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The Bill Excessive Noise

To The Senate.in regards to excessive noise at wind farms.

I support a excessive noise bill to enforce compliance to fair and reasonable levels of noise ,low frequency infrasound and air pressure variance that does not affect human health.
6subsection 30E[3] Omit "may" substitute " shall "[must does not mean something will be done.]
After subsection30E the use of [believes on reasonable grounds] to me that sounds very much like relying on honesty and people who are actually well trained ,it has not been good enough in the past ,a number of times I have made known my concerns about compliance and have an email come back to say the company believes they have meet the requirements ,that response has been useless in addressing complaints and compliance issues ,there needs to be strong factual evidence supplied and the person trained adequately trained to present the information in plain English that a lay person that is the complainant and any other person not trained in acoustics can understand the evidence.

I am a polio sufferer I have lost my home to sound pollution in the low frequency infrasound range creating air pressure variance, I had gotten very unwell because of the turbines I have had to remove my self from the Waubra area to 8km set back to get clear of the sound pollution from the turbines on the advise of at least 4 medical people because of lack of sleep ,physical pain and suffering, emotional trauma because slander from a company director and the public response to the slander in favour of the director, I initially needed to borrow $500,000 to remove my family from Waubra and relocates to another work place , I have $500,000 of unused assets doing nothing, because attempts to mediation through the justice department failed I have sold the main farm at Waubra to complete relocation[at a rate of 15% is in the order of at least $500,000 and met financial commitments ,the losses of not being able to work effectively the properties leading up to the sale could well in the order of $100,000. that is a total $1.100,000 I have now lost ,$1,000,000 lost in assets due to relocation because of the Turbine pollution at Waubra with it's emission of low frequency sound and infrasound at levels identified in The Dean Report July2010.

I commissioned The Dean Report in October 2009 and released in July 2010 after several legal threats in was necessary to make the report that cost more than $40,000 available to the public free without any compensation to prevent further legal action against me ,the report investigated low frequency sound in my house that had been done and not supplied to me and also not supplied to the Senate inquiry of 2011 because it was a in house document .

The only way to alleviate the pain right inside the head is to stay away completely in excess of at least 8 kms from Waubra. I have not been in the Waubra Area since about mid April 2012, symptoms of pain around the head I need to stay well away from the turbines too, but these symptoms return when the wind blows outdoors very bad, and also in doors to a lesser degree, or spending time [about one hour]at a Railway Station in Melbourne, or also working within 1 km of telecom mast with guy wires at Watchem, I get headaches and can be too ill to work for around 3 days .

I have Not had the Electromagnetic spasm of the head ,the effect is that the scalp muscles pull tight like a glove or the prickly affect on the top of the head for about 2 years, as I have only spent about 6 hrs a year in the wind farm area for each of the last 2 years.for short periods at a time half of that doing interviews to help.

Tinnitus is still annoying ,so is the body throbbing during the night which I think is nerves ,as is the pain in the legs I still need to rub liniment into my legs during the night, thank fully now only once during the night.

After 40 years of driving I have been the driver at fault for 2 car accidents in the past 2 years, nearly rolled the vehicle two times soon after the turbines started operating, before I realised the effect on the organs of balance in my head were inflamed from excessive noise vibration from the wind farm, the consequences were that I have driven a very small percentage of the distance travelled since the start of the turbines the 2 car accidents happened when Janine was not well enough to drive.

I have been slandered in the media I am a nervous wreck, this has caused a great deal of distress and withdrawal from the community for myself and my wife and son .

Other issues include blinking to regain focus is because of dehydration ,this is possibly the reason for stiffness in the backs of the legs ,I strongly suspect the lowfrequency sound infrasound from the turbines and the effect on the brain and other organs including the organs of balance has resulted in the lack of temperature of the body, for about 5 months after the initial impact of the wind turbines my body suffered from vibration and my legs would be cold up to the waste even in the warmer weather I would wake up with my legs cold and feeling damp , at times my body would start vibrating not shivering, at times legs go in to spasm on contraction.

Because of anxiety ,tension in the muscle in the back of the neck[I have now resumed acupuncture] I was snoring a lot, I went to sleep clinic but because my chest was to tense from the low frequency sound an infrasound from the turbines after they started at Waubra I could not get to sleep with a sleep app machine and needed to discard it to get sleep as I could not get to sleep before midnight and I was tired and needed sleep,since I have not been closer than 8 kms to the turbines for more than 6 months I am now sleeping better and breathing better and not snoring as much.

