.

It said **“the health effects of infra-sound (below 20 Hz) and low-frequency sound (below 100 Hz) in relation to emissions from wind turbines were ‘still open questions’**, as were **“the effects of noise below the hearing threshold or lower frequencies with increasing exposure duration”**. The assembly said the erection of more turbines close to settlements should be stopped until there was reliable data to exclude a safety hazard.

## Appendix 3 - Conflict of Interest: Ruff

### Scientific journals and conflict of interest disclosure: what progress been made?

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#### Abstract

The article addresses the failure of the scientific community to create an effective mechanism to protect the integrity of the scientific literature from improper influence by vested interests. The seriousness of this threat is increasingly recognized. Scientists willing to distort scientific research to serve vested interests receive millions of dollars for their services. Organizations such as the International Committee of Medical Journal Editors, the World Association of Medical Editors and the Committee on Publication Ethics (COPE) have launched initiatives to establish international standards for Conflict of Interest (COI) disclosure. COPE requires its 7,000 member journals to comply with its Code of Conduct for Journal Editors. While these initiatives are encouraging, they are internal educational endeavours only. Five examples are given showing failure of COPE member journals to comply with COPE's Code of Conduct. While COPE offers a complaint process, it involves only discussion and voluntary compliance. COPE neither polices nor enforces its Code. Instead of the current feeble, un-resourced process, which delivers neither transparency nor accountability, the article proposes the creation of a mechanism that will employ specific, effective measures to address contraventions of COI disclosure requirements.

#### Keywords

Industry influence, Conflict of interest disclosure, Publication ethics, Enforcement mechanism

#### Background

In its 2010 Science Report [1] UNESCO noted the growing concern about conflict of interest (COI) in scientific journals. UNESCO cited a call for scientific journals to adopt a common standard regarding —the complex and growing financial arrangements that have developed in recent years between vested interests and independent scientists [2].||

Clear evidence exists that industry funding can and does influence research findings. An analysis by vom Saal and Welshons for example, showed that 11 out of 11 industry-funded studies found bisphenol A (BPA) had no significant action, while 109 of 119 studies that had no industry funding (92 %) did find effects of BPA [3].

Some steps have been taken to require disclosure of industry and other funding. The International Committee of Medical

Journal Editors (ICMJE) has produced a standard Disclosure of Conflicts of Interest Form [4] which ICMJE member journals require authors to use.

The World Association of Medical Editors (WAME) has highlighted the need for journals to

take action regarding the issue of COI: —If COI is not managed effectively it can cause

authors, reviewers, and editors to make decisions that, consciously or unconsciously, tend to serve their competing interests at the expense of their responsibilities in the publication process, thereby distorting the scientific enterprise. This consequence of COI is especially dangerous when it is not immediately apparent to others. In addition, the appearance of COI, even where none actually exists, can also erode trust in a journal by damaging its reputation and credibility [5]||.

In 2010 the 2nd World Conference on Research Integrity approved a Position Statement, Responsible research publication: international standards for authors [6]. The Committee on Publication Ethics (COPE) described these as the first universal global guidelines for authors from all areas of scholarly publishing. COPE urged all editors to incorporate these standards into their editorial policies and instructions for authors [7]. In December 2013, as a joint endeavour to promote a common standard regarding COI disclosure, WAME, COPE, the Directory of Open Access Journals, and the Open Access Scholarly Publishers Association published The Principles of Transparency and Best Practice in Scholarly Publishing [8].

COPE has adopted a Code of Conduct for Journal Editors with which it requires in theory, its 7,000 member journals to comply [9]. COPE recommends that, if a conflict of interest comes to light after publication of an article, the journal should publish a Correction disclosing the conflict of interest. COPE provides a complaint mechanism regarding contraventions of its Code of Conduct [10]. It also has enforcement ability, although a weak one. If a COPE member is not willing to comply with its Code of Conduct, COPE —will aim to discuss that with the member, and will ask them to consider their membership of the organization.||

These provisions imply that COPE enforces its Code.



At face value it appears that progress has been made. In the cases below, however, involving five COPE member journals, these policies were disregarded. Even when COPE concluded that a complaint regarding undisclosed conflict of interest was substantiated and recommended that the journal involved publish a Correction in compliance with COPE's policy, COPE categorically notified the journal that it was free to disregard COPE's recommendation and continue as a COPE member without any consequences.