Affects on birds and animals .The affect of turbulence is such that the trees shake even when there is little wind so much so that birds can not sit in the trees ,I have seen the shaking the birds trying to sit in the trees ,darting out of the trees screeching.

I have observed a possum being so stunned that it could not walk I was able to put it in a possum relocator by opening the door and sliding it in using my boot, I relocated it to another part of the shed and when I released it the next day it walked to a tree in a drunken like manner and managed to climb the tree very awkwardly.

I also had issues with cattle spooked so much so the fence was smashed down and also the front legs of a 18 month old steer's front legs went stiff and poked out sideways while in one paddock so I let the cattle free range through a number of paddocks it come good after about 3 weeks or so and I was able to sell it.

me after many requests this has not happened.

The Physics of Sound

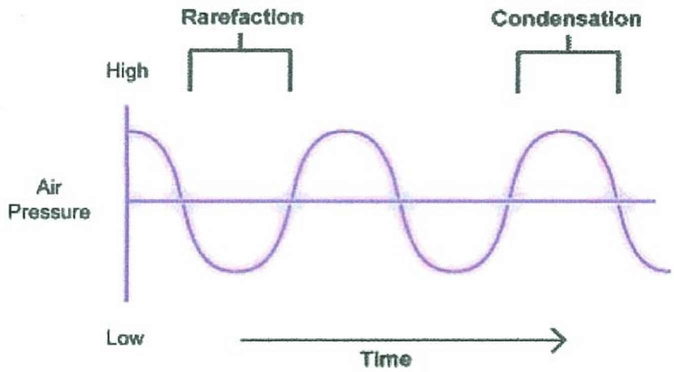
What is Sound?

Put simply, sound is vibration. As such, sound can pass through many different substances - in fact, it requires the presence of a medium. Sound cannot travel in a vacuum.

The most common medium within which we perceive sound is, of course, air. Various movements around us cause vibrations in air molecules, and this sound energy is transported outwards as waves. Much in the same way as waves move across the surface of a pond, so does sound move through the air. Once the action that caused the waves ceases, then the pond will gradually return to its original position, as if nothing had happened.

Sound also travels through water, and can travel through solids too, such as wood, brick, iron and so on. The ease with which it can do so depends upon the composition of the medium, and the nature of the sound itself. Different frequencies can move more easily through certain substances than others, and some frequencies travel further than others. Approaching a concert, for example, you may well hear the thumping of the bass drum before all else.

Waves travel as a transfer of energy within a medium - a wave is essentially a sequence of compressions (moving together) and rarefactions (moving apart) of molecules.



Properties Of A Wave

A number of properties are commonly used to define a wave. The wavelength may be defined as the horizontal distance between two successive equivalent points on the waveform. For convenience, these two points are usually taken at peaks (highest point) or troughs (lowest).

The period then is the time it takes for the wave to complete one full cycle.

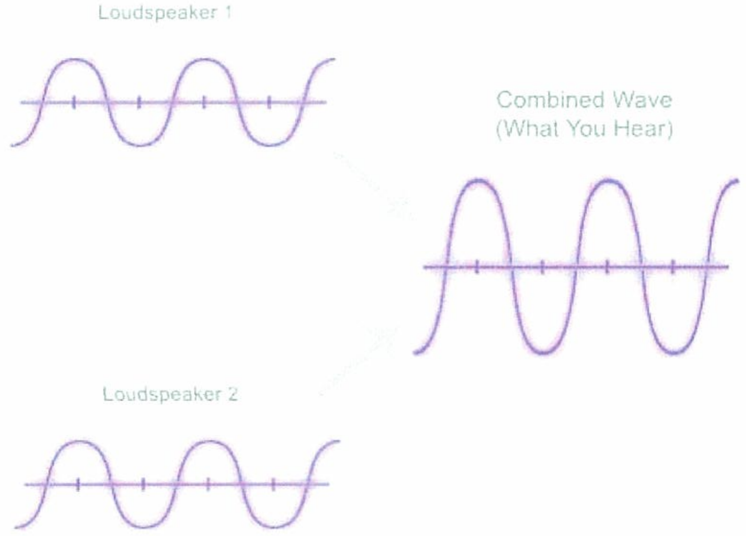
The amplitude equates to the height of the wave; loud sounds produce waves of higher amplitude. The loudness or intensity of sound is measured in decibels; however, it must be remembered that this is not a linear or absolute scale of measurement. The lowest threshold of human hearing is set at zero; a decibel is sometimes defined as the smallest change in volume discernable by a human. For a doubling in volume, the decibel level goes up by six. Within this scale, normal speech levels fit in at around 60dB.

The frequency of a wave is the number of cycles that pass a set point in a second, and is measured in Hertz (Hz). Frequency is intimately connected to pitch, although they are not exactly synonymous; the A above middle C is a vibration at a rate of 440 Hz. Lower frequency vibrations are perceived as being lower in pitch, and higher frequencies seem higher in pitch.

Basic Interference Patterns

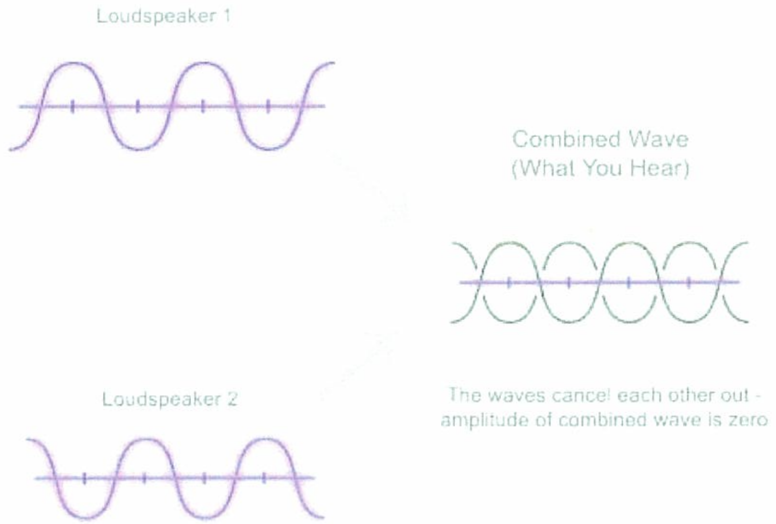
Sound, like all waves, rarely occurs in isolation. Every day, the world around us is awash with sounds, from the rustling of leaves to the roaring of engines. All of these sounds interact with one another, and with all the elements and obstacles of their environment. Hence, the same sound sources can sound vastly different depending upon the position of the listener in relation to them.

A practical example can illustrate how soundwaves interfere with one another. We can set up two loudspeakers located at a distance of three metres from the listener. The speakers are producing the same tone, with a wavelength of one metre. The speakers diaphragms are also moving in synchrony - that is, they both move in and out at the same time.



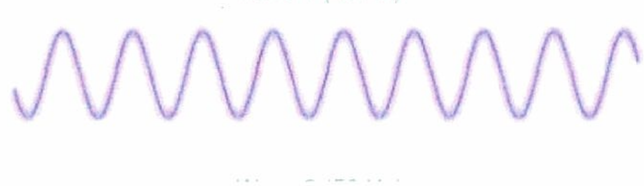
As the distances are equal, the compressions of each wave (peaks) are reaching the listener at the same time. A process of linear superposition then occurs - the combined pattern of the waves is the sum of the individual wave patterns. As the pressure of both waves is waxing at the same time, the pressure fluctuations where the two waves meet exhibits twice the amplitude of the individual waves. This means that the waves are exactly in phase - creating a condition known as constructive interference.

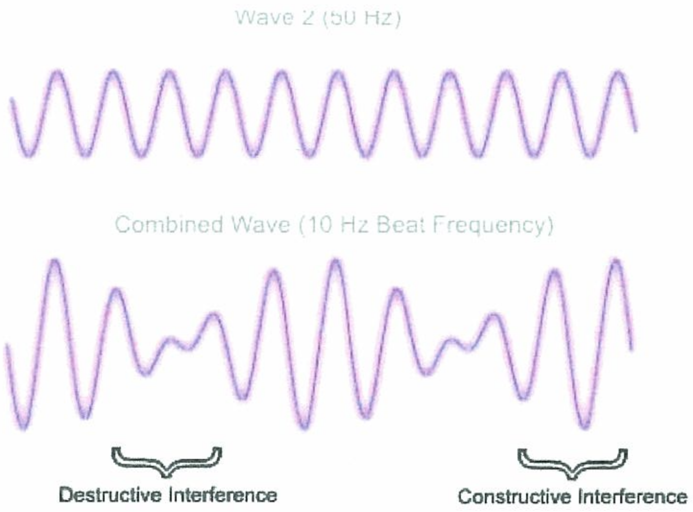
However, if one of the speakers is moved half a wavelength further away from the listener (in this example, half a metre), then an entirely different effect will be observed. The rarefactions (troughs) of one of the waves will now reach the listener at the same time as the compressions (peaks) of the other. Following the same additive principles as before, the variations in air pressure now cancel each other out. This is destructive interference, when two signals are perfectly out of phase. Noise-cancelling headphones use this technique to reduce unwanted ambient sounds.