Thus COPE does not require its member journals to comply with its Code. COPE has never used its enforcement ability and has never asked a journal to withdraw its membership of COPE. Furthermore apart from COPE, the scientific community has created no mechanism to address COI disclosure violations. COPE is the only recourse available.

### 1) Annals of occupational hygiene

In 2011 and 2012 the Annals of Occupational Hygiene (AOH) published two papers on research, financed by Georgia Pacific Corporation (GP) regarding asbestos-containing joint compound that the company had sold in the past [11, 12]. The company was facing court cases involving nearly \$ 1 billion in liability related to this product.

Three of the five authors of the two articles worked for Exponent and one was an employee who GP deliberately transferred for the purpose of carrying out the research, to be under the control of GP's litigation department.

David Michaels has described Exponent as one of the premier firms in the product defense

business. These firms —profit by helping corporations minimize public health and environmental protection and fight claims of injury and illness. (...) This is science for hire period, and it is extremely lucrative,|| states Michaels [13].

In June 2013 a New York court ruled that the two papers, and six additional similar articles financed by GP, constituted potential crime-fraud [14]. The court stated that GP had commissioned the research with the intent of casting doubt on the capability of chrysotile asbestos to cause cancer, planned to use the articles to assist its litigation efforts, that GP's lawyers had significant input in the content, reporting of the results and prepublication review process of the articles, and that the articles failed to disclose the participation of the company lawyers.

Article 2.1 of COPE's Code of Conduct requires that readers be informed whether the funder

of the research had any role in the research and its publication and if so, what this was [9].

The AOH articles violate this requirement. They do not disclose that the company's litigation

department had control over the work nor that one of the authors had been transferred so as to be under the direction of GP's litigation department.

The role of a litigation department is not to be impartial or independent. Its purpose is to do

everything possible to defend the company's interests.

These are improprieties of an extremely serious character. The AOH should have withdrawn the articles or at the very least, required publication of an Erratum in compliance with COPE's Article 2.1, to disclose that the study was not a normal study, but controlled by GP's litigation department, with the research data thus rendered inaccessible under lawyer-client privilege. This is the opposite of transparent scientific research.

The AOH did not do so. Instead the article remains on the AOH website with no conflict of interest statement from the authors disclosing their own and their consulting companies' financial ties to Georgia Pacific. No information is provided to readers regarding the improprieties involved in the article. The reader thus assumes that the article complies with COPE's Code of Ethics, which it does not.

The chief editor of the AOH Noah Seixas, published a commentary, Protecting Our Science, stating that through reviewing the GP decision, it had become clear that the AOH should strengthen its procedures regarding COI [15]. The AOH will monitor the results of the litigation involving the GP research, Seixas wrote, and —If the court finds evidence of fraud in the production of the research reported in our pages, we will act on these findings in accord

with the COPE guidelines for ethical publication.||

Of course the AOH should take action in accord with the COPE guidelines in the face of evidence of research fraud. And it is commendable that the AOH is discussing these issues and plans to adopt stronger COI disclosure standards. Seixas avoids the question however, as to why the AOH took no action to address the non-compliance with the COPE Code of Conduct—a Code the AOH says it follows.

### 2) Current opinion in pulmonary medicine

In July 2014 the journal Current Opinion in Pulmonary Medicine (COPM) published an article by David Bernstein, Health Risks of Chrysotile Asbestos [16], which stated: —There are no conflicts of interest.||

The journal's disclosure form [17] specifically requires authors to state —relevant financial activities outside the submitted work||. Bernstein did not comply with this requirement and indicated that he had no such activities. This is untrue. For more than a decade his work has been funded by asbestos industry organisations such as the Chrysotile Institute and the International Chrysotile Association. Over the past several years, Bernstein has been continuously financed by the asbestos industry to write articles and make presentations promoting use of chrysotile asbestos in Brazil, China, Colombia, India, Indonesia, Korea, Mexico, Quebec, Russia, South Africa, Thailand, Vietnam, Malaysia, the Philippines, Ukraine and Zimbabwe.

In COPM Bernstein stated that he received no funding for his article. The article, however, relied on and cited Bernstein's asbestos industry financed articles, which Bernstein self-praised as being —of outstanding importance||. COPM thus acted as a conduit for undeclared asbestos industry financed work which promoted the industry's interests.

A complaint was submitted to the editors and publisher that Bernstein had contravened the journal's COI disclosure requirements by failing to disclose his intimate long-standing and continuing financial ties to the asbestos industry [18]. In response to the complaint, the publisher stated: —We will publish an erratum that states he (Bernstein) is a paid consultant to the chrysotile asbestos industry and name the commercial organisations he has been paid by in the last 36 months.||

The journal then published the following Erratum:

—The health risk of chrysotile asbestos: Erratum

During the editing process of the recent article by Bernstein [1] the conflicts of interest statement was wrongly amended from 'No conflicts of interest relevant to this article' to 'There are no conflicts of interest.' The publisher apologises for this error.

Dr Bernstein would like to take this opportunity to clarify that he works as a scientific consultant to the chrysotile asbestos industry and gives presentations worldwide on the science of chrysotile asbestos. In the last three years he has received

payment for his consultancy services from: Honeywell International, Chrysotile Association and Zimbabwe National Chrysotile Taskforce.

Dr Bernstein received no payment compensation or funding for the current article [1]. The article is solely his work and the opinions stated therein are his own.

[1] Bernstein DM. The health risk of chrysotile asbestos. *Curr Opin Pulm Med.* 2014; 20:366–370.||

The implied interpretation put forward by the publisher, that only payments made for work conducted for the single particular article constitute COI, guts any meaningful COI disclosure; it violates the journal's COI disclosure form, which requires authors to disclose financial activities —outside the submitted work||; and it flaunts the ICMJE's COI standard that authors must disclose —interactions with ANY entity that could be considered broadly relevant to the work.|| [3].

### 3) Critical reviews in toxicology

In 2013, Bernstein and co-author Jacques Dunnigan published a review article, *Health Risks of Chrysotile Revisited* [19], in *Critical Reviews in Toxicology* (CRT). They stated that the preparation of the review was funded by a grant from two asbestos industry organisations, the International Chrysotile Association (ICA) and the Chrysotile Institute. This statement was untrue. In a court deposition, the president of the ICA, Bob Pigg, stated that no grant existed. Instead, court documents show that Bernstein submitted invoices of

approximately US \$2,800 per-diem to the ICA for —services rendered|| in writing the manuscript. In total, the ICA paid US \$179,306.51, almost all of which was paid to Bernstein, with a small amount going to Dunnigan, for the writing of the article.

The Declaration of interests stated that Bernstein had appeared as an expert witness in

litigation concerned with —alleged health effects of exposure to chrysotile|| and Dunnigan had

served as an expert witness on the health effects of chrysotile before the Workers Compensation Board of Québec. The authors did not disclose the extensive financing they receive as consultants to the asbestos industry.

The publisher of the journal, Informa Pharmaceutical Science, requires —full disclosure of all

financial, consulting, and personal relationships that could be viewed as presenting a potential

conflict of interest [20].|| Furthermore, Informa states that —If any potential conflicts of

interest are found to have been withheld following publication, the journal will proceed

according to COPE guidance.||

Several scientists submitted a complaint to the editor of the journal, pointing out that the

authors had violated the journal's COI requirements [21]. The editor did not respond and took

no action.

Clearly, the COI policy of *Critical Reviews in Toxicology* is excellent on paper. In practice, however, it was disregarded.

### 4) International journal of environmental research and public health

In 2013, the *International Journal of Environmental Research and Public Health* (IJERPU) published an article, *Domestic Asbestos Exposure: A Review of Epidemiologic and Exposure Data* [22]. Three of the authors were employees of the consulting company, Exponent. The fourth, David Dahlstrom, a former Exponent employee, now has his own consulting company.

Between 2001 and 2009, three auto companies (Chrysler, Ford and GM) paid Exponent over 26 million dollars to help them defeat claims by mechanics and family members regarding asbestos-related disease.