Beat Patterns

Now that we know what happens when two sound waves with the same frequency overlap, let's explore what happens when two sound waves with different frequencies overlap. Two instrument tuners are placed side by side, one set to emit a sound whose frequency is 440 Hz and the other set to emit a sound whose frequency is 438 Hz. If the two tuners (which have the same amplitude) are turned on at the same time, you will not hear a constant sound. Instead, the loudness of the combined sound rises and falls. Whenever a condensation meets a condensation or a rarefaction meets a rarefaction, there is constructive interference and the amplitude increases. Whenever a condensation meets a rarefaction and vice versa, there is destructive interference, and you can hear nothing. These periodic variations in loudness are called beats. In this situation you will hear the loudness rise and fall 2 times per second because 440-438=2. So, there is a beat frequency of 2 Hz. Musicians listen for beats to hear if their instruments are out of tune. The musician will listen to a tuner that has the correct sound and plays the note on his intrument. If the musician can hear beats, then he knows that the instrument is out of tune. When the beats disappear, the musician knows the instrument is in tune.

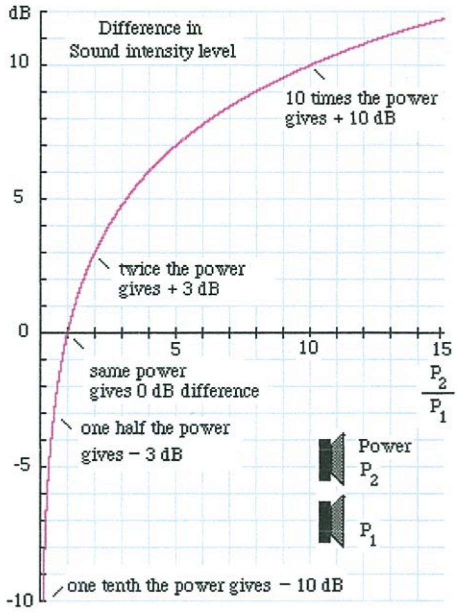



Wave 2 (50 Hz)
Combined Wave (10 Hz Beat Frequency)
Destructive Interference
Constructive Interference

dB: What is a decibel?

Decibels: dB, dBA, dBC, dBV, dBm and dBi? What are they all? How are they related to loudness, to phons and to sones? This page describes and compares them all and gives sound file examples. A related page allows you to measure your hearing response and to compare with standard hearing curves. This is a background page to the multimedia chapters Sound and Quantifying Sound.

- Definition and examples
- Sound files to show the size of a decibel
- Standard reference levels ("absolute" sound level)
- Logarithmic response, psychophysical measures, sones and phons
- Recording level and decibels (dBV and dBm)
- Intensity, radiation and dB
- Pressure, intensity and specific impedance
- dBi and anisotropic radiation
- Example problems using dB for amplifier gain, speaker power, hearing sensitivity etc.
- Occupational health and safety and the law
- Related pages
- What is a logarithm? A brief introduction.



Definition and examples

The decibel (**dB**) is used to measure sound level, but it is also widely used in electronics, signals and communication. The dB is a logarithmic unit used to describe a ratio. The ratio may be power, sound pressure, voltage or intensity or several other things. Later on we relate dB to the **phon** and the **sone** (units related to loudness). But first, to get a taste for logarithmic units, let's look at some numbers. (If you have forgotten, go to What is a logarithm?)

For instance, suppose we have two loudspeakers, the first playing a sound with power P_1, and another playing a louder version of the same sound with power P_2, but everything else (how far away, frequency) kept the same.