In the article in the IJERPU, the authors stated under Conflicts of Interest: —No funding was

obtained to prepare this manuscript. Two of the authors (David L. Dahlstrom and Fionna Mowat) have been designated as experts in litigation matters related to asbestos, and all authors have been retained as consultants in asbestos-related litigation matters.||

Thus, apparently, the authors carried out this work pro bono. The article was conspicuously tailored to meet the exact needs of auto companies facing litigation on this issue and its conclusions were beneficial to these companies' litigation activities: —These results provide support that brake dust derived from chrysotile containing brake drums would not initiate a pathological response in the lung following short term inhalation.||

Under its Potential COI requirements, the IJERPU states that —Financial support for the study must be fully disclosed.|| The publication fee for the article to be published in this open access journal was \$1,750. The authors did not disclose who paid the fee.

When asked, Dahlstrom, said that he did not know who paid the fee for his article to be published, but felt confident that Exponent had paid. A request was made to Dahlstrom that, in the interest of transparency, he and his co-authors publish a Correction in the IJERPU to disclose who paid the fee for publishing their manuscript and whether the payer had any COI.

Dahlstrom refused. Requests to the corresponding author of the article, Emily Goswami, and to the Editor-in-Chief of the journal, Paul B. Tchounwou, were met with silence.

The publisher of the journal, MDPI AG in Switzerland, responded saying: —We are a member

of COPE and refer to their guidelines and advice when cases that are not clear-cut come up. Payment of article processing fees would be considered as financial support for the research, so any conflict of interest between the funder and the research topic should be declared.||

When requested to disclose who paid the publication fee for the article and whether the payer

had any COI, MDPI AG refused, however, to do so. —Authors need only acknowledge external funding sources,|| said MDPI AG. —Funding by the authors themselves or their employer does not need acknowledgment, as it doesn't add an additional stakeholder.||

Thus the payer of the publication fee remains anonymous. Readers are not informed whether Exponent paid its employees to write the article, and whether Exponent paid the publication fee. They are not informed that Exponent has received multi-million dollar contracts from auto companies that derived a benefit from the article.

### 5) European journal of cancer prevention

In its May 2012 issue, the European Journal of Cancer Prevention (EJCP) published an article by Carlo La Vecchia

and Paolo Boffetta, Role of stopping exposure and recent exposure to asbestos in the risk of mesothelioma [23]. La Vecchia is an Associate Editor of the journal.

The EJCP states the following: —Conflicts of Interest. Authors must state all possible conflicts of interest in the manuscript, including financial, consultant, institutional and other relationships that might lead to bias or a conflict of interest [24].||

The authors stated they had no conflict of interest, when they had, in fact, been paid by companies facing criminal charges for asbestos-related deaths of workers from mesothelioma. In March 2011 and July 2011 they advanced in courts, as expert witnesses for the defence, the same arguments they put forward in the article they submitted to the EJCP in September 2011. As soon as the print proofs of the EJCP paper became available in November 2011, the company lawyers submitted them as evidence for the defence. These arguments enabled the current company managers to have impunity for the deaths of the workers.

The authors stated that the Italian Cancer Research Association (AIRC) had funded the article. This was untrue. AIRC confirmed that it had provided no funding for the article.

The Editor-in-Chief of the journal, Jaak Janssens, rejected the complaint, saying that the

authors had reaffirmed that they had no COI. The Associate Editor, J. Bogers, stated: —I don't really understand this complaint. I still don't see the conflict of interest, especially reading the content of the paper again.||

In March 2014, a complaint was submitted to COPE [25], pointing out that the journal had

contravened specific provisions of COPE's Code of Conduct by failing to disclose COI; that

the Editor-in-Chief had no known expertise on the asbestos issue but had approved the article in four days, which constituted an improper peer review process; that no policies were in place for handling submissions from an Associate Editor to ensure unbiased review; that the journal had not corrected the inaccurate funding information; that the journal did not have a system for managing board members' conflicts of interest and did not publish a list of board members' relevant financial and other interests.

On October 6, 2014, COPE informed the journal that the information indicated that the authors had a COI, which should have been declared. COPE recommended that the journal publish a Correction in line with COPE's guidelines [26].

On October 14, Phil Daly, Senior Publisher, Medical Journals, at Wolters Kluwer, informed

COPE and the complainants: —We are following your recommendation and we are preparing a note for publication that addresses these issues.||

In December 2014, the EJCP published the following Erratum [27]:

—Role of stopping exposure and recent exposure to asbestos in the risk of mesothelioma: Erratum

European Journal of Cancer Prevention 2015, 24:68

The authors would like to bring the reader's attention the

conflicts of interest for their review paper (La Vecchia and Boffetta, 2012), and subsequent correspondence (La Vecchia and Boffetta, 2014). La Vecchia has acted as expert witness for the defendants or the judge in criminal trials involving occasional exposure to asbestos, on behalf of ENEL (Rome, Italy), Edison (Milan, Italy), Pirelli Tyres (Milan, Italy) and the Ordinary Tribunal of Turin (Italy). Boffetta has acted as expert witness for the defendants in a criminal trial involving exposure to asbestos in the manufacture of synthetic polymers and risk of mesothelioma (Edison, Milan, Italy).

This work was not conducted with the contribution of the Italian Association for Cancer Research as stated on page 229 and the authors withdraw this statement on the acknowledgement of funding.||

When asked what action will be taken with regard to the other issues raised in the complaint,

Daly stated: —During our review, in addition to those points mentioned previously, we have

raised the awareness on conflicts of interest. We have met some of the editors and have other communication and educational recommendations (e.g. COPE's eLearning modules) planned, and that we will follow these up on a regular basis.||

It is a positive outcome that, as a result of the complaint filed with COPE, the EJCP finally published the Erratum and is undertaking educational activities for the journal's editors re COI, education that is clearly much needed. The publisher deserves credit for taking action to comply with COPE's standards, for publishing an Erratum that addresses the COI issue clearly and for requiring the authors to accept responsibility for correcting their undeclared COI.

Relying on individuals to devote a year of continuous effort to persuade a COPE member journal to comply with COPE's Code of Conduct is not, however, an effective mechanism. Furthermore, COPE stated it would take no action whatsoever, if the EJCP rejected COPE's recommendation.

The mounting evidence of systematic attempts by commercial interests to corrupt the literature cannot be ignored, states the British Medical Journal (BMJ) [28]. The problem is so serious that the BMJ has adopted a policy of zero tolerance on education articles with financial links to industry.

Yet, as the above examples show, when authors or journals violate COI requirements, no accountability mechanism is in place. Without accountability, COI disclosure requirements

lack credibility.

When COPE receives complaints of violations of its Code of Conduct, COPE acts —as a

neutral third party, with the overall aim that airing of these concerns will lead to an

improvement in the understanding and practice of publication ethics more widely.|| COPE

also protects its member journals with anonymity, when it reports the cases on its website. There is no transparency and no public accountability.

In addition to using an internal, voluntary approach, comparable to corporate Codes of

Conduct, COPE underlines its lack of resources to handle complaints: —complainants,

journals and publishers should understand that COPE is run by a voluntary council, and complaints are just one of a large number of activities undertaken by the council.|| [9].

Thus, a handful of COPE volunteers deal with complaints of ethical violations on the edges of their spare time. The evidence clearly demonstrates that ensuring ethical publishing standards is not a priority of the scientific community.

COPE describes its role as being —a forum for editors and publishers of peer-reviewed journals to discuss all aspects of publication ethics.|| This is a valuable role, but exposes the crux of the problem. Neither the scientific community nor the publishing community has established an effective mechanism to deal with the COI issue. While hundreds of millions of dollars are spent on scholarly studies, virtually no funds are dedicated to upholding ethical standards and keeping the field honest. Yet, as the BMJ and UNESCO point out, this is a key public policy challenge of our times and poses a significant threat to human and environmental health.

These are not abstract issues. Countless lives have been destroyed because scientists, with undisclosed industry ties, have abetted endless industry subterfuge by creating doubt over the evidence. The strategy invented by the asbestos and tobacco industries has been appropriated by numerous other industries. In addition to the human tragedy, the economic costs caused by distorted scientific research of this kind are huge.

A recent editorial in Nature noted: —Transparency is the best defense against the purchase of

undue influence by those with the most financial clout. In areas where tough standards are needed to protect public health, and powerful and wealthy interests have a financial incentive to water down these standards, such transparency is more than desirable—it is essential, and history demonstrates that.|| [29].