The **difference in decibels** between the two is defined to be

$$10 \log (P_2/P_1) \text{ dB} \qquad \text{where the log is to base 10.}$$

If the second produces twice as much power than the first, the difference in dB is

$$10 \log (P_2/P_1) = 10 \log 2 = 3 \text{ dB}.$$

as is shown on the graph, which plots $10 \log (P_2/P_1)$ against P_2/P_1. To continue the example, if the second had 10 times the power of the first, the difference in dB would be

$$10 \log (P_2/P_1) = 10 \log 10 = 10 \text{ dB}.$$

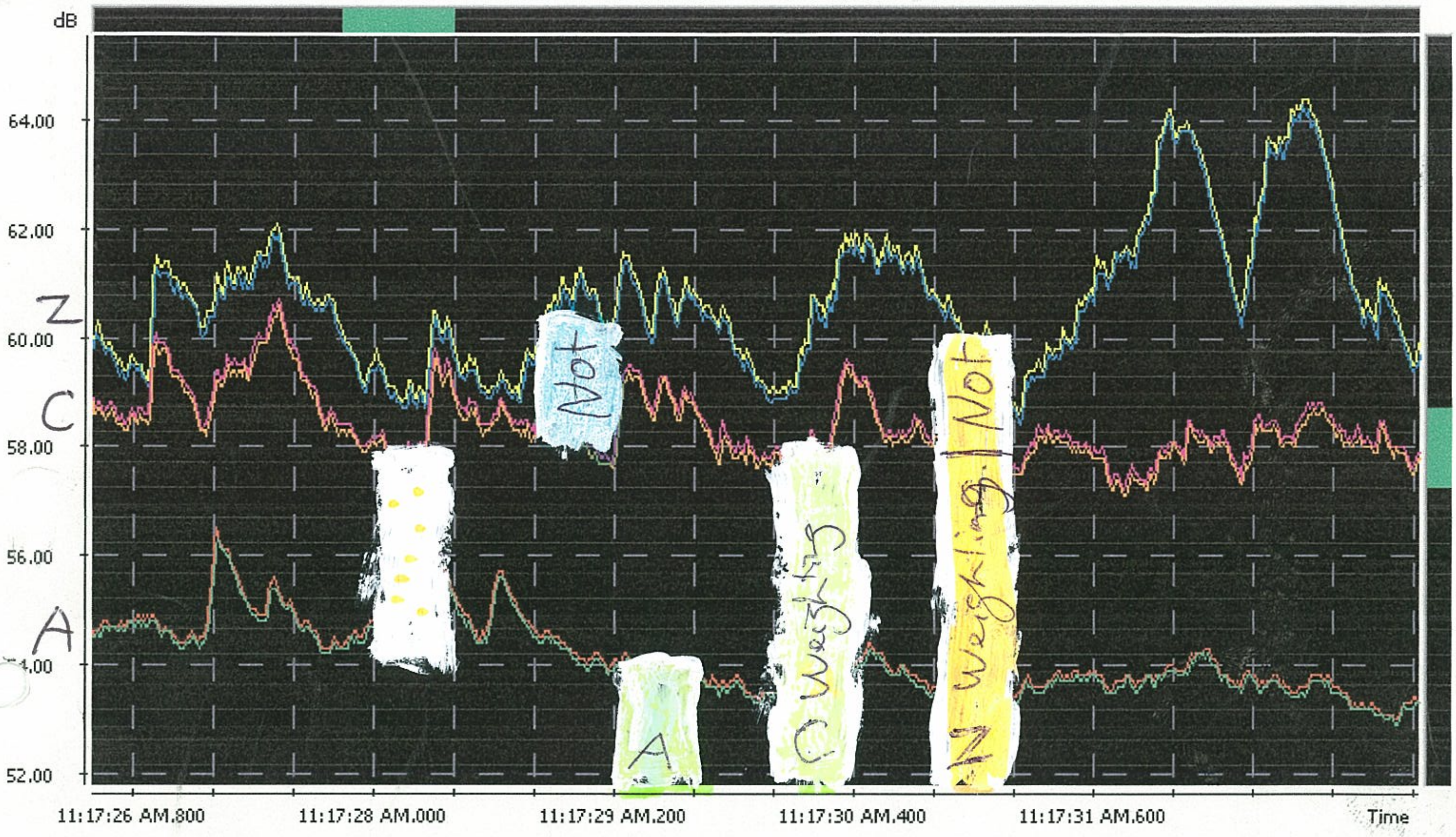
If the second had a million times the power of the first, the difference in dB would be

$$10 \log (P_2/P_1) = 10 \log 1{,}000{,}000 = 60 \text{ dB}.$$

This example shows one feature of decibel scales that is useful in discussing sound: they can describe very big ratios using numbers of modest size. But note that the decibel describes a *ratio*: so far we have not said what power either of the speakers radiates, only the ratio of powers. (Note also the factor 10 in the definition, which puts the 'deci' in decibel).