The problem is widespread and serious. Margaret Chan, Director-General of the World

Health Organization (WHO), states that: —Research, evidence, and information are the

foundation for sound health policies, for monitoring the impact, and for ensuring

accountability. They keep us on track.|| She then points out that —even the very best scientific evidence can have less persuasive power than corporate lobbies [30].|| A major global problem, notes Chan, is the fact that industries fund research geared to create doubt and prevent needed action to protect public health. Industry suppression of scientific data creates misinformation and skews priorities for research and public health interventions, says the WHO, which has called for action to stop this abuse [31]. The failure of the scientific community to take effective action to address conflict of interest has serious repercussions for public health policy. Faced with this void, government scientists, who have less freedom to act than other scientists, are challenging the censorship and distortion of research that conflicts with agribusiness industry interests. Public Employees for Environmental Responsibility, for example, representing local, state and federal researchers in the U.S., have

filed a legal petition to require the U.S. Department of Agriculture to adopt policies to

prevent —political suppression or alteration of studies and to lay out clear procedures for investigating allegations of scientific misconduct|| [32].

Faced with the same problems of suppression and distortion of scientific research, government scientists in Canada are seeking to protect scientific integrity through collective bargaining. The Professional Institute of the Public Service of Canada, representing 15,000 federal government scientists, engineers and researchers has tabled a proposal that would obligate the government to negotiate scientific integrity policies [33].

### Call for action

These are welcome but makeshift initiatives. The scientific community has created self- educational, professional mechanisms, such as COPE and WAME. What is urgently needed is that the scientific community create a practical mechanism whose purpose is to provide transparency, oversight and accountability to help stop the contamination of the scientific literature by undisclosed COI.

- Leaders in the scientific community with an impeccable track record of commitment to ethical standards should launch an initiative to set up an independent, effective and credible mechanism, such as a Center for Monitoring and Implementing Publication Ethics. It would take responsibility to investigate complaints, call for appropriate action and report publicly. Even a small Center, set up by respected scientists, would make a difference in

creating transparency and accountability.

- A Center that monitored and publicly reported contraventions would impact a journal's and a scientist's credibility. Amnesty International does not have enforcement powers; but its monitoring and public reporting role has great impact.
- The Impact Factor of journals should include contraventions of COI disclosure requirements reported by the Center. Even journals with loose ethical standards would take this consequence seriously.
- COPE, ICMJE, WAME and other organisations and agencies should provide funds (perhaps 5 % of their budget) to the Center, since it will be playing a critical role to implement the fundamental goals to which these organisations are committed. If necessary, a special —publication ethics implementation fee|| could be charged to members. If the scientific community is not willing to put resources into ethical quality control, then they will send a clear message that they have no serious commitment to ethical standards.
- The leadership committee should examine previous initiatives such as the Integrity in Science Project, operated by the Center for Science in the Public Interest, which monitored the scientific literature for failure to disclose COI and maintained an open database of scientists' ties to industry.
- Institutions, such as the National Library of Medicine, that appear to confer credibility via listing studies, as well as government committees and agencies, such as the Environmental Protection Agency and the Occupational Safety and Health Administration, universities and professional societies, must adopt a strict policy requiring public COI disclosure and specifying consequences for violations, such as exclusion from future participation or placement on a list of unsatisfactory COI disclosure conduct.
- The proposed Ethics Centre should play a leadership role in monitoring and reporting how well, or how badly, government agencies, professional societies, universities and journals are requiring and enforcing ethical standards. It could be a much needed, credible voice calling for practical and effective changes, where systemic and repeated problems exist.
- Opportunities to develop practical solutions should be seized, such as funding currently offered by the Office of Research Integrity, US Department of Health and Human Services, for conferences or

workshops to —produce tangible outcomes|| towards research integrity compliance [34].

- A campaign could be launched calling for 1 % of all research funding to be dedicated to ethical quality control carried out by the proposed Ethics Centre. As well as monitoring and reporting, the Centre would thus be able to fund independent, public interest research to document significant ethical failures in the current system, such as fraudulent peer review mechanisms [35], and propose practical solutions. Presently, these egregious problems are dealt with in an ad hoc, random manner.

- The Centre would be able to address other instances of conflicting interests, such as the fact that scientists' career opportunities may be affected by their ability to bring in grants or research contracts to their university [36].