Sound pressure, sound level and dB. Sound is usually measured with microphones and they respond (approximately) proportionally to the sound pressure, p. Now the power in a sound wave, all else equal, goes as the square of the pressure. (Similarly, electrical power in a resistor goes as the square of the voltage.) The log of the square of x is just $2 \log x$, so this introduces a factor of 2 when we convert to decibels for pressures. The difference in sound pressure level between two sounds with p_1 and p_2 is therefore:

Logger results
User title...



Cursor	Time	Date	Function	Main cursor
Main cursor	11:17:12 AM.010	27/03/20...	Max (Ch1, P1)	53.70 dB

Fig 9

Beach A C Z about 2.5 db

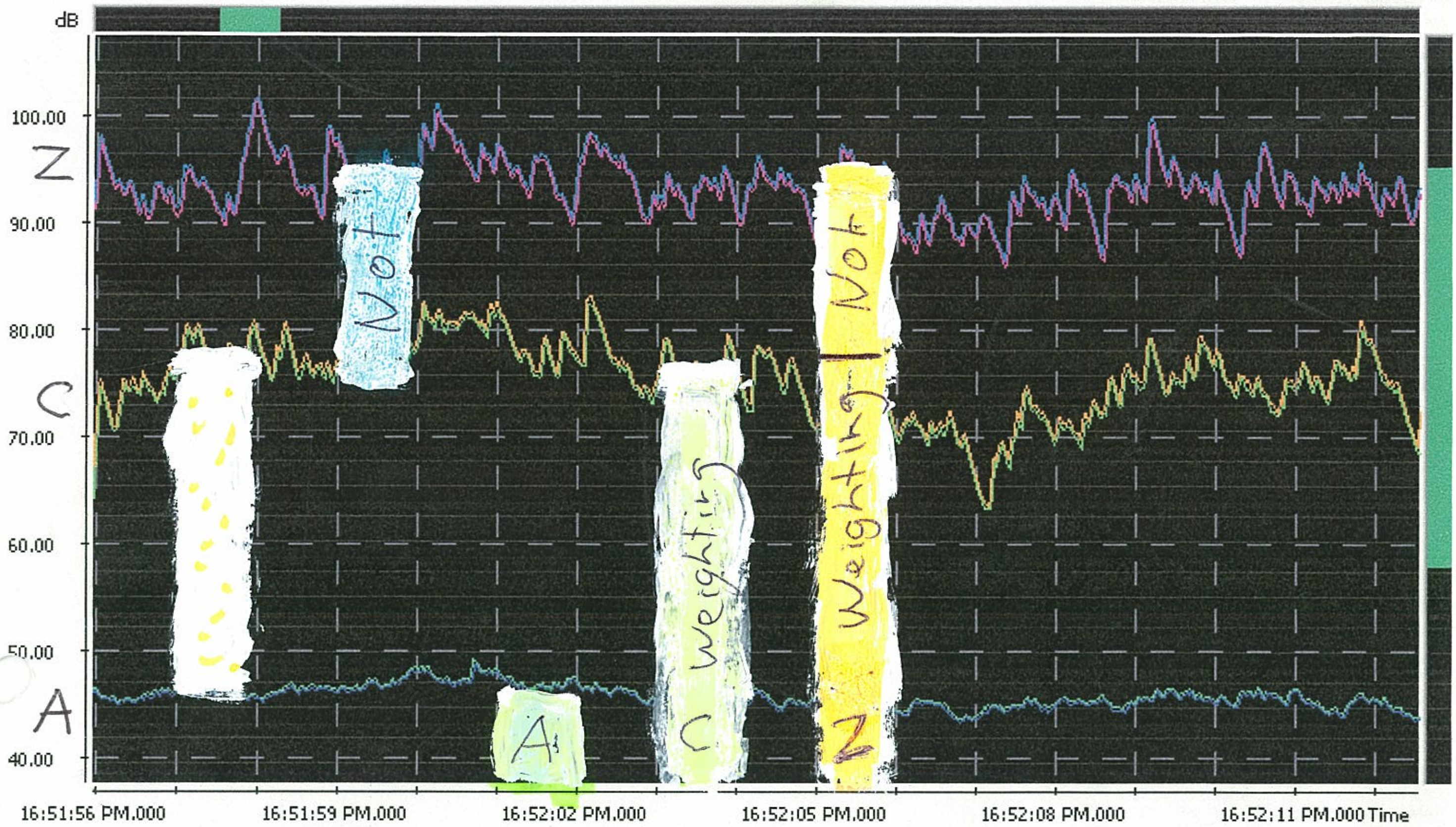
Blue inaudible between 58-60.5 db.