- The leadership committee should draw on the expertise of individuals and organisations who have successfully implemented effective, credible accountability mechanisms to protect the public interest. Various models could be examined—Research Integrity Offices set up by universities; Ombudsman offices set up by governments. Sometimes these models are deliberately created to be weak. However, reliable knowledge and practical models exist as to how to make them effective.

#### Conclusion

It is not beyond the capability of the scientific community to take practical action on the problem of COI. Above are some examples of action that could be taken. To fail to act is a betrayal of public trust and scientific integrity.

#### Abbreviations

AIRC, Italian cancer research association; AOH, Annals of occupational hygiene; BMJ, British medical journal; BPA, Bisphenol A; COI, Conflict of interest; COPE, Committee on publication ethics; COPM, Current opinion in pulmonary medicine; CRT, Critical reviews in toxicology; EJCP, European journal of cancer prevention; GP, Georgia pacific corporation; ICA, International chrysotile association; ICMJE, International Committee of Medical Journal Editors; IJERPU, International Journal of Environmental Research and Public Health; WAME, World Association of Medical Editors; WHO, World Health Organization

#### Competing interests

KR works pro bono in the field of science, ethics and public health. She receives no funding, payments or benefits for her work. She pays costs, such as the publication cost of this commentary, herself. She has no competing interests to declare.

#### Acknowledgments

I express my appreciation to Leslie London and Bruce Lanphear for their helpful comments and suggestions.

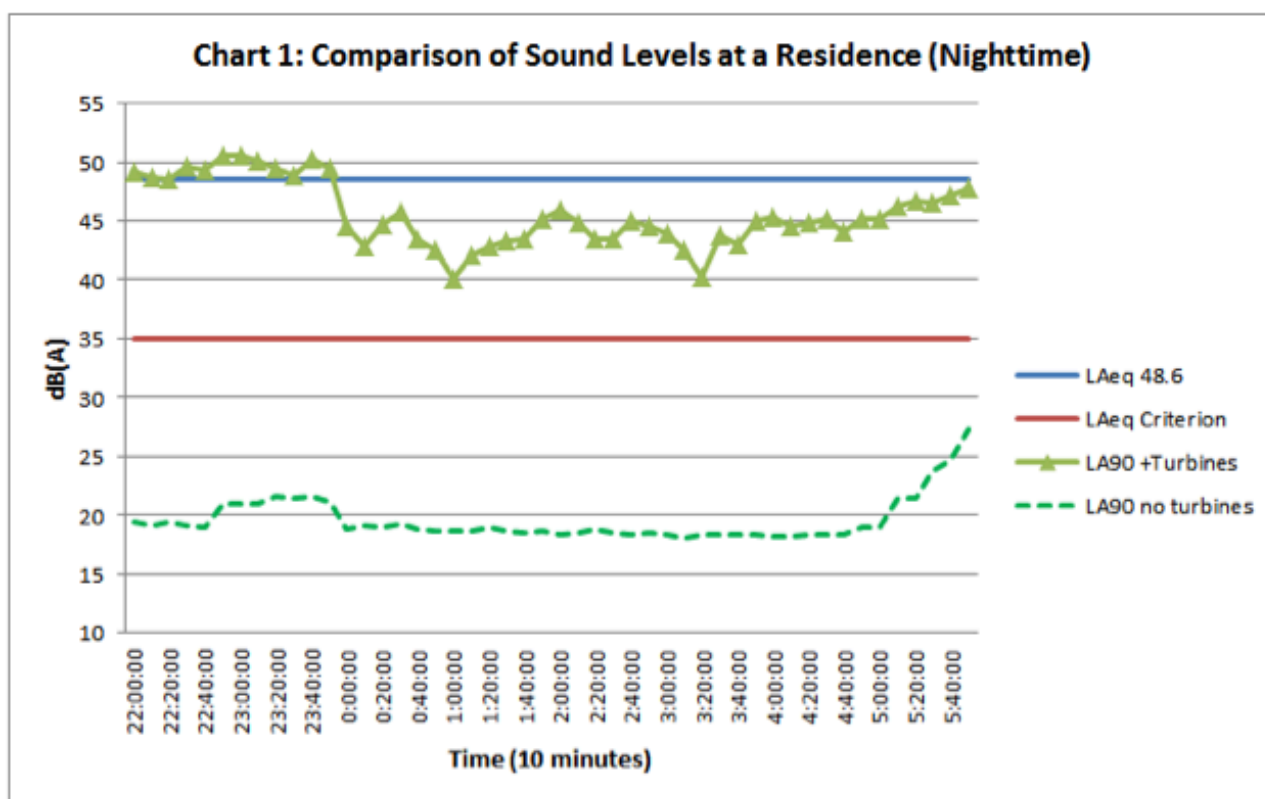
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## Appendix 4 - Windfarm control question