White with spots audible up to 58 db.

A. High Frequency Sound. 54 dba.

Different in pressure
Between A and Z is of Concern
At the Beach is 6.5 db.

Logger results
User title...



Cursor	Time	Date	Function	Main cursor
Main cursor	16:51:22 PM.025	30/10/20...	Max (Ch1, P1)	44.10 dB

Fig 8

Between Towers ACZ
about 19 db

Blue in audible. 76 — 95db

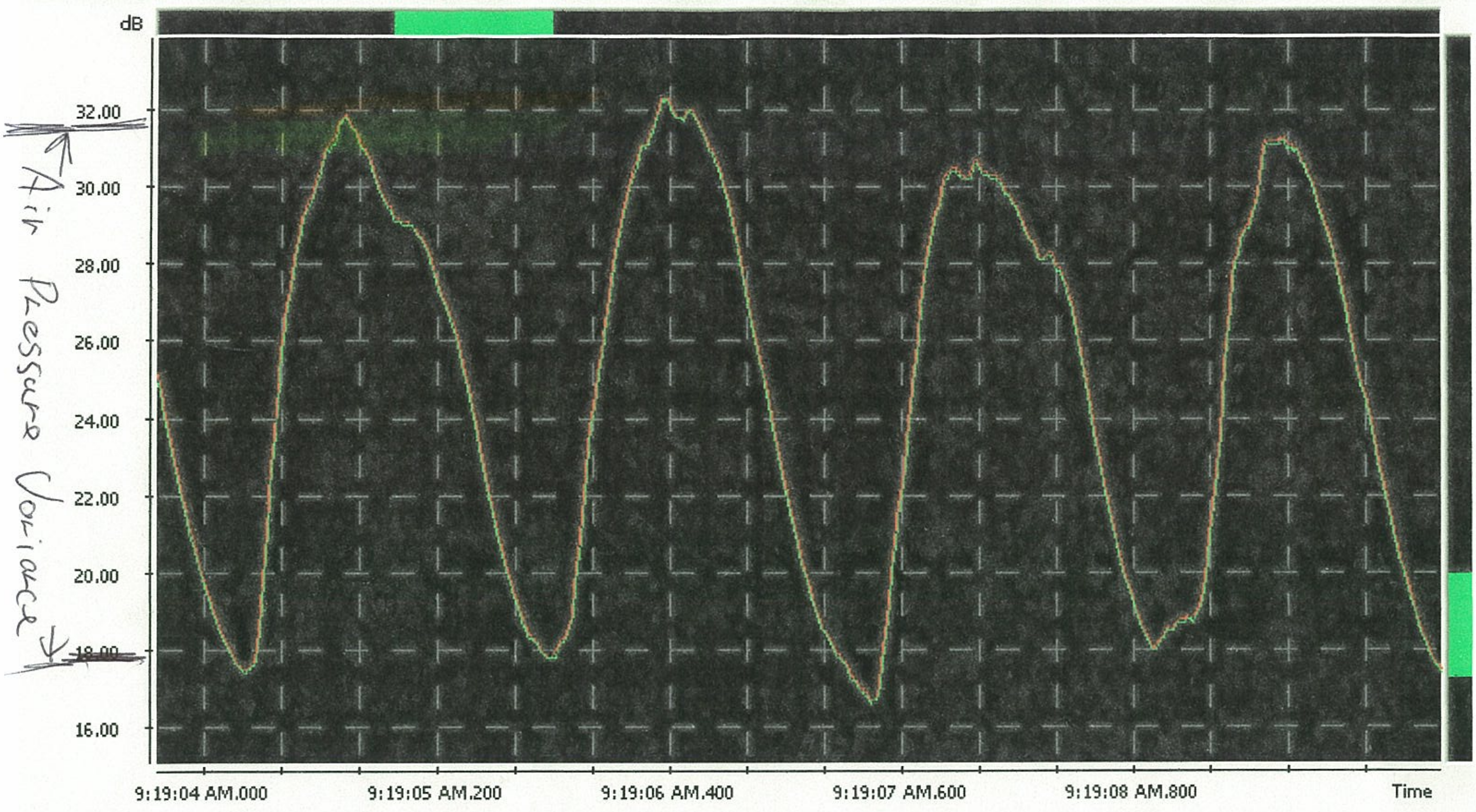
White with spots audible upto 76 db

A. High Frequency Sound 46 dba

Difference in pressure
Between A and Z is of concern.
Between The Turbine Towers is 49 db.

Logger results

User title...



Cursor	Time	Date	Function	Main cursor
Main cursor	9:18:54 AM.010	12/09/20...	Max (Ch1, P1)	40.10 dB

Fig 10

Inside House at Waubra

Air Pressure Variance

equivelent to Blade pass at

Little less or about 1 per Sec.

or around 17-19. Rev Per Minute

Whilst the aerodynamic noise from a rotating turbine blade produces energy in the infrasound range, measurements of infrasound noise emissions from modern upwind turbines indicates that at distances of 200 metres, infrasound is in the order of 25 dB below the recognised perception threshold of 85 dB(G) and other similar recognised perception thresholds (Hayes Mckenzie Partnership Ltd, 2006). A 25 dB difference is significant and represents at least a 100 fold difference in energy content. Infrasound also reduces in level when moving away from the source, and separation distances between wind farms and dwellings are generally well in excess of 200m.

Notwithstanding the above, there are natural sources of infrasound including wind and breaking waves, and a wide range of man-made sources such as industrial processes, vehicles and air conditioning and ventilation systems that make infrasound prevalent in the natural and urban environment (Howe, 2006).

Future Designs

A wind turbine converts wind energy into rotational energy (which in turn becomes electricity) and acoustic energy. An efficient wind turbine converts more of the wind energy into rotational energy with all other factors, such as blade angles, being equal. Therefore, it is in the best interests of wind turbine manufacturers to research and make available quieter turbines, as this indicates an increase in the available electricity generating capacity as well as the benefits of lower noise levels:

> *The sound produced by wind turbines has diminished as the technology has improved. As blade airfoils have become more efficient, more of the wind energy is converted into rotational energy, and less into acoustic energy. Vibration damping and improved mechanical design have also significantly reduced noise from mechanical sources.*