The question has been asked in the Hearings as to what different noise criteria mean. I hope that the following chart can assist the Hearing. The chart records sound levels from a wind farm as heard at a residence and compares them to the background sound levels (LA90) of a quiet rural locale without turbines.



### FINDINGS

#### LAeq Noise Criterion

1. The time period for the LAeq level is over the whole of the night (10pm to 6am) is 48.6 dB(A).
2. If the LAeq noise criterion is taken as 35 dB(A) for the whole of the night then the criterion is exceeded and the wind farm is in (theory) non-compliant.
3. However, the LAeq measurement includes ALL sounds in the environment, such as from insects, animals, noise from the nearby residence, farming activities and so



on. The sound levels due to these activities cannot be excluded from the noise measurement.

4. The LAeq criterion is, therefore, not particularly useful unless only the sound of the turbines is recorded and can be verified as such.

### **Background Sound Levels.**

1. The background sound levels are normally recorded in the absence of the wind farm. Under the Australian wind farm standard the background sound level includes the sound of the turbines and is compared to the "original, pre-turbine" background sound levels.
2. A time period of 10 minutes is recorded.
3. The quiet rural sound levels are shown in the chart as a dotted line. If the standard criterion of "+5 dB(A)" is added to the sound levels the line will lift and will be around 25 to 27 dB(A).
4. The actual measured background sound levels, including wind turbines, is shown in the line+triangles and is broadly 40 to 48 dB(A).
5. If +5 dB(A) is added to this then the background sound level criterion becomes broadly 45 to 53 dB(A).
6. The average level of the background sound levels including turbines is 45.6 dB(A), 10pm to 6am.
7. The turbines are in non-compliance.
8. Although it may seem obvious that in this case the wind farm is not in compliance with the controls, proving it to the satisfaction of a court would be almost impossible without much more data - data that territorial authorities and almost all acoustical consultants would be unable to provide"

My Submission is that the standard compliance conditions applied in Australia under the Australian or New Zealand wind farm noise standards are not effective and are technically severely flawed.

## Appendix 5 - About the author

Dr. Bruce Rapley is a consulting scientist with Atkinson & Rapley Consulting Ltd., New Zealand, specialising in acoustics and human health.

He has three degrees from Massey University in New Zealand. A BSc in biological systems, an MPhil in technology (System Design and Testing of a Medical Biostimulator) and a PhD in acoustics and human health (Sound in the Military Environment: Detection, Measurement and Perception - undertaken in collaboration with the New Zealand Defence Force).

Dr. Rapley's area of expertise includes the interaction of exogenous energy and living systems. He has published a number of scientific papers in the field of bioelectromagnetics, applied acoustics and health.

For the past 15 years, Dr. Rapley has spearheaded a research and development project to produce a new environmental monitoring and analysis system for sound, vibration and low-frequency magnetic fields. This has culminated in the launch of the SAM technology (Soundscape Analysis and Monitoring) in 2011. This dual-channel, comparative analysis system is purpose-built for on-site, remote monitoring of environmental noise, such as wind turbines or other industrial plants. It includes such features as automated one-touch English-language reporting, on-site or remote analysis, recording of sound events, full time SPL history with acoustic statistics, spectral analysis and amplitude modulation analysis.

The SAM technology has been used by local authorities, universities, research institutions and the New Zealand Military.

Now semi-retired, Dr. Rapley continues to consult, part-time, on problems related to acoustics and human health as well as continuing to development the environmental monitoring and analysis system: SAM - Evolution 5. In his spare time, he is engaged in writing books and scientific papers on topics relating to science and health.