> *(Rogers et al, 2006)*

Amplitude Modulation

Amplitude modulation is an inherent noise character associated with wind farms. It should be noted that the ambient environment modulates in noise level by a significantly greater margin and over a significantly greater time period than that which would be audible from a wind farm at a typical separation distance. Notwithstanding, the South Australian Guidelines (2003 & 2009) note that the objective standards include a 5 dB(A) penalty for this fundamental and inherent character of amplitude modulation.

A 5 dB(A) penalty is a significant acoustic impost. To reduce a noise source by 5 dB(A) requires either the distance between the source and the receiver to be approximately doubled, or the noise source to reduce its output by two thirds. In wind farm terms, this means the distance between the farm and the nearest dwellings might need to be doubled, or up to two thirds of the total turbine numbers would need to be removed, compared to a wind farm not subject to such a penalty.

The ability to hear the "swish" (amplitude modulation) depends on a range of factors. It will be most prevalent when there is a stable environment (temperature inversion) at the wind farm and the background noise level at the listening location is low. In addition, amplitude modulation is greater when located cross wind from a wind turbine (Olermans and Schepers, 2009). It is noted that whilst the amplitude modulation is greater at a cross wind location, the actual noise level from the wind farm will be lower than at a corresponding downwind location. These conditions are most likely to occur when wind speeds at the wind farm are low under a clear night sky.

The swish is at its greatest under the above conditions as the change in wind speed at increased heights above the ground is also at its greatest, and this results in an increased difference in wind speed as the blades move through the top of their arc and down past the tower. In addition, if there are several turbines subject to similar conditions, then it is possible this can have an amplifying effect on the modulation. The increase in swish under these specific conditions is termed the Van Den Berg Effect, and it is suggested higher levels of swish might result in higher levels of annoyance and potentially sleep disturbance